

**Document Preparation Profile (DPP)
Version 3 dated 19 September, 2014**

1. IDENTIFICATION

Document Category Safety Guide

Working ID: DS491

Proposed Title: Deterministic Safety Analysis for Nuclear Power Plants, Rev. 1

Proposed Action: Revision of Safety Standards Series No. SSG-2, IAEA, Vienna
(2009)

Review Committee(s) or Group: NUSSC, RASSC, WASSC

Technical Officer: Palmiro Villalibre

2. BACKGROUND

The IAEA Safety Guide SSG-2, “Deterministic Safety Analysis for Nuclear Power Plants” was published in 2009 to provide recommendations on meeting the requirements established in NS-R-1, “Safety Requirements on the Safety of Nuclear Power Plants: Design” of 2000.

General safety requirements were developed in parallel to SSG-2 under GSR-Part 4 “Safety Assessment for Facilities and Activities” (2009). A few years later NS-R-1 was superseded by SSR-2/1, “Safety of Nuclear Power Plants: Design” in 2012.

Among the significant changes incorporated in SSR-2/1 are the inclusion of design extension conditions in the plant design and the strengthening of the independence and effectiveness of the different levels of defence in depth. The importance of addressing these changes was strongly highlighted by the feedback of experience from the Fukushima accident.

3. JUSTIFICATION FOR THE PRODUCTION OF THE DOCUMENT

Since SSG-2 was developed to provide guidance in fulfilling the requirements of NS-R-1 and the requirements of SSR-2/1 represent a significant change with respect to those of NS-R-1, it is necessary to revise SSG-2 for making it consistent with SSR-2/1. On the other hand, in the process of review and revision of the IAEA safety guides conducted mainly in 2013 to account for the feedback of experience from the Fukushima accident, several gaps were identified in the relevant IAEA safety assessment guidance and SSG-2 is one of the main safety guides affected by the outcome of this exercise. The pilot review of SSG-2 led to the conclusion endorsed by NUSSC in July 2014 that it is necessary to produce a new version of the guide (See Annex 1).

4. OBJECTIVE AND SCOPE

The main objective of the revised Safety Guide is to provide recommendations and guidance on the use of deterministic safety analysis and its application to nuclear power plants in compliance with the safety requirements established in GSR Part 4 and SSR-2/1. The publication is intended for use by designers, regulators, technical support organizations and operators regarding primarily the safety design of new nuclear power plants and, as far as reasonably achievable, also to the safety re-evaluation or assessment of existing nuclear power plants taking into account applicable feedback of experience from the Fukushima accident.

The main changes to be covered by the revised Safety Guide are:

- In general, the terminology of the Safety Guide needs to be revised and made consistent with the plant states described in SSR 2/1.
- Deterministic safety analysis for design extension conditions needs to be included in the scope of the revised safety guide.
- Decommissioning and dismantling needs to be added to the applications of the deterministic safety analysis, referring to detailed guidance already available, including WS-G-5.2 on “Safety Assessment for Decommissioning of Facilities using Radioactive Material”, 2008.
- Regarding individual and collective doses to workers and the public, the reference to NS-R-1 needs to be replaced by GSR Part 3 “Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards”, 2014
- The revised safety guide needs to include changes resulting from the revisions of GSR Part 4 and SSR-2/1 on the basis of feedback of experience from the Fukushima accident.

5. PLACE IN THE OVERALL STRUCTURE OF THE RELEVANT SERIES AND INTERFACES WITH EXISTING AND/OR PLANNED PUBLICATIONS

The new version of the Safety Guide will be directly related to SSR-2/1, and will be consistent with definitions and terminology given in:

- Safety Assessment for Facilities and Activities, General Safety Requirements GSR Part 4
- Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards GSR Part 3

Interfaces with other Safety Guides and Security Guides will also be considered, including the following:

- Format and Content of the Safety Analysis Report for Nuclear Power Plants, GS-G-4.1 (2004), DS449 project.

- Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants, SSG-3 (2010)
- Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants, SSG-4 (2010)
- Seismic Hazards in Site Evaluation for Nuclear Installations, SSG-9 (2010)
- Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations, SSG-18 (2011)
- Safety Assessment for the Decommissioning of Facilities Using Radioactive Material, WS-G-5.2
- Safety Classification of Structures, Systems and Components in Nuclear Power Plants, SSG-30
- Engineering Safety Aspects of the Protection of Nuclear Power Plants against Sabotage, NSS-4
- Identification of Vital Areas at Nuclear Facilities, NSS-16

6. OVERVIEW

The revised Safety Guide should have a structure in line with the current format and content of Specific Safety Guides and a scope consistent with the relevant safety requirements of SSR 2/1. It is planned that the document will include the following main contents (given for illustration):

1. INTRODUCTION
2. IDENTIFICATION AND CATEGORIZATION OF POSTULATED INITIATING EVENTS
3. APPROCHES FOR DETERMINISTIC SAFETY ANALYSIS. ACCEPTANCE CRITERIA
4. IMPLEMENTATION OF DETERMINISTIC SAFETY ANALYSIS
 - 4.1 DETERMINISTIC SAFETY ANALYSIS FOR NORMAL OPERATION
 - 4.2 DETERMINISTIC SAFETY ANALYSIS FOR ANTICIPATED OPERATIONAL OCCURRENCES
 - 4.3 DETERMINISTIC SAFETY ANALYSIS FOR DESIGN BASIS ACCIDENTS
 - 4.4 DETERMINISTIC SAFETY ANALYSIS FOR DESIGN EXTENSION CONDITIONS
5. VERIFICATION AND VALIDATION OF COMPUTER CODES
6. RELATION OF DETERMINISTIC SAFETY ANALYSIS TO ENGINEERING ASPECTS OF SAFETY AND PROBABILISTIC SAFETY ANALYSIS
7. APPLICATION OF DETERMINISTIC SAFETY ANALYSIS
8. SOURCE TERM EVALUATION FOR OPERATIONAL STATES AND ACCIDENT CONDITIONS

REFERENCES

CONTRIBUTORS TO DRAFTING AND REVIEW

BODIES FOR THE ENDORSEMENT OF IAEA SAFETY STANDARDS

7. PRODUCTION SCHEDULE: Provisional schedule for preparation of the document:

STEP 1: Preparing a DPP	DONE
STEP 2: Approval of DPP by the Coordination Committee	September 2014
STEP 3: Approval of DPP by the relevant review Committees	November 2014
STEP 4: Approval of DPP by the CSS	2Q – 2015
STEP 5: Preparing the draft	July 2016
STEP 6: Approval of draft by the Coordination Committee	September 2016
STEP 7: Approval by the relevant review Committees for submission to Member States for comments	4Q 2016
STEP 8: Soliciting comments by Member States	2Q 2017
STEP 9: Addressing comments by Member States	3Q 2017
STEP 10: Approval of the revised draft by the Coordination Committee. Review in NS-SSCS	4Q 2017
STEP 11: Approval by the relevant review Committees	1Q 2018
STEP 12: Endorsement by the CSS	2Q 2018
STEP 13: Establishment by the Publications Committee	3Q 2018
STEP 14: Target publication date	4Q 2018

8. RESOURCES

It is envisaged that the development of the document will entail the organization of three consultancy meetings and one Technical Meeting for the production of the draft and two further consultancy meetings for addressing comments from MSs, NUSSC, RASSC, WASSC and CSS

ANNEX 1

NUSSC agreed in the 37th meeting that it is necessary to revise the Safety Guide and requested the Secretariat to initiate a DPP for this purpose. NUSSC also requested the Secretariat to present a proposal for covering the *engineering aspects important to safety* initially included in NS-G-1.2 “Safety Assessment and Verification for Nuclear Power Plants”, 2001, which are not included in the existing guidance. Account was taken in this decision of the elements provided by the Secretariat in the following presentation:

Nuclear Safety Standards Committee
37th Meeting
1 – 4 July 2014

Agenda item 1.12
Review of SSG-2 – Gap Analysis

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 Division of Nuclear Installation Safety*



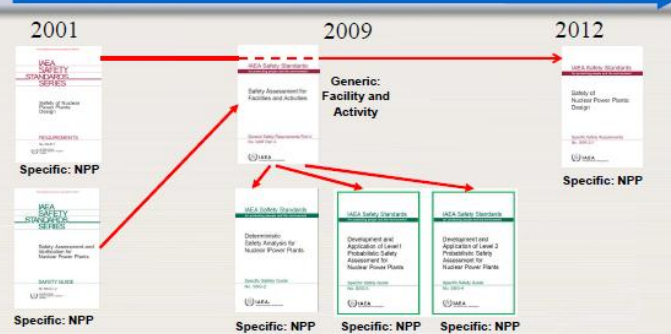
IAEA
 International Atomic Energy Agency

Background

- Pilot Exercise on SG review /revision process conducted in 2013 identified gaps in safety assessment guidance as a result of:
 - Fukushima lessons learned,
 - publication of SSR 2/1
 - Superseding of N-SG-1.2 Safety Assessment and Verification
- **SSG-2 is a main document affected**




Background




Current Situation

- Main issues found so far:
- Not all the contents of NS-G-1.2 have been carried forward into GSR Part 4 as the basis for requirements for “NPP” safety assessment.
- Not all the requirements of GSR Part 4 are covered by the supporting safety assessment safety guides (for NPPs).




Current Situation

- NS-G-1.2 covered the topics of deterministic and probabilistic safety assessment, and all the issues of the engineering aspects important to safety assessment and **safety verification** that are necessary for assessing an NPP design.
- These design assessment topics are not covered in SSG-2, which concentrates on the accident analysis methodological approaches.
- NS-G-1.2 was also more practical and specific for the safety assessment and verification of an NPP design.
- The development of concepts in SSR-2/1 (DEC etc.) need to be reflected in the safety assessment guidance.

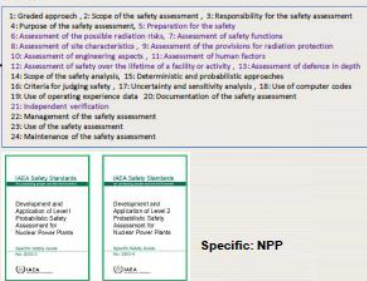


Current Situation

2001



2009



Generic: Facility and Activity

- 1: Graded approach, 2: Scope of the safety assessment, 3: Responsibility for the safety assessment
- 4: Purpose of the safety assessment, 5: Preparation for the safety assessment
- 6: Assessment of the possible radiation risks, 7: Assessment of safety functions
- 8: Assessment of site characteristics, 9: Assessment of the provisions for radiation protection
- 10: Assessment of engineering aspects, 11: Assessment of human factors
- 12: Assessment of safety over the lifetime of a facility or activity, 13: Assessment of defence in depth
- 14: Scope of the safety analysis, 15: Deterministic and probabilistic approaches
- 16: Criteria for judging safety, 17: Uncertainty and sensitivity analysis, 18: Use of computer codes
- 19: Use of operating experience data, 20: Documentation of the safety assessment
- 21: Independent verification
- 22: Management of the safety assessment
- 23: Use of the safety assessment
- 24: Maintenance of the safety assessment

Specific: NPP

IAEA Safety Standards: Specific: NPP

Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants

Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants

SAFETY ASSESSMENT, SAFETY ANALYSIS AND INDEPENDENT VERIFICATION

ENGINEERING ASPECTS IMPORTANT TO SAFETY

Process engineering practices and operational experience; Innovative design features; Implementation of defense in depth; Radiation protection; Safety classification of structures, systems and components; Protection against internal hazards; Protection against external hazards; Conformity with applicable codes, standards and rules; Load and load combination; Selection of materials; Single failure assessment and redundancy/independence; Diversity; In-service testing, maintenance, repair, inspection and monitoring of items important to safety; equipment qualification; Aging and wear-out mechanisms; Human-machine interface and the application of human factor engineering; System interactions; Use of computational aids in the design process

SAFETY ANALYSIS: General guidance; Postulated initiating events; Deterministic safety analysis; Probabilistic safety analysis; Sensitivity studies and uncertainty analysis; Assessment of the computer codes used

INDEPENDENT VERIFICATION

