Joint Session

26 – 27 November 2014
Agenda item 7.1

DS491 Draft Safety Guide: Deterministic Safety Analysis for Nuclear Power Plants (Rev. 1 of SSG-2)

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Outline

- Guidance evolution
- Background and justification
- Implications from Fukushima Daiichi NPP accident
- Objectives and scope of the revision
- Planned structure of the revised SSG-2
- Comments and resolutions. Rationale
- Conclusion
ASPECTS COVERED BY NS-G-1.2 BUT MISSED IN EXISTING GUIDANCE INCLUDE THE FOLLOWING:

- Engineering aspects and operational experience; Innovative design features; Implementation of DiD; Radiation protection; Protection against external hazards; Protection against internal events; Conformity with applicable codes, standards and guides; Load and load combination; Selection of materials; Single failure assessment and redundancy/independence; Diversity; In-service testing, maintenance, repair, inspections and monitoring of items important to safety equipment qualification; Ageing and wear-out mechanisms; Human–machine interface and the application of human factor engineering; System interactions; Use of computational aids in the design process.

- INDEPENDENT VERIFICATION
Deterministic Safety Analysis for NPPs

Guidance evolution (2/2)

2001

NS-R-1
Specific: NPPs

2009

GSR Part 4
Generic: Facilities and Activities

2012

SSR-2/1
Specific: NPP

2014-15

(Step 13)

GSR Part 4
Rev. 1

SSR-2/1
Rev. 1

Revised Requirements

DPP
SSG-2 Rev1

New Guide to cover missed aspects is planned

ASPECTS COVERED BY NS-G-1.2 BUT MISSED IN EXISTING GUIDANCE
- ENGINEERING ASPECTS IMPORTANT TO SAFETY
- INDEPENDENT VERIFICATION

NS-G-1.2
Specific: NPP

SSG-2
Specific: NPP

SSG-3
Specific: NPP

SSG-4
Specific: NPP
Background and Justification

- SSG-2 was published in 2009 and meets Requirements from NS-R-1 ("Safety of NPPs: Design", 2000) and GSR Part 4 ("Safety Assessment for Facilities and Activities", 2009).

- Key aspects motivating its revision include:
  - New Specific Requirements were developed in SSR-2/1 (2012) and are being currently revised.
  - Feedback experience and lessons learned from Tepco Fukushima Daiichi NPP accident and from other sources
  - Review exercise of Safety Guides performed in 2013 highlighted the need to revise SSG-2
  - Pilot review performed by Secretariat
Implications from Fukushima Daiichi NPP accident

- Implementation of national regulations adopted after the accident provided lessons learned to be taken into account in DSA.
- Specific aspects to which deterministic safety analysis should pay specific attention include:
  - Availability of safety margins to justify fulfilment of defence in depth levels in terms of tools, methods and acceptance criteria.
  - Design Extension Conditions
  - Application to the development of guidelines for the management of severe accidents
Objective and scope of the revision

- To update the recommendations and guidance to meet the existing Requirements
- To take into account available feedback and experience
- To specifically address the implementation of deterministic safety analysis for each plant state
- To include the application of deterministic safety analysis to relevant decommissioning tasks
- To cover the review and update of deterministic safety analysis performed
Planned structure of the revised SSG-2 (for illustration)

1. INTRODUCTION
2. BASIS FOR ESTABLISHING DETERMINISTIC SAFETY ANALYSIS
3. GROUPING, IDENTIFICATION AND CATEGORIZATION OF POSTULATED INITIATING EVENTS AND ASSOCIATED TRANSIENTS RELATING TO PLANT STATES
4. APPROACHES FOR DETERMINISTIC SAFETY ANALYSIS. ACCEPTANCE CRITERIA
5. IMPLEMENTATION OF DETERMINISTIC SAFETY ANALYSIS
   5.1 DETERMINISTIC SAFETY ANALYSIS FOR NORMAL OPERATION
   5.2 DETERMINISTIC SAFETY ANALYSIS FOR AOO
   5.3 DETERMINISTIC SAFETY ANALYSIS FOR DESIGN BASIS ACCIDENTS
   5.4 DETERMINISTIC SAFETY ANALYSIS FOR DEC
6. VERIFICATION AND VALIDATION OF COMPUTER CODES
7. RELATION INTERFACES OF DETERMINISTIC SAFETY ANALYSIS WITH ENGINEERING ASPECTS OF SAFETY AND WITH PROBABILISTIC SAFETY ANALYSIS
8. APPLICATION OF DETERMINISTIC SAFETY ANALYSIS
9. SOURCE TERM EVALUATION FOR OPERATIONAL STATES AND ACCIDENT CONDITIONS
10. DOCUMENTATION, REVIEW AND UPDATE OF DETERMINISTIC SAFETY ANALYSIS

REFERENCES

ANNEX 1. SAFETY MARGINS
CONTRIBUTORS TO DRAFTING AND REVIEW
BODIES FOR THE ENDORSEMENT OF IAEA SAFETY STANDARDS
Comments and resolutions

- Received 28 comments in total:
  - Ukraine (2); Germany (11); ENISS (1); USA (3); Japan (4); Canada (6); Hungary (1)
- 14 of them are editorial or represent technical clarifications
- From the remaining 14, only 2 of them were considered not fully applicable, for which rationale is provided
- The outcome from almost all the comments is an enhancement of the draft DPP, and most of them additionally help to understand expectations from IAEA Member States
Comment 11 (#9 from Germany):

• “The revised Safety Guide needs to incorporate all the issues of engineering aspects important to safety assessment and safety verification of any specific NPP design. These topics were initially covered by NS-G-1.2 “Safety Assessment and Verification for NPPs” (published in 2001), but are not included in the existing guidance”

Rationale

• According to slide 4, Secretariat plans to cover those topics in a new Safety Guide
  • They apply also to Probabilistic Safety Assessment
• Structure of draft DPP includes in Section 7: “Interface of DSA with engineering aspects important to safety and with PSA”
Comment 27 (#6 from Canada):

- Add Safety of Research Reactors Safety Requirements No. NS-R-4 to interfaces in Section 5
  - This will enable the document to be used by the research reactor community and help to facilitate consistency across the nuclear industry

Rationale

- Including NS-R-4 in the list of interfaces might create confusion about the scope of SSG-2 regarding facilities other than NPPs
- SSG-2 enables its use in different kind of facilities through application of graded approach although it mainly focuses NPPs
Conclusion

- Requirements regarding deterministic safety analysis have been significantly modified after the publication of SSG-2, mainly in Rev 1 of GSR Part 4 and SSR-2/1
  - In the process to identify IAEA Safety Guides requiring review to incorporate insights and lessons learned following Tepco Fukushima Daiichi NPP accident, SSG-2 was clearly noted
  - In its 37th meeting, NUSSC requested Secretariat to prepare the corresponding DPP based on the pilot review performed and presented by Secretariat to the Committee
- Secretariat would appreciate the consideration of approval of this DPP by NUSSC-RASSC-WASSC Committees, in order to be able to proceed with the detailed review and revision of the Safety Guide.
Thank you for your attention