

## **SPESS F**

### **Document Preparation Profile (DPP)**

#### **1. IDENTIFICATION**

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

**Specific Safety Guide**

**Working ID:** DS498

**Proposed Title:** External Events Excluding Earthquakes in the Design of Nuclear Installations

**Proposed Action:** Revision

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

**Technical Officer(s):** Ovidiu Coman (ISSC/NSNI)

#### **2. BACKGROUND**

The IAEA safety guide NS-G-1.5, “External Events Excluding Earthquakes in the Design of Nuclear Power Plants”, was published in 2003 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 A decade later, in 2012, NS-R-1 was superseded by SSR-2/1, “Safety of Nuclear Power Plants: Design”, which has been also recently revised to incorporate the lessons learned from Fukushima Daiichi accident into SSR-2/1 Rev.1 (2016). The inclusion of design extension conditions (DECs) in the plant design envelope requires that structures, systems and components (SSCs) utilized for safety features for DECs need to be protected against the impact of internal and external hazards as appropriate. The potential for multiple external hazards to challenge the fundamental safety functions has received more attention after Fukushima Daiichi accident, as reflected in the IAEA Fukushima Daiichi Accident Report (2015) and in the safety requirements NS-R-3 Rev.1, “Site Evaluation for Nuclear Installations” (2016).

In addition, the safety guide on external events design needs to be aligned not only with SSR-2/1 Rev.1 but also with other applicable safety requirements for research reactors (SSR-3) and for fuel cycle facilities (SSR-4/DS478). Therefore, this revision will also extend the scope to include all nuclear installations. For the same purpose, the safety guide on seismic design and qualification (currently NS-G-1.6) is under revision as well.

#### **3. JUSTIFICATION FOR THE PRODUCTION OF THE DOCUMENT**

After the publication of the new requirements for NPP Design, SSR 2/1, Rev. 1 (2016), the revision of the safety guides for NPP design against external events that are subordinated to the previous requirements, NS-R-1 (2001), became necessary. The design safety guide against external events other than earthquakes for nuclear installations other than NPPs has been missing for a long time. The scope of the current safety guide will be expanded from nuclear power plants to all nuclear installations, observing of the current applicable requirements for research reactors (SSR-3) and fuel cycle facilities (SSR-4/DS478).

#### **4. OBJECTIVE**

The main objective of the revised safety guide is to provide recommendations and guidance on meeting the applicable requirements for the design of nuclear installations against external hazards excluding earthquakes. Second objective is to align the guidance to the current international state of practice consistent with the applicable requirements for (a) NPP Design (SSR 2/1, rev.1), (b) Safety of Research Reactors (SSR-3) and (c) Safety of Fuel Cycle Facilities (SSR-4/DS478).

#### **5. SCOPE**

This Safety Guide makes recommendations and provides guidance on the design provisions for items important to the safety of nuclear installations against external hazards excluding earthquakes.

The most relevant changes and topics that this revision will bring are the following:

- The scope of the safety guide will be extended to all nuclear installations
- This safety guide considers design protection measures of nuclear installations against external hazards, covered by the existing IAEA Safety Standards.
- In general, the terminology used needs to be revised and made consistent with the new definitions in the safety requirements and the safety glossary (2016 edition).
- The existing recommendations will be revised to ensure consistency with the Safety Requirements on Site Evaluation for Nuclear Installations NS-R-3 rev. 1.
- The existing recommendations will be reformulated as necessary to fulfil the current design requirements in SSR-2/1, rev. 1, SSR-3 and SSR-4/DS478.
- As far as possible, the new guide will propose a common approach for all the external hazards and address applicable combinations of external hazards.
- The new guide will include explicit references to the safety requirements for which recommendations to meet them are developed.
- The new guide will address the design and/or protection of safety features for DEC against external hazards (when applicable).
- The new guide will introduce guidance for achieving adequate safety margins beyond design basis to avoid or reduce early or large releases of radioactive material and cliff edge effects consistent with applicable safety requirements.
- Malicious acts are not included in 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 NS-R-3 rev.1, SSR-2/1 rev.1, SSR-3, SSR-4/DS478 and will have interfaces with a number of safety guides on hazard evaluation and safety of nuclear installations, among them the following ones:

- Site Evaluation for Nuclear Installations (NS-R-3, Rev.1)
- Safety of Research Reactors (SSR-3)

- Safety of Nuclear Fuel Cycle Facilities (SSR-4/DS478)
- Safety of Nuclear Power Plants: Design (SSR 2/1, Rev.1)
- Safety Assessment for Facilities and Activities (GSR Part 4, Rev.1)
- Safety Guide on Safety Classification of Structures, Systems and Components in Nuclear Power Plants (SSG-30)
- Human Induced Hazards in Site Evaluation for Nuclear Installations NS-G-3.1
- Meteorological and Hydrological Hazards in Site Evaluation for nuclear Installations SSG-18
- Volcanic Hazards in Site Evaluation for Nuclear Installations SSG-21
- Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants DS481 revision of NS-G-1.9
- Design of Reactor Containment Systems for Nuclear Power Plants DS482, revision of NS-G-1.10
- Design of the Reactor Core for Nuclear Power Plants DS488 revision of NS-G-1.12
- Seismic Design and Qualification for Nuclear Power Plants (DS490, revision of NS-G-1.6)
- Design of Electric Power Systems for NPPs SSG-34.
- Design of I & C Systems for NPPs SSG39.
- Protection against Internal Hazards in the Design of Nuclear Power Plants (DPP494, revision of NS-G-1.7 and NS-G 1.11)

As well as other relevant IAEA Safety Standards such as:

- Preparedness and Response for a Nuclear or Radiological Emergency (GSR Part 7 )
- The Management System for Facilities and Activities

## **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. It will be part of the revision process to define the detailed structure of the new safety guide. It is planned that the safety guide will address the external hazards addressed in IAEA Safety Guides for site evaluation excluding earthquake:

- External Floods including Tsunami
- Extreme Winds
- Other Extreme Meteorological Conditions
- Volcanism
- External Fire
- External Explosions including Missiles, Shockwaves
- Asphyxiant, Toxic Gases, Toxic Chemicals and Flammable Vapour Clouds
- Corrosive and Radioactive Fluids
- Aircraft Crash (unintended)
- Electromagnetic Interference

- Biological Phenomena
- Collisions of Floating Bodies with Water Intakes and Ultimate Heat Sink (UHS) components
- Other Hazards
- Combination of Hazards

As far as possible, there will be aspects for these hazards receiving a common treatment, but each of these hazards needs specific considerations. The following topics will be addressed in the safety guide:

- Application of safety requirements to the design for protection against external events
- Safety classification and equipment qualification of SSCs
- Design Basis for External Events
- Detection, protection and mitigation of the impact of external hazards.
- Design measures for prevention of failures and common cause modes induced by external hazards.
- Design measures for prevention and limitation of the propagation of the effects induced by external hazards to other areas,

For some hazards, e.g. biological phenomena, some of these points would not be applicable or need only a simplified treatment. The list of contents will be the following:

1. INTRODUCTION
  2. OBJECTIVES AND SCOPE
  3. GENERAL CONCEPTS
  4. APPLICATION OF SAFETY CRITERIA TO THE DESIGN FOR PROTECTION AGAINST EXTERNAL EVENTS
  5. GRADED APPROACH
  6. DESIGN BASIS FOR EXTERNAL EVENTS
    - a. LOADS COMBINATIONS
    - b. ACCEPTANCE CRITERIA
    - c. SAFETY MARGINS AND CLIFF EDGE EFFECTS
    - d. DEC FOR EXTERNAL EVENTS
  7. PLANT LAYOUT AND APPROACH TO BUILDING DESIGN
  8. SAFETY DESIGN PROVISIONS AGAINST EXTERNAL EVENTS
    - a. External Floods, Including Tsunami
    - b. Extreme Winds
    - c. Other Extreme Meteorological Conditions
    - d. Volcanism
    - e. External Fire
    - f. External Explosions including Missiles, Shockwaves
    - g. Asphyxiant, Toxic Gases, Toxic Chemicals and Flammable Vapour Clouds
    - h. Corrosive and Radioactive Fluids
    - i. Aircraft Crash
    - j. Electromagnetic Interference
    - k. Biological Phenomena
      - l. Collisions of Floating Bodies with Water Intakes and UHS components
    - m. Other external hazards
    - n. Combination of Hazards
  9. SAFETY DESIGN PROVISIONS FOR NUCLEAR INSTALLATIONS OTHER THAN NUCLEAR POWER PLANTS.
  10. REFERENCES
- APPENDICES

It is considered premature at the time of developing the DPP to elaborate a detailed table of contents that possibly to be updated 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		
STEP 2: Approval of DPP by the Coordination Committee	September 2016		
STEP 3: Approval of DPP by the relevant review Committees	December 2016		
STEP 4: Approval of DPP by the CSS	April 2017		
STEP 5: Preparing the draft a TM is not expected to be organized	November 2017		
STEP 6: Approval of draft by the Coordination Committee	2Q 2018		
STEP 7: Approval by the relevant review Committees for submission to Member States for comments	2Q 2018		
STEP 8: Soliciting comments by Member States	2Q 2018		
STEP 9: Addressing comments by Member States	4Q 2018		
STEP 10: Approval of the revised draft by the Coordination Committee	1Q 2019		
STEP 11: Approval by the relevant review Committees	2Q 2019		
STEP 12: Endorsement by the CSS	3Q 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.