IAEA
International Atomic Energy Agency

Technical Meeting on the Demonstration of Defence in Depth Implementation Using Deterministic and Probabilistic Approaches

IAEA Headquarters, Vienna, Austria

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Hybrid Event

Information Sheet

Introduction

Defence in depth is recognized as the primary means to prevent and mitigate the consequences of potential nuclear accidents. It has been applied in the nuclear industry for decades. In practice, implementation of defence in depth consists of an adequate site selection, a robust design to ensure the fundamental safety functions, an effective organisation of operational safety, comprehensive management of accidents and emergency preparedness, and an adequate design of safety improvements throughout the nuclear installation's lifetime.

In analyses and lessons learned from the Fukushima Daiichi nuclear power plant (NPP) accident the merits of the defence in depth principle are recognized, and it is noted that proper implementation of the defence in depth principle is paramount to ensuring the fundamental safety functions. In particular, accounting for the correct design basis external hazards has been a key lesson from the March 2011 accident, as well as the importance of ensuring plant resilience to cope with common cause or multiple failures, to face unknowns and large uncertainties.

The principle of defence in depth is presented in several IAEA safety standards and INSAG publications (e.g. SF-1, GSR Part 4, SSR-2/1 (Rev. 1), SSR-2/2 (Rev. 1), INSAG-10); in particular, ensuring sufficient independence and robustness amongst the different levels of defence as part of the safety assessment is addressed in Requirement 10 and paras 4.17 and 4.18 of SSR-2/1 (Rev. 1). Paragraph 4.47 of GSR Part 4 (Rev. 1) states on how to "determine whether defence in depth has been adequately implemented".

SSR-2/1 (Rev. 1) also states in para. 5.72 that "The safety analysis shall provide assurance that defence in depth has been implemented in the design of the plant". The requirements to perform the safety analysis are underpinned at a lower level by recommendations in SSG-2 on deterministic safety analysis (DSA), SSG-3 on Level 1 probabilistic safety assessment (PSA) and SSG-4 on Level 2 PSA. In addition, the assessment of the implementation of defence in depth is addressed in SSG-88, Design Extension Conditions and Application of the Concept of Practical Elimination in the Design of Nuclear Power Plants, and in DS537, Safety Demonstration of Innovative Technologies in Power Reactor Designs, which is currently in preparation.

The above-mentioned IAEA safety standards provide high level requirements and recommendations. However, there remains a need to present good practices and practical examples of how to demonstrate defence in depth implementation in an integrated manner.

A review of the applicability of the IAEA safety standards to non-water cooled reactors (NWCRs) and small modular reactors (SMRs) is presented in IAEA Safety Reports Series No. 123. It concludes that, in general, safety assessment approaches and techniques that are used for conventional reactors, including implementing all levels of the defence in depth concept as currently defined, are applicable for SMRs and innovative reactors. However, such implementation for some advanced designs is not so evident, and due consideration of their specificities is needed when comparing to existing nuclear power plants. Therefore, the review also identified the need for additional guidance on safety assessment for SMR technologies. As a result, a new safety report entitled "Safety Assessment for Non-Water Cooled Reactors and Small Modular Reactors" is under development. Although this safety report will describe practical applications of the safety approach to different innovative technologies, it will not address the assessment of the practical implementation of defence in depth using DSA and PSA in an integrated manner, or the existing fleet of NPPs operating under proven designs.

Finally, recommendation 6 from the International Conference on Topical Issues in Nuclear Installation Safety: Strengthening Safety of Evolutionary and Innovative Reactors Designs, held from 18 to 21 October 2022, states: "Integrated use of DSA and PSA: Member States to enhance integration of deterministic and probabilistic approaches for a wide range of safety topics of evolutionary and innovative reactor designs (such as defence in depth, SSC classification)".

While there is a need for examples of how to demonstrate defence in depth in an integrated manner for future technologies, the existing and proven technologies will remain in operation for decades and are even still being constructed in some countries. Therefore, in particular for embarking and developing countries, there is also a need for practical examples of how to demonstrate defence in depth using deterministic and probabilistic inputs, in an integrated manner.

Objectives

The purpose of the meeting is to bring together designers, licensees, operators, and regulators to share information on and practical examples of how to define and implement the defence in depth principle in a consistent and comprehensive way, specifically through the safety analysis using deterministic and probabilistic approaches, and how to determine whether defence in depth has been adequately implemented.

Target Audience

The event is open to representatives of nuclear power organizations from Member States with an active nuclear power programme, including from embarking countries that have undertaken activities to implement their first nuclear power plant, and Member States with extensive expertise in the topics covered by the event. It includes government organizations (policymakers, analysts, regulatory bodies and research and development agencies), and industry (vendors, engineering companies, plant operators and technology developers).

Working Language(s)

English.

Expected Outputs

The expected outputs of this event are 1) provision of support to Member States in understanding the proper implementation of defence-in-depth, 2) provision of assistance to Member States in developing a comprehensive approach to demonstrate that defence in depth in properly implemented using deterministic and probabilistic approaches, and 3) compilation of inputs from experimented practitioners in the area.

The outcomes from this meeting will provide inputs to a TECDOC compiling authoritative information from Member States on the demonstration of the adequate implementation of defence-in-depth combining probabilistic and deterministic methods and approaches.

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 or invited organization, participants are requested to submit their application via the InTouch+ platform (https://intouchplus.iaea.org) to the competent national authority (Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or organization for onward transmission to the IAEA by **15 December 2024**, following the registration procedure in InTouch+:

1. Access the InTouch+ platform (https://intouchplus.iaea.org):
    - Persons with an existing NUCLEUS account can sign in to the platform with their username and password;
    - Persons without an existing NUCLEUS account can register here.
2. Once signed in, prospective participants can use the InTouch+ platform to:
    - Complete or update their personal details under 'Complete Profile' and upload the relevant supporting documents;
    - Search for the relevant event under the 'My Eligible Events' tab;
    - Select the Member State or invited organization they want to represent from the drop-down menu entitled 'Designating Authority' (if an invited organization is not listed, please contact InTouchPlus.Contact-Point@iaea.org);
    - If applicable, indicate whether financial support is requested and complete the relevant information (this is not applicable to participants from invited organizations);
    - Based on the data input, the InTouch+ platform will automatically generate the Participation Form (Form A) and/or the Grant Application Form (Form C);
    - Submit their application.

Once submitted through the InTouch+ platform, the application, together with the auto-generated form(s), will be transmitted automatically to the required authority for approval. If approved, the application, together with the applicable form(s), will automatically be sent to the IAEA through the online platform.

NOTE: The application for financial support should be made, together with the submission of the application, by **15 December 2024**.

For additional information on how to apply for an event, please refer to the InTouch+ Help page. Any other issues or queries related to InTouch+ can be sent to InTouchPlus.Contact-Point@iaea.org.

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

Participants are hereby informed that the personal data they submit will be processed in line with the Agency's Personal Data and Privacy Policy and are collected solely for the purpose(s) of reviewing and assessing the application and to complete logistical arrangements where required. The IAEA may also use the contact details of Applicants to inform them of the IAEA's scientific and technical publications, or the latest employment opportunities and current open vacancies at the IAEA. These secondary purposes are consistent with the IAEA's mandate. Further information can be found in the Data Processing Notice concerning IAEA InTouch+ platform.

Selected participants will be informed in due course on the procedures to be followed with regard to administrative and technical matters. They will also receive a questionnaire regarding their practices in demonstrating defence in depth implementation, and are expected to send their answers by **7 February 2025**.

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 2 pages (including figures and tables) and should not exceed 500 words. It should be sent electronically to Ms Tania Veneau, the Scientific Secretary of the event (see contact details below), not later than **15 December 2024**. Authors will be notified of the acceptance of their proposed presentations by **31 January 2025**.

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 **15 December 2024**.

Expenditures and Grants

No registration fee is charged to participants. The IAEA is generally not in a position to bear the travel and other costs of participants in the event. The IAEA has, however, limited funds at its disposal to help meet the cost of attendance of certain participants. Upon specific request, such assistance may be offered to normally one participant per country, provided that, in the IAEA's view, the participant will make an important contribution to the event.

The application for financial support should be made using the Grant Application Form (Form C), which has to be stamped, signed and submitted by the competent national authority to the IAEA together with the Participation Form (Form A) by **15 December 2024**.

Venue

The event will be held at the Vienna International Centre (VIC), where the IAEA's Headquarters are located. Participants must make their own travel and accommodation arrangements. General information on the VIC and other practical details, such as a list of hotels offering a reduced rate for IAEA participants, are listed on the following IAEA web page: www.iaea.org/events.

Participants are advised to arrive at Checkpoint 1/Gate 1 of the VIC one hour before the start of the event on the first day in order to allow for timely registration. Participants will need to present an official photo identification document in order to be admitted to the VIC premises.

Visas

Participants who require a visa to enter Austria should submit the necessary application to the nearest diplomatic or consular representative of Austria at least four weeks before they travel to Austria. Since Austria is a Schengen State, persons requiring a visa will have to apply for a Schengen visa. In States where Austria has no diplomatic mission, visas can be obtained from the consular authority of a Schengen Partner State representing Austria in the country in question.

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:

https://www.iaea.org/events/evt2400479