Nuclear Safety Standards Committee

48th Meeting, 26 – 28 November, 2019

Agenda item 3.1

DS508 – Safety Guide on Assessment of the Application of General Requirements for Design of Nuclear Power Plants

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DPP for DS508

• First proposal to NUSC in June 2017 including gaps originated by superseding NS-G 1.2 : “Safety Assessment and Verification”

• IAEA was requested to narrow the scope with DEC and Practical Elimination highlighted as focal topics of interest.

• New DPP prepared with involvement of interest countries focused on these topics, framed under the application of “Assessment of the Application of General Requirements for Design of Nuclear Power Plants” and approved by CSS in April 2018
DPP for DS508: Proposed structure / table of contents

• Introductory parts

• Assessment of DiD
  • General part on DiD Implementation
  • Assessment of different plant states (NO, AOO, DBA, DEC)
  • Assessment of independence between different plant states

• Practical Elimination
  • General aspects, concept and interpretation for new NPPs
  • Identification of sequences to be practically eliminated
  • Demonstration (general aspects)
    • Physical impossibility
    • Very low likelihood with high confidence in the assessment
  • Elements of demonstration
  • Annex. Demonstration of practical elimination for specific common cases
Overview of the Draft Safety Guide

• The overall safety approach for design
  • Safety and radiation protection in design /Safety Assessment
  • Minimization of the radiological consequences of very unlikely conditions exceeding the plant design envelope

• Implementation and assessment of the concept of defence in depth
  • Application of defence in depth to the design of a nuclear power plant
  • Assessment of the implementation of the defence in depth concept
  • Assessment of independence between safety provisions for different plant states

• Practical elimination of early radioactive releases or large radioactive releases
  • Identification of ‘credible severe accident sequences’ leading to accident conditions to be ‘practically eliminated’
  • Identification and design of provisions for practical elimination
  • Demonstration of ‘practical elimination’. General aspects

Annex: Assessment of practical elimination of specific common cases
Overall Concept of Draft Safety Guide

• The guide introduces the overall Safety Approach for Design from the safety fundamentals

• It addresses the rationale for the requirements in SSR 2/1 and the framework for addressing the principal requirements of primary interest, Defence in Depth and Fundamental Safety Functions

• The focus is placed on novelties introduced by SSR 2/1, rev. 1 for preventing harmful consequences to the public, namely:
  – Extension of the plant design envelope to include design extension conditions
  – Practical elimination or event sequences leading to early or large releases
  – Minimization of the radiological consequences of very unlikely conditions exceeding the plant design envelope, e.g. extreme external hazards
Foundations of NPP Safety-Safety Approach

Fundamental Safety Principles
Fundamental Safety Objective: Protect people and the environment
- No.5: Optimization of the protection
- No.6: Limitation of risks to individuals
- No.8: Prevention and mitigation of accidents

Radiation Protection
- Doses below limits and ALARA for each plant state category
- No need for off site protective actions in DBA
- Large releases practically eliminated

Defence in depth
Consecutive levels of protection (5), including physical barriers

Fundamental Safety Functions
- Control of reactivity
- Removal of heat from the fuel
- Confinement of radioactive material and shielding

Ensure the protection of the barriers.
Plant Design Envelope

Operational States: NO, AOO

Accident Conditions:
- DBAs (safety systems)
- DEC's

Acceptance Criteria:
- Large Component Failure
- Fast Reactivity Excursion

Beyond Plant Design Envelope:
- HPME
- MCCI
- H₂ Detonation
- Containment Bypass
Draft Safety Guide Development

• Consultancy Meetings in April and December 2018, and July 2019 with involvement of experts from several interested countries and organizations.

• Feedback received from some contributing parties has led IAEA to defer the submittal of the draft to NUSSC for:
  • Resolving some diverging views and introducing improvements
    – The approach and scope
    – Contents for specific topics, e.g. in relation to practical elimination
  • Seeking advice on further development of some sections of the guide
  • Involvement of other countries
The advice of NUSSC on the path forward and its involvement would be instrumental in the finalization of the draft safety guide.
Thank you!