

**Document Preparation Profile (DPP)  
Version 01 dated 31 July 2017**

## 1. IDENTIFICATION

**Document Category:** Specific Safety Guide

**Working ID:** DS511

**Proposed Title:** Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors

**Proposed Action:** Revision of SSG-22, Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors (2012)

**Review Committee(s):** NUSSC, EPRéSC, RASSC, TRANSSC, WASSC, NSGC

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## 2. BACKGROUND

The IAEA Safety Standards related to the safety of research reactors include IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors (2016), and eleven Specific Safety Guides (hereinafter referred to as Guides). These Guides were all published before SSR-3 was released and represent the international consensus on the safety of research reactors at the respective date of publication. These Guides have been extensively used as the basis for the safety assessments conducted during the IAEA Integrated Safety Assessment of Research Reactors (INSARR) missions and were used by many Member States as reference when establishing national safety regulations and safety policies and practices of research reactor operating organizations.

The publication of SSR-3 in 2016 superseded IAEA Safety Standards Series No. NS-R-4, Safety of Research Reactors (2005), and in doing so introduced several new requirements on the safety of research reactors and significantly modified the substance of others. To assess the extent of these changes, a gap analysis was performed to compare the requirements in SSR-3 with the previous safety requirements in NS-R-4. The analysis identified new requirements in SSR-3, including Req. 22, Design Extension Conditions; Req. 39, Prevention of Unauthorized Access to, or Interference with, Items Important to Safety; Req. 40, Prevention of Disruptive or Adverse Interactions between Systems Important to Safety; Req. 55, Emergency Response Facilities on the Site; Req. 76, Material Conditions and Housekeeping; and Requirement 90, Interfaces between nuclear safety and nuclear security. Requirements related to management for safety and verification of safety, site evaluation, general design requirements, treatment of accident conditions, safety analysis and defence-in-depth were significantly modified. The gap analysis also identified information in NS-R-4 that was not carried over to SSR-3 because it was more suitable for inclusion in Guide-level publications. Additionally, the scope of SSR-3 includes subcritical assemblies, a category of nuclear installation that was not previously grouped with research reactors and therefore not subject to the requirements of NS-R-4 nor covered by the existing Guides.

An analysis of the scope and content of the Guides and the new and significantly modified requirements in SSR-3 was performed. The analysis resulted in identification of eight Guides (Group 1) that largely remain valid in their technical content, but have outdated references and minor deviations from the requirements in SSR-3. Two Guides were found to need more in-depth technical revisions mainly due to the new requirement in SSR-3 on design extension conditions (Group 2). Finally, the analysis showed that IAEA Safety Standards Series No. SSG-22, Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors (2012), needs to be revised in its entirety due to its heavy reliance on outdated references to individual paragraphs of NS-R-4 and a lack of guidance related to new requirements in SSR-3, particularly design extension conditions and interfaces between nuclear safety and nuclear security (Group 3). More detailed results of the analysis and the main revisions needed to the Guide covered by this DPP are provided in the Annex.

Based on the results of the analysis, the 11 Guides will be revised by amendment in three groups according to the estimated extent of the revisions needed and their technical interlinkages. These groups are as follows:

#### Group 1

- IAEA Safety Standards Series No. NS-G-4.1, Commissioning of Research Reactors, IAEA, Vienna (2006);
- IAEA Safety Standards Series No. NS-G-4.2, Maintenance, Periodic Testing and Inspection of Research Reactors, IAEA, Vienna (2006);
- IAEA Safety Standards Series No. NS-G-4.3, Core Management and Fuel Handling for Research Reactors, IAEA, Vienna (2008);
- IAEA Safety Standards Series No. NS-G-4.4, Operational Limits and Conditions and Operating Procedures for Research Reactors, IAEA, Vienna (2008);
- IAEA Safety Standards Series No. NS-G-4.5, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors, IAEA, Vienna (2008);
- IAEA Safety Standards Series No. NS-G-4.6, Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors, IAEA, Vienna (2008);
- IAEA Safety Standards Series No. SSG-10, Ageing Management for Research Reactors, IAEA, Vienna (2010);
- IAEA Safety Standards Series No. SSG-37, Instrumentation and Control Systems and Software Important to Safety for Research Reactors, IAEA, Vienna (2015).

#### Group 2

- IAEA Safety Standards Series No. SSG-20, Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report, IAEA, Vienna (2012);
- IAEA Safety Standards Series No. SSG-24, Safety in the Utilization and Modification of Research Reactors, IAEA, Vienna (2012).

#### Group 3

- IAEA Safety Standards Series No. SSG-22, Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors, IAEA, Vienna (2012).

One Guide (Group 3) will be revised under this DPP. Group 1 and Group 2 will be revised under separate DPPs.

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

The revision of SSG-22 is timely because it predates SSR-3 and most of the General Safety Requirements publications, and as such, it contains many references to superseded requirements, does not fully address all of the current requirements and does not cover the safety of subcritical assemblies. The added value of the revised Guide will be to provide target users with comprehensive, consistent and up-to-date guidance for using a graded approach when implementing the safety requirements listed in SSR-3 and the General Safety Requirements as they apply to research reactors.

The revision of SSG-22 will benefit from amendments to take into consideration the following:

- Revisions implemented in the General Safety Requirements, other IAEA Safety Standards and, in particular, the new and modified requirements in SSR-3 since publication of the SSG-22;
- Long Term Structure of the IAEA Safety Standards;
- Feedback from the users of the IAEA Safety Standards related to research reactors, including feedback from a Technical Meeting on graded approach held in 2016 and attended by 55 participants from 39 Member States;
- Use of SSG-22 by organizations involved in the safety of subcritical assemblies, which are now in the scope of SSR-3;
- Lessons from the accident at the Fukushima Daiichi nuclear power plant and other events in the nuclear industry, including those occurring at research reactors that were reported to the Incident Reporting System for Research Reactors.

More specifically, amendments of SSG-22 are needed to address the following:

1. As mentioned above in Section 2, there are several new requirements in SSR-3 and others have been substantively modified from their original form in NS-R-4. Obviously, some of these requirements are not addressed at all in SSG-22, including Req. 22, Design Extension Conditions; Req. 55, Emergency Response Facilities on the Site; Req. 76, Material Conditions and Housekeeping; and Req. 90, Interfaces between nuclear safety and nuclear security. The guidance related to other requirements in SSR-3 that were substantively modified needs to be rechecked and updated to ensure it provides complete and consistent coverage of SSR-3.
2. The IAEA Safety Standards proposed for revision under separate DPPs (Group 1 and Group 2, as explained in Section 2, above) were all published before SSG-22 (except SSG-37) and contain information about applying a graded approach in their respective areas. This information needs to be removed from the other Guides and consolidated in a harmonized manner in the revision to SSG-22.
3. The publication of SSR-3 expanded the scope of the safety requirements for research reactors to include subcritical assemblies. As SSG-22 was published prior to SSR-3, it does not provide explicit guidance about how the safety requirements should be implemented for subcritical assemblies using a graded approach. Given that subcritical assemblies are typically much simpler nuclear installations than critical facilities and research reactors that operate at significant power levels, there are many requirements in SSR-3 that can be graded much differently for subcritical assemblies than for other types of research reactors. Target users will benefit from guidance in this area.

#### **4. OBJECTIVE**

The objective of SSG-22 is to provide research reactor operating organizations, regulatory bodies and other organizations involved in the site evaluation, design, construction, operation and planning for decommissioning of research reactors with guidance on using a graded approach when implementing the requirements of SSR-3 and the General Safety Requirements as they apply to research reactors.

## 5. SCOPE

The revised SSG-22 will cover use of a graded approach in all areas important to the safety of research reactors, including subcritical assemblies. The guidance and recommendations in SSG-22 are applicable to all phases of a research reactor lifecycle, including siting, design, construction, commissioning, operation, utilization and modification, extended shutdown and planning for decommissioning.

The scope of SSG-22 will change during the revision process, because it will be expanded to treat subcritical assemblies explicitly and to address application of a graded approach to interfaces between safety and security for research reactors.

In addition, the analysis described in Section 2 resulted in identification of the main revisions to SSG-22 (see the Annex) that are needed to fully address the requirements in SSR-3 and the General Safety Requirements.

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

The revised SSG-22 will be facility-specific (i.e. research reactors and subcritical assemblies), support the application of SSR-3 and interface with all General Safety Requirements and General Safety Guides. SSG-22 interfaces with the following IAEA Safety Standards and other publications (this is not, and cannot be, regarded as an exclusive or exhaustive list):

- IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), Governmental, Legal and Regulatory Framework for Safety, IAEA, Vienna (2016);
- IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety, IAEA, Vienna (2016);
- IAEA Safety Standards Series No. GSR Part 3, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA, Vienna (2014);
- IAEA Safety Standards Series No. GSR Part 4, (Rev.1) Safety Assessment for Facilities and Activities, IAEA, Vienna (2016);
- IAEA Safety Standards Series No. GSR Part 5, Predisposal Management of Radioactive Waste, IAEA, Vienna (2009);
- IAEA Safety Standards Series No. GSR Part 6, Decommissioning of Facilities, IAEA, Vienna (2014);
- IAEA Safety Standards Series No. GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA, Vienna (2015);
- IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors, IAEA, Vienna (2016);
- IAEA Safety Standards Series No. NS-R-3 (Rev. 1), Site Evaluation for Nuclear Installations, IAEA, Vienna (2016);
- IAEA Safety Standards Series No. GS-G-3.1, Application of the Management System for Facilities and Activities, IAEA, Vienna (2006);
- IAEA Safety Standards Series No. GS-G-3.5, The Management System for Nuclear Installations, IAEA, Vienna (2009);
- IAEA Safety Standards Series No. NS-G-4.1, Commissioning of Research Reactors, IAEA, Vienna (2006);
- IAEA Safety Standards Series No. NS-G-4.2, Maintenance, Periodic Testing and Inspection of Research Reactors, IAEA, Vienna (2006);
- IAEA Safety Standards Series No. NS-G-4.3, Core Management and Fuel Handling for Research Reactors, IAEA, Vienna (2008);

- IAEA Safety Standards Series No. NS-G-4.4, Operational Limits and Conditions and Operating Procedures for Research Reactors, IAEA, Vienna (2008);
- IAEA Safety Standards Series No. NS-G-4.5, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors, IAEA, Vienna (2008);
- IAEA Safety Standards Series No. NS-G-4.6, Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors, IAEA, Vienna (2008);
- IAEA Safety Standards Series No. SSG-10, Ageing Management for Research Reactors, IAEA, Vienna (2010);
- IAEA Safety Standards Series No. SSG-20, Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report, IAEA, Vienna (2012);
- IAEA Safety Standards Series No. SSG-24, Safety in the Utilization and Modification of Research Reactors, IAEA, Vienna (2012);
- IAEA Safety Standards Series No. SSG-37, Instrumentation and Control Systems and Software Important to Safety for Research Reactors, IAEA, Vienna (2015);
- IAEA Services Series No. 25, Guidelines for the Review of Research Reactor Safety, IAEA, Vienna (2013).

As applicable, it will be necessary to coordinate with the development and revision of other relevant IAEA Safety Standards in cooperation with IAEA Regulatory Activities Section, Incident and Emergency Centre, Division of Nuclear Security and Division of Radiation, Transport and Waste Safety.

## 7. OVERVIEW

This Section presents the proposed structure of the revision to SSG-22. It is possible that during the revision process, changes in the structure of the guide will be identified to improve their user-friendliness and better align with the structure and content of SSR-3.

One significant change to the structure is proposed to align the Guide with the structure of SSR-3; a new Section 9, “Interfaces between Safety and Security for a Research Reactor”, will be added. The proposed structure is as follows:

### **Revision of SSG-22**

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure
2. Basic Elements of the Graded Approach
  - General Considerations Regarding the Application of a Graded Approach
  - Description of the Application of a Graded Approach
3. Regulatory Supervision
  - Application of a Graded Approach to Legal Infrastructure
  - Application of a Graded Approach to the Regulatory Body
  - Application of a Graded Approach to the Licensing Process
  - Application of a Graded Approach to Inspection and Enforcement
4. Management and Verification of Safety
  - Application of a Graded Approach to the Management of Safety
  - Application of a Graded Approach to the Verification of Safety
5. Design
  - Application of a Graded Approach to Design
6. Operation
  - Application of a Graded Approach to Organizational Provisions

- Application of a Graded Approach to Training, Retraining and Qualification
- Application of a Graded Approach to Operational Limits and Conditions
- Application of a Graded Approach to Commissioning
- Application of a Graded Approach to Operating Procedures
- Application of a Graded Approach to Maintenance, Periodic Testing and Inspection
- Application of a Graded Approach to Core Management and Fuel Handling
- Application of a Graded Approach to Fire Safety
- Application of a Graded Approach to Emergency Planning
- Application of a Graded Approach to Records and Reports
- Application of a Graded Approach to Utilization and Modification
- Application of a Graded Approach to Radiation Protection
- Application of a Graded Approach to Safety Assessments
- Application of a Graded Approach to Ageing Related Aspects
- Application of a Graded Approach to Extended Shutdown
- 7. Decommissioning
  - Application of a Graded Approach to Decommissioning
- 8. Interfaces between Safety and Security for a Research Reactor
  - Application of a Graded Approach to Interfaces between Safety and Security for a Research Reactor

#### References

Annex: Example of Steps in the Graded Approach for Packaging of Radioactive Material  
Contributors to Drafting and Review

### 8. PRODUCTION SCHEDULE:

Provisional schedule for preparation of the document, outlining realistic expected dates for each step:

STEP 1: Preparing a DPP	DONE
STEP 2: Approval of DPP by the Coordination Committee	Q3 2017
STEP 3: Approval of DPP by the relevant review Committees	Q4 2017
STEP 4: Approval of DPP by the CSS	Q2 2018
STEP 5: Preparing the draft 2 consultancy meetings are expected to be organized for the preparation of the draft	Q1-Q4 2018
STEP 6: Approval of draft by the Coordination Committee	Q4 2018
STEP 7: Approval by the relevant review Committees for submission to Member States for comments	Q2 2019
STEP 8: Soliciting comments by Member States	Q2 2019
STEP 9: Addressing comments by Member States	Q4 2019
STEP 10: Approval of the revised draft by the Coordination Committee Review in NS-SSCS	Q1 2020
STEP 11: Approval by the relevant review Committees	Q2 2020
STEP 12: Endorsement by the CSS	Q4 2020
STEP 13: Establishment by the Publications Committee	Q1 2021
STEP 14: Target publication date	Q2 2021

**9. RESOURCES**

Staff: 15 staff weeks

Consultants: 5 consultant weeks

## 10. ANNEX: MAIN REVISIONS TO THE GUIDES

The following table presents the main revisions to SSG-22 at the Section level. These revisions were identified by detailed comparison of SSR-3 with NS-R-4 and the analysis described in Section 2 of this DPP.

<b>SSG-22, Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors</b>	
<b>Section</b>	<b>Main Revisions</b>
1	Standardize background, objective and scope. Align discussion of graded approach with the new text in SSR-3 referencing subcritical assemblies.
2	Add guidance on subcritical assemblies.
3	Revise for consistency with GSR Part 1, Section 3 of SSR-3 and (draft) revised safety guides on regulatory supervision (DS472 and DS473).
4	Revise for consistency with SSR-3 Section 4 and GSR Part 2.
5	Delete (Site Evaluation is covered extensively in NS-R-3)
6	Revise for consistency with SSR-3 Section 6, including general design requirements and specific design requirements. Address changes in SSR-3 Reqs. 16-29, especially design extension conditions and qualification of items important to safety. Add guidance on subcritical assemblies. Add guidance on application of a graded approach to the interface between safety and security.
7	Revise for consistency with SSR-3 Section 7. Add guidance on subcritical assemblies.
8	Revise for consistency with SSR-3 Section 8. Add guidance on subcritical assemblies.
9	Add new Section to align with the structure of SSR-3. Add guidance on application of a graded approach to interfaces with nuclear security.
Annex	Editorial.