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Document Preparation Profile (DPP)
Version 2 dated 05 February 2016

1. IDENTIFICATION

Document Category or set of publications to be revised in a concomitant manner

Safety Guide

Working ID:

Proposed Title: **Protection against Internal Hazards in the Design of Nuclear Power Plants**

Proposed Action: **Revision and combination of Safety Standards Series No. NS-G-1.7, IAEA, Vienna (2004) and No. NS-G-1.11, IAEA, Vienna (2004)**

Review Committee(s) or Group: **NUSSC, NSGC**

Technical Officer(s): **Abdallah Amri**

2. BACKGROUND

The IAEA safety guides NS-G-1.7, "Protection against Internal Fires and Explosions in the Design of Nuclear Power Plants", IAEA, Vienna (2004), and No. NS-G-1.11, "Protection against Internal Hazards other than Fires and Explosions in the Design of Nuclear Power Plants", IAEA, Vienna (2004), were published in 2004 to provide recommendations on meeting the requirements included in NS-R-1, "Safety Requirements on the Safety of Nuclear Power Plants: Design" of 2001. A decade later, in 2012, NS-R-1 was superseded by SSR-2/1, "Safety of Nuclear Power Plants: Design", which has been also recently revised to incorporate lessons learned from the Fukushima Daiichi accident. As a result, the requirements for protection against internal and external hazards have been reinforced with respect to those in NS-R-1. The inclusion of design extension conditions (DECs) in the plant design envelope requires also that safety features for DEC are protected against the impact of internal and external hazards as appropriate. The potential for external hazards, in particular earthquakes, to induce internal hazards such as internal fires and floods, has received more attention after the Fukushima Daiichi accident, as reflected in complementary safety assessments and plant improvements conducted in many countries after the accident. In February 2015, the Diplomatic Conference on the Convention on Nuclear Safety adopted the Vienna Declaration on Nuclear Safety, which calls inter alia for designing new nuclear power plants with the objective of preventing accidents and, should an accident occur, mitigating possible releases of radionuclides causing long-term off site contamination and avoiding early radioactive releases or radioactive releases large enough to require long-term protective measures and actions. In order to meet that objective for existing nuclear power plants, reasonably practicable or achievable safety improvements are to be implemented in a timely manner, as results of comprehensive and systematic safety assessment to be carried out periodically and regularly.

3. JUSTIFICATION FOR THE PRODUCTION OF THE DOCUMENT

After the publication of the new requirements for NPP Design, SSR 2/1, now in Revision 1, the revision of the safety guides for NPP design subordinated to the previous requirements, NS-R-1 (2001), needs to be swiftly accomplished. In addition, in the discussions of planning the transition to the long-term structure of the Safety Standards, the agreement was originally made to merge the four existing safety guides on internal and external hazards in a single one. Meanwhile, it has been

considered impractical to merge the safety guides related to internal hazards with external hazards for several reasons. Separated revision of safety guides for external hazards are already underway.

A new safety guide addressing all the hazards contained in NS-G-1.7 and NS-G-1.11 under a common approach, reflecting the changes in the requirements for NPP Design and advances in knowledge, technology and regulations in Member States has become therefore necessary. During the production of the safety guide, the implications of the Vienna Declaration on Nuclear Safety will need to be taken into account and addressed as appropriate.

4. OBJECTIVE

The main objective of the revised safety guide is to coalesce the recommendations for protection against internal hazards in the design of NPPs provided in NS-G-1.7 and NS-G-1.11 under a common approach and making them consistent with the changes introduced in the newest requirements for NPP Design (SSR 2/1, rev.1), and relevant advances in knowledge, technology and regulations in Member States in this field.

It should be noted that whereas for fire protection there is a specific safety guide on fire safety in the operation of NPPs (N-SG-2.1) which includes a number of aspects related to the prevention of fires in NPPs and the operational measures contribution to fire prevention and fire suppression, similar guidance doesn't exist for internal flooding and other internal hazards.

5. SCOPE

The safety guides NS-G-1.7 and NS-G-1.11 will be coalesced in a single new safety guide for Protection against Internal Hazards in the Design of new Nuclear Power Plants. The most relevant changes and topics that the revision and combination of the safety guides will bring are the following:

- Updating of the style and format of the safety guides, making appendices or annexes consistent with modern technology in protection against internal hazards, e.g. fires. Aspects that are covered in other safety guides, e.g. safety classification, will be reduced making the appropriate references to SSG-30. Narrative paragraphs will be reduced and the guide will be more oriented to providing design recommendations.
- In general, the terminology used needs to be revised and made consistent with the new definitions in the safety requirements and the safety glossary.
- The existing recommendations will be reformulated as necessary to fulfil the current design requirements in SSR-2/1, rev. 1.
- The new guide will address the protection of safety features for DEC against internal hazards.
- The new guide will propose a common approach for all the internal hazards and address applicable combinations of internal hazards as well as internal hazards induced by external hazards.
- Explicit references to the safety requirements that are developed in the safety guides (not currently included).

It is recognized that electromagnetic fields and electromagnetic interference by high voltage switchgear at the plant are possible but this is a matter of electrical and I&C design and qualification. As a matter of fact, electromagnetic fields and electromagnetic interference are addressed in the new safety guides on the design of electrical power systems SSG-34 and design of I&C systems SSG-39, both under publication. The electromagnetic interferences which could be created by the use of portable communication equipment or other devices should be prevented by administrative procedures

(not NPP design). Therefore, internal hazards due to electromagnetic fields or electromagnetic interference are not considered within the scope of this safety guide.

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

The new safety guide will be directly related to SSR-2/1 rev.1, and will have interfaces with a number of safety guides on NPP Design and other standards for safety, among them:

- Safety of Nuclear Power Plants: Design (SSR 2/1, Rev.1)
- Safety Assessment for Facilities and Activities (GSR Part 4, Rev.1)
- Fire Safety in the Operation of Nuclear Power Plants (NS-G-2.1)
- Seismic Design and Qualification for Nuclear Power Plants (DS490, revision of NS-G-1.6)
- External Events Excluding Earthquakes in the Design of Nuclear Power Plants (NS-G-1.5)
- Design of Electric Power Systems for NPPs (DS430)
- Design of I & C Systems for NPPs (DS431)
- Safety Guide on Safety Classification of Structures, Systems and Components in Nuclear Power Plants (SSG-30)

There will also be relations with applicable guides for nuclear security, such as:

- NSS13: Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities, and
- NSS4: Engineering Safety Aspects of the Protection of Nuclear Power Plants against Sabotage.

7. OVERVIEW

The new 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, rev. 1. It will be part of the revision process to define the detailed structure of the new safety guide. At this moment, it is planned that the safety guide will address specifically the following internal hazards:

- Internal fires
- Internal explosions
- Internal floods
- Missiles
- Physical effects of breaks in fluid systems
- Collapse of structures and falling objects
- Release of hazardous substances inside the plant

There will be aspects for these hazards receiving a common treatment, but each of these hazards needs also some specific considerations. In general for each internal hazard the following topics will be addressed in the safety guide:

- Design measures for prevention of the internal hazard or minimizing its magnitude
- Design measures and systems for detection and mitigation of the internal hazard
- Design measures and equipment for prevention or limitation of the propagation of the effects of the internal hazards to other areas, including secondary effects
- Protection of plant equipment against the internal hazard for:

- a. Safe shutdown of the plant and preserving spent fuel integrity
- b. Prevention of radioactive releases in case of severe accidents
- Safety classification and equipment qualification of SSCs for prevention, detection, mitigation and confinement of the internal hazard

These points will have a full application in some hazards like internal fires. For some hazards, e.g. missiles, some of these points would not be applicable or need only a simplified treatment. In addition, a specific terminology will be used in relation to these points for each hazard, e.g., for the mitigation of the hazards, the term for fires would be fire extinguishing and the term for floods would be flood isolation. The global structure of the list of contents will be the following:

1. INTRODUCTION
2. OBJECTIVES AND SCOPE
3. GENERAL CONCEPTS
4. INTERNAL HAZARDS TO BE CONSIDERED IN THE DESIGN
5. INTERNAL HAZARDS POTENTIALLY INDUCED BY OTHER HAZARDS
6. PLANT LAYOUT AND APPROACH TO BUILDING DESIGN
7. INTERNAL FIRES
8. INTERNAL EXPLOSIONS
9. INTERNAL FLOODS
10. MISSILES
11. PHYSICAL EFFECTS OF BREAKS IN FLUID SYSTEMS
12. COLLAPSE OF STRUCTURES AND FALLING OBJECTS
13. RELEASE OF HAZARDOUS SUBSTANCES INSIDE THE PLANT

REFERENCES

APPENDICES

For each internal hazard the points described above will be addressed as appropriate. It is considered premature at the time of developing the DPP to elaborate a detailed table of contents that possibly would not be maintained during the development of the safety guide.

8. PRODUCTION SCHEDULE: Provisional schedule for preparation of the document, outlining realistic expected dates for each step (*fill the column corresponding to your proposed document and delete the other columns*):

	A*	B*	C*
STEP 1: Preparing a DPP	DONE	DONE	DONE
STEP 2: Approval of DPP by the Coordination Committee	August 2015		
STEP 3: Approval of DPP by the relevant review Committees	December 2015		
STEP 4: Approval of DPP by the CSS	April 2016		
STEP 5: Preparing the draft a TM is not expected to be organized	November 2016		
STEP 6: Approval of draft by the Coordination Committee	3Q 2017		
STEP 7: Approval by the relevant review Committees for submission to Member States for comments	4Q 2017		
STEP 8: Soliciting comments by Member States	1Q 2018		
STEP 9: Addressing comments by Member States	2Q 2018		
STEP 10: Approval of the revised draft by the Coordination Committee Review in NS-SSCS	3Q 2018		
STEP 11: Approval by the relevant review Committees	4Q 2018		
STEP 12: Endorsement by the CSS	2Q 2019		
STEP 13: Establishment by the Publications Committee and/or Board of Governors (for SF and SR only))			
STEP 14: Target publication date	4Q 2019		

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- *Column A for Safety Fundamentals, Safety Requirements and Safety Guides.*
- *Column B for Nuclear Security Series publications noting that for Technical Guides a fast track may be proposed and justified for approval by the NSGC at step 3. If approved, the draft will not be subject to the steps 4 to 10 and, be provided at step 11 to the NSGC to take note of it before its publication*
- *Column C for TECDOCs, safety reports and other publications*

9. RESOURCES

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