

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

**1. IDENTIFICATION**

**Document Category:** Specific Safety Guides

**Working ID:** DS509

**Proposed Title:**

- Commissioning of Research Reactors;
- Maintenance, Periodic Testing and Inspection of Research Reactors;
- Core Management and Fuel Handling for Research Reactors;
- Operational Limits and Conditions and Operating Procedures for Research Reactors;
- The Operating Organization and the Recruitment and Qualification of Personnel for Research Reactors;
- Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors;
- Ageing Management for Research Reactors;
- Instrumentation and Control Systems and Software Important to Safety for Research Reactors.

**Proposed Action:** Revision by amendment of 8 Specific Safety Guides on Research Reactors as a set of publications:

- NS-G-4.1: Commissioning of Research Reactors (2006);
- NS-G-4.2: Maintenance, Periodic Testing and Inspection of Research Reactors (2006);
- NS-G-4.3: Core Management and Fuel Handling for Research Reactors (2008);
- NS-G-4.4: Operational Limits and Conditions and Operating Procedures for Research Reactors (2008);
- NS-G-4.5: The Operating Organization and the Recruitment and Qualification of Personnel for Research Reactors (2008);
- NS-G-4.6: Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors (2008);
- SSG-10: Ageing Management for Research Reactors (2010);
- SSG-37: Instrumentation and Control Systems and Software Important to Safety for Research Reactors (2015).

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

**Technical Officer(s):** David SEARS

Amgad SHOKR

William KENNEDY

Deshraju RAO

Field Code Changed

Field Code Changed

## 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 in the period 2006-2012 (except SSG-37 which was published in 2015) before SSR-3 and represent the international consensus on the safety of research reactors which existed at that time the respective date of publication. These Guides have been extensively used as a 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 deviations from the requirements in SSR-3. Two Guides (Group 2) were found to need more in-depth technical revisions mainly due to the new requirement in SSR-3 on design extension conditions. 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 Guides 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);

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

- 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).

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

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

The revision of the Guides proposed in this DPP is timely because they predate SSR-3 and most of the General Safety Requirements publications, and as such, the Guides contain many references to superseded requirements, do not fully address all of the current requirements and do not cover the safety of subcritical assemblies. Also, some of the Guides are ten or more years old. [In addition, guidance in similar NPP safety standards will be considered to ensure overall consistency.](#) The added value of the revised Guides will be to provide target users with comprehensive, consistent and up-to-date guidance for implementing the safety requirements in SSR-3 and the General Safety Requirements as they apply to research reactors.

The revision of the eight Guides covered by this DPP will benefit from revisions 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 Guides;
- Long Term Structure of the IAEA Safety Standards;
- Feedback from the users of the IAEA Safety Standards related to research reactors;
- Use of these Guides for 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;
- Experience gained with INSARR missions.

More specifically, amendments of the Guides 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. These requirements are not

Field Code Changed

Field Code Changed

fully addressed in the Guides, particularly 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.

Field Code Changed

Field Code Changed

2. There are many references in the Guides to the quality assurance programme (Quality Assurance Code and appropriate Safety Guides, Safety Series No. 50-C/SG-Q). All these references should be updated to refer to the relevant provisions of the management system presented in the relevant IAEA Safety Standards, including IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety, IAEA, Vienna (2016); IAEA Safety Standards Series No. GS-G-3.1, Application of the Management System for Facilities and Activities, IAEA, Vienna (2006); and IAEA Safety Standards Series No. GS-G-3.5, The Management System for Nuclear Installations, IAEA, Vienna (2009).
3. Some statements in the Guides that are expressed as “should” statements do, in fact, duplicate some requirements of SSR-3 and GSR Parts 1-7. As such they do not add any value in the Guides and could confuse users about whether something is a requirement or a recommendation. Such statements should be carefully rechecked and either removed from the Guides (as no value added) or modified to make them useful recommendations, supporting the appropriate requirements.
4. IAEA Safety Standards Series No. SSG-22, Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors, was published in 2012. The Guides proposed for revision in this DPP 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 Guides and consolidated in a harmonized manner in a revision to SSG-22 that will be proposed under a separate DPP.
5. The publication of SSR-3 expanded the scope of the safety requirements for research reactors to include subcritical assemblies. As they were all published prior to SSR-3, the Guides do not provide explicit guidance about how subcritical assemblies should implement the safety requirements. Although most requirements in SSR-3 are universally-applicable to research reactors and subcritical assemblies, SSR-3 makes several explicit references to the safety of subcritical assemblies (for example, SSR-3, Paras. 6.62 and 6.66). The Guides need to be updated to address subcritical assemblies in general and the specific references in SSR-3.
6. Currently, NS-G-4.6 covers radioactive waste management in the design and operation of research reactors. IAEA Safety Standards Series No. SSG-40, Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors, was published in 2016 and also contains guidance related to managing radioactive waste generated at research reactors. An analysis of the guidance and information in NS-G-4.6 and SSG-40 was made to assess whether the topic of waste management could be removed from NS-G-4.6. The analysis showed that there is some overlap between the Guides (e.g. information in NS-G-4.6 on sources of radioactive waste at research reactors was duplicated in SSG-40), but in general, SSG-40 provides a more generic treatment of the topic, while NS-G-4.6 provides more detailed guidance specifically for research reactors. This is consistent with the scope of SSG-40 which covers “predisposal management of all types of radioactive waste generated at nuclear power plants and research reactors” and “all stages in the lifetime of a waste management facility”. [The issue of combining radiation protection aspects of NS-G-1.13, WS-G-2.1 and NS-G-4.6 was also considered.](#) As a result of the analysis, it is recommended to retain the detailed guidance in NS-G-4.6 and add references to the additional guidance ~~in SSG-40~~ (e.g. [in SSG-40](#) Section 3, Roles and Responsibilities and Section 4, Integrated Approach to Safety which provide additional guidance beyond what is in NS-G-4.6, Section 9, Organizational Aspects.) This approach will provide target users with detailed and user-friendly guidance document for radioactive waste

Field Code Changed

Field Code Changed

management in the design and operation of research reactors, while benefitting from the additional guidance for waste management facilities in SSG-40.

Field Code Changed

Field Code Changed

7. In some cases, the Guides have to be updated to better reflect the current operational practices at research reactors and the state-of-the-art in relevant technologies.

7-8. An analysis of the guidance and information in SSG-10 and NS-G4.2 was made to assess whether the two documents should be combined. Ageing management is one of the main issues facing the worldwide fleet of research reactors with more than 40% exceeding 50 years of operation. The analysis indicated that separate guidance is warranted on ageing management and on maintenance, periodic testing and inspection of research reactors to support Member States to enhance safety in these two separate and distinct areas.

Formatted: List Paragraph, No bullets or numbering

#### 4. OBJECTIVE

The objective of the revised Guides is to provide research reactor operating organizations, regulatory bodies and other organizations involved in the safety of research reactors in Member States with guidance on meeting the requirements of SSR-3 and the General Safety Requirements as they apply to research reactors.

#### 5. SCOPE

The revised Guides (in conjunction with those being revised under separate DPPs, as described in Section 2, above) will cover all areas important to the safety of research reactors, including the safety of subcritical assemblies. The Guides cover all stages in the lifetime of a research reactor facility, including design, construction, commissioning, operation, utilization and modification, extended shutdown and planning for decommissioning.

The scope of each Guide will not change during the revision process, with the exception that all revised Guides will also be applicable to subcritical assemblies.

In addition, the analysis described in Section 2 resulted in identification of the main revisions to each Guide (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 publications in this DPP are 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. The Guides interface 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);

Field Code Changed

Field Code Changed

- 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. SSG-20, Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report, IAEA, Vienna (2012);
- 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);
- IAEA Safety Standards Series No. SSG-24, Safety in the Utilization and Modification of Research Reactors, IAEA, Vienna (2012);
- 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 each Guide, which in most cases is identical to the structure of the current Guide. The revised Guides will be published as individual Guides and retain their current structure, with a few exceptions, as explained below. It is possible that during the revision process, changes in the structure of individual Guides will be identified to improve their user-friendliness and better align with the structure and content of SSR-3 (one such change is already proposed for NS-G-4.5).

The Guides also have another structural level below the Sub-Section level, which is not represented below. In many cases, these will remain unchanged, however some will need to be modified/deleted/included to ensure comprehensive coverage of the requirements in SSR-3.

### Revision of NS-G-4.1

This Guide will cover commissioning of research reactors (and major modifications and new utilization activities) and provide recommendations and guidance mainly related to implementing Requirements 1, 5, [12](#), [24](#), [30](#), [36](#), [40](#), [51](#), [55](#), [67](#), [73](#), [74](#), [82](#) and [83](#) of SSR-3. The proposed structure is as follows:

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure
2. Management System for Commissioning
  - Management Responsibility
  - Resource Management
  - Process Implementation
  - Measurement, Assessment and Improvement

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

3. Commissioning Programme
    - General Objectives
    - Format and Content
  4. Commissioning Organization
    - Organization
    - Responsibilities
    - Interfaces between Activities of Participating Groups
    - Handover of the Facility
    - Emergency Planning
  5. Commissioning Stages
    - General
    - Stages, Tests and Prerequisites
  6. Commissioning Procedures and Reports
    - Procedures
    - Reports
  7. Documentation
    - Record Keeping
    - Updating the Safety Analysis Report
  8. Commissioning of New Experimental Devices and Modifications
    - General
    - Extension of Commissioning Period
- Appendix: Prerequisites and tests for each stage of commissioning
- References
- Contributors to Drafting and Review

### **Revision of NS-G-4.2**

This Guide will cover maintenance, periodic testing and inspection of research reactors and provide recommendations and guidance mainly related to implementing Requirements 24, 31, 37, [51](#), 63, 67, 69, 70, 71, 72, 74, 77, 80, [81](#), 82, 84, 87, 88 and 90 of SSR-3. The proposed structure is as follows:

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure
2. Management System for Maintenance, Periodic Testing and Inspection
  - General
  - Management Responsibility
  - Resource Management
  - Process Implementation
  - Measurement, Assessment and Improvement
3. Overview of Maintenance, Periodic Testing and Inspection
  - General
  - Interrelationship between Maintenance, Periodic Testing and Inspection
  - Maintenance
  - Periodic Testing
  - Inspection
4. Design Considerations
  - Design for Maintainability
  - Design for Testability
  - Design for Inspectability
5. Programme for Maintenance, Periodic Testing and Inspection

Field Code Changed

Field Code Changed

- General
  - Content of the Programme
  - Additional Non-Routine Maintenance, Testing and Inspection
  - 6. Organization and Responsibilities for Maintenance, Periodic Testing and Inspection
    - [Organizational Structure](#)
    - Coordination and Interfaces
    - Responsibilities
  - 7. Selection, Training and Qualification of Maintenance Personnel
  - 8. Procedures
    - Administrative Procedures
    - Procedures for Maintenance, Periodic Testing and Inspection
  - 9. Administrative Controls
    - Work Authorization (Work Permit)
    - Work Coordination
    - Work Performed by Contractors
  - 10. Maintenance Facilities
    - Workshop Facilities
    - Facilities for Maintenance of Radioactive Items
    - Decontamination Facilities
    - Lifting and Handling Facilities
    - Special Equipment and Tools
    - Mock-Ups and Models
  - 11. Procurement and Storage
    - Procurement
    - Receipt
    - Storage
  - 12. Testing and Inspection Methods and Techniques
    - Visual Examination
    - Surface Examination
    - Volumetric Examination
    - Other Testing Techniques
- Appendix: Relationships between Terms Used
- References
- Contributors to Drafting and Review
- Bodies for the Endorsement of IAEA Safety Standards

Field Code Changed

Field Code Changed

### **Revision of NS-G-4.3**

This Guide will cover core management and fuel handling for research reactors and provide recommendations and guidance mainly related to implementing Requirements 7, 9, 15, 38, 39, 41, 44, 45, 58, 63, 71, 74, 77, 78, 82, 87 and 90 of SSR-3. The proposed structure is as follows:

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure
2. Management System for Core Management and Fuel Handling
  - General
  - Management Responsibility
  - Resource Management
  - Process Implementation
  - Measurement, Assessment and Improvement

Field Code Changed

Field Code Changed



3. Core Management
    - General
    - Core Calculations
    - Core Operation
    - Core Monitoring
    - Ensuring Fuel Integrity
    - New Fuel Procurement and Design Modifications
    - Refuelling Process
  4. Handling and Storage of Fresh Fuel
    - Fresh Fuel Management
    - Receipt of Fresh Fuel
    - Storage of Fresh Fuel
  5. The Refuelling Programme
    - Preparation
    - Loading Fuel and Core Components into the Reactor
    - Unloading Fuel and Core Components
    - Handling Fuel and Core Components
  6. Handling and Storage of Irradiated Fuel
    - General Objectives
    - Handling of Irradiated Fuel
    - Storage of Irradiated Fuel
    - Inspection of Irradiated Fuel
  7. Handling and Storage of Core Components
  8. Preparation of Fuel for Dispatch
  9. Administrative and Organizational Aspects
  10. Documentation
- References  
 Annex: Reasons for Core Management for Research Reactors  
 Contributors to Drafting and Review

Field Code Changed

Field Code Changed

#### **Revision of NS-G-4.4**

This Guide will cover operational limits and conditions and operating procedures for research reactors and provide recommendations and guidance mainly related to implementing Requirements 6, 18, 20, 21, 24, 35, 41, 45, 50, 67, 69, [70](#), 71, 72, 74, 75, 77, 78, 81, 82, 83, 84, 85, 87, [88](#) and 90 of SSR-3. Two changes in the structure of NS-G-4.4 are proposed, including:

- Changing the title of a Sub-Section of Section [6 \(previously Section 5\)](#) to, “Procedures for Operator Response to Anticipated Operational Occurrences and Accident Conditions”, to reflect the inclusion of guidance on procedures for the operator to respond to accident conditions.
- Section 8, “Quality Assurance”, will be replaced with a new Section 2, “Management System for Operational Limits and Conditions and Operating Procedures”. This change is needed to reflect the current Agency terminology and better align with the contents of SSR-3 and structure of the other Guides.

The proposed structure is as follows:

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure

Field Code Changed

Field Code Changed

2. Management System for Operational Limits and Conditions and Operating Procedures
    - General
    - Management Responsibility
    - Resource Management
    - Process Implementation
    - Measurement, Assessment and Improvement
  3. Development of Operational Limits and Conditions
    - General
    - Attributes of Operational Limits and Conditions
  4. Content of the Operational Limits and Conditions Document
    - Table of Contents
    - Definitions
    - Introduction
    - Safety Limits
    - Safety System Settings
    - Limiting Conditions for Safe Operation
    - Surveillance Requirements
    - Administrative Controls
  5. Development of Operating Procedures
    - General
    - Roles and Responsibilities
    - Categorization and List of Operation Procedures
    - General Considerations for the Development of Operating Procedures
    - Steps in the Preparation of a Procedure
  6. Format and Content of Operating Procedures
    - General
    - Commissioning Procedures
    - Operational Procedures
    - Maintenance Procedures
    - Inspection, Calibration and Periodic Testing Procedures
    - Radiation Protection Procedures
    - Procedures for the Authorization of Operation, Maintenance and Utilization
    - Procedures for Operator Response to Anticipated Operational Occurrences and Accident Conditions
    - Emergency Procedures
    - Physical Protection Procedures
    - Procedures for the Handling of Radioactive Waste and Control of Radioactive Releases
    - Procedures for Extended Shutdown
    - Procedures for Utilization and Modification of the Reactor
    - Administrative Procedures
  7. Training of Personnel in the Use of Procedures
  8. Compliance with Operational Limits and Conditions and Operating Procedures
- Appendix I: Factors to be Considered in Establishing Limiting Conditions for Safe Operation
- Appendix II: Indicative List of Operating Procedures
- References
- Contributors to Drafting and Review

Field Code Changed

Field Code Changed

### **Revision of NS-G-4.5**

This Guide will cover the operating organization and the recruitment, training and qualification of personnel for research reactors and provide recommendations and guidance mainly related to implementing Requirements 2, 3, 4, 5, 6, 11, 67, 68, 69, 70, 76, 79, [81](#), 82, 87 and 90 of SSR-3. The proposed structure is as follows:

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure
2. The Operating Organization
  - General
  - Organizational Plan
  - Structure of the Organization
  - Communication
  - Responsibilities
  - Management System
  - Programmes for Operation of a Research Reactor
3. Recruitment and Selection of Operating Personnel
  - General
  - Staffing Arrangements
  - Selection Process
4. Training and Qualification of Operating Personnel
  - General
  - Training System
  - Initial Training Programmes
  - Qualification
  - Continuing Training and Requalification
5. Authorization of Operating Personnel
  - General
  - Positions to be Authorized
  - Conditions of Authorization
  - Reauthorization
6. Training Records

## References

Annex I: The systematic Approach to Training

Annex II: Example of a Curriculum for a Training Course for Research Reactor Operators

Contributors to Drafting and Review

**Revision of NS-G-4.6**

This Guide will cover radiation protection and radioactive waste management in the design and operation of research reactors and provide recommendations and guidance mainly related to implementing Requirements 8, 15, 34, 43, 57, 59, 69, 70, 71, 77, 84 and 85 of SSR-3. One change in the structure of NS-G-4.6 is proposed, namely the title of a Sub-Section in Section 8 will be changed from “Requirements for Instruments” to “Recommendations for Instruments”. The proposed structure is as follows:

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure
2. Applicable Requirements, Objectives and Concepts
  - Safety Objective
  - Dose Limits and Constraints
  - Application of the Principle of Optimization

Field Code Changed

Field Code Changed

- Design Target Doses
  - Design Target Doses for Accidents
  - 3. Research Reactors and Associated Radiological Hazards
    - Introduction
    - Radiological Hazard According to Reactor Type and Utilization
    - Sources of Radiation
  - 4. Aspects of Radiation Protection and Radioactive Waste Management in Design
    - Approach to Design for Operational States and Decommissioning
    - Design Features for Radioactive Waste Management
    - Lifetime Management and Decommissioning of the Facility
    - Design Approaches for Dealing with Accident Conditions
    - Design of Structures, Systems and Components
    - Decontamination
    - Design of Shielding
    - Ventilation
  - 5. Radiation Protection in Operation
    - Introduction
    - Dose Limitation
    - Reference Levels
    - Dose Control on the Site
    - Off-Site (Public) Dose Control by Minimization of Releases
  - 6. Operational Radioactive Waste Management
    - General
    - Generation of Radioactive Waste
    - Optimizing Exposure Associated with the Management of Radioactive Waste
    - Packaging and Confinement of Radioactive Waste
    - Storage of Radioactive Waste
    - Documentation Relating to the Management of Radioactive Waste
    - Classification and Characterization of Radioactive Waste
    - Processing of Radioactive Waste
    - Transport of Radioactive Waste
    - Discharge Control and Compliance Monitoring
  - 7. Monitoring
    - Introduction
    - Facility Monitoring
    - Individual Monitoring
    - Effluent Monitoring
    - Environmental Monitoring
  - 8. Instrumentation
    - Introduction
    - Recommendations for Instruments
    - Maintenance and Calibration of Instruments
  - 9. Organizational Aspects
    - Introduction
    - Organizational Structure
    - Responsibilities
    - Qualification and Training of Personnel
    - Documentation
  - 10. Radiological Aspects of Emergencies
    - Introduction
    - Radiological Assessment
    - Protective Actions
    - Corrective Actions
- References

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Annex I: Examples of Possible Sources of Radiation in a Research Reactor

Annex II: Personal Protective Equipment

Annex III: Design Considerations for Collection or Holding (Delay) Tanks for Liquid Radioactive Waste

Contributors to Drafting and Review

### **Revision of SSG-10**

This Guide will cover ageing management of research reactors and provide recommendations and guidance mainly related to implementing Requirements 9, [10](#), 17, 24, 29, 37, [38](#), 77, 86 and 87 of SSR-3. The proposed structure is as follows:

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure
2. Management System for Ageing Management
  - General
  - Management Responsibility
  - Resource Management
  - Process Implementation
  - Measurement, Assessment and Improvement
3. Ageing and Safety of Research Reactors
  - Basic Concepts
  - Ageing and Defence in Depth
  - Service Conditions and Ageing
4. Ageing Considerations in Different Stages of the Lifetime of a Research Reactor
  - General
  - Design
  - Fabrication and Construction
  - Commissioning
  - Operation
  - Utilization and Modifications
  - Extended Shutdown
  - Decommissioning
5. Elements of Ageing Management Programmes
  - General
  - Screening of SSCs for Ageing Management Review
  - Identification and Understanding of Ageing Degradation
  - Minimization of Expected Ageing Degradation
  - Detection, Monitoring and Trending of Ageing Degradation
  - Mitigation of Ageing Degradation
  - Continuous Improvement of the Ageing Management Programme
  - Record Keeping
6. Management of Obsolescence
7. Interfaces with other Technical Areas
  - Introduction
  - Maintenance, Periodic Testing and Inspection
  - Periodic Safety Review
  - Equipment Qualification
  - Reconstitution of the Design Basis
  - Configuration Management

Field Code Changed

Field Code Changed

Continued Safe Operation  
Post-Service Surveillance and Testing

References

Annex I: Effects of Ageing for Different Service Conditions

Annex II: Example for Screening of Research Reactor SSCs for Ageing Management Purposes  
Contributors to Drafting and Review

**Revision of SSG-37**

This Guide will cover instrumentation and control systems and software important to safety for research reactors and provide recommendations and guidance mainly related to implementing Requirements [10](#), [16](#), [17](#), [24](#), [25](#), [26](#), [27](#), [28](#), [29](#), [31](#), [35](#), [37](#), [39](#), [41](#), [49](#), [50](#), [51](#), [52](#), [53](#), [54](#), [55](#), [71](#), [75](#), [77](#), [86](#), [87](#) and 90 of SSR-3. The proposed structure is as follows:

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure
2. Safety Classification of Instrument and Control Systems
  - General Considerations
  - Methods of Classification
  - Design, Construction, Commissioning, Operation and maintenance of Instrumentation and Control Systems
3. Instrumentation and Control System Architecture
  - General
  - Defence in Depth
  - Independence
  - Consideration of Common Cause Failure
  - Architectural Design of the Instrumentation and Control System
4. Design Guidelines and Criteria
  - General
  - Design Basis
  - Design for Reliability
  - Design Considerations for Ageing
  - Consideration of the Safety and Security Interface in the Design
  - Equipment Qualification
  - Testing and Testability
  - Maintainability
  - Design analysis
  - Safety System Settings
  - Identification of Items Important to Safety
5. System Specific Design Guidelines
  - Sensing Devices
  - Reactor Protection System
  - Other Instrumentation and Control Systems Important to Safety
  - Power Supplies of Instrumentation and Control Systems
6. Operation
  - Operational Limits and Conditions
  - Control of Access to Items Important to Safety
  - Maintenance, Testing, Surveillance and Inspection of Instrumentation and Control Systems and Components Important to Safety
  - Provisions for Removal from Service for Testing or Maintenance

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

- Extended Shutdown
7. Human Factors Engineering and the Human-Machine Interface
    - General Considerations
    - Criteria for Human Factors Engineering and Design for the Human-Machine Interface
  8. Computer Based Systems and Software
    - General Considerations
    - Computer Based Systems and Software Design Considerations
    - Project Planning
    - Specification of Requirements for Computer Based Systems
    - Verification and Analysis
    - Computer System Integration
    - Operation, Maintenance and Modification
  9. Configuration Management
  10. Modification and Modernization of Instrumentation and Control Systems
- References  
Annex: Instrumentation and Control Systems that can be used in a Research Reactor  
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-Q3 2018
STEP 6: Approval of draft by the Coordination Committee	Q3 2018
STEP 7: Approval by the relevant review Committees for submission to Member States for comments	Q4 2018
STEP 8: Soliciting comments by Member States	Q1 2019
STEP 9: Addressing comments by Member States	Q3 2019
STEP 10: Approval of the revised draft by the Coordination Committee Review in NS-SSCS	Q4 2019
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	Q4 2020
STEP 14: Target publication date	Q1 2021

## 9. RESOURCES

Staff: 40 staff weeks

Consultants: 15 consultant weeks

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

## 10. ANNEX: MAIN REVISIONS TO THE GUIDES

The following tables present the main revisions to the Guides 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>NS-G-4.1, Commissioning of 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	Revise to focus guidance on how the specific topic of the safety guide is covered in the management system following the structure of GSR Part 2, GS-G-3.1 and GS-G-3.5: Responsibility of Management, Management of Resources, Process Implementation and Measurement, Assessment and Improvement. Eliminate repetition with GS-G-3.1 and GS-G-3.5.
3	Include information to clarify the Role of the Regulatory Body, The Role of the Operating Organization and the Role of the Design Organization or Technical Support Organization in commissioning, similar to IAEA Safety Standards Series No. SSG-28, Commissioning for Nuclear Power Plants (2017).
4	Editorial.
5	Clarify the scope of the commissioning stages for subcritical assemblies.
6	Editorial.
7	Editorial.
8	Editorial.
Appendix	Include information on subcritical assemblies.

<b>NS-G-4.2, Maintenance, Periodic Testing and Inspection of 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	Revise to focus guidance on how the specific topic of the safety guide is covered in the management system following the structure of GSR Part 2, GS-G-3.1 and GS-G-3.5: Responsibility of Management, Management of Resources, Process Implementation and Measurement, Assessment and Improvement. Eliminate repetition with GS-G-3.1 and GS-G-3.5.
3	SSR-3, Paras. 6.88 and 6.89 on replacement of structures, systems and components should be addressed fully.
4	SSR-3, Paras. 6.88 and 6.89 on replacement of structures, systems and components should be addressed fully.
5	SSR-3, Paras. 6.88 and 6.89 on replacement of structures, systems and components should be addressed fully. Need to elaborate the interface of the maintenance programme with the ageing management programme.
6	Add guidance on the interface with nuclear security organizations.
7	Add guidance on training on the interface with nuclear security.
8	Add guidance on developing maintenance procedures considering possible interfaces with nuclear security.
9	Add guidance on the interface with nuclear security organizations.
10	Editorial.
11	Editorial.
12	Consider state-of-the-art in inspection and testing methods and techniques.
Appendix	Editorial.
Annex I	Add information on preventive maintenance for equipment related to design extension conditions.
Annex II	Editorial.
Annex III	Add information on the interface with nuclear security.

Field Code Changed

Field Code Changed



Field Code Changed

Field Code Changed

NS-G-4.3, Core Management and Fuel Handling for Research Reactors	
Section	Main Revisions
1	Standardize background, objective and scope. Align discussion of graded approach with the new text in SSR-3 referencing subcritical assemblies.
2	Revise to focus guidance on how the specific topic of the safety guide is covered in the management system following the structure of GSR Part 2, GS-G-3.1 and GS-G-3.5: Responsibility of Management, Management of Resources, Process Implementation and Measurement, Assessment and Improvement. Eliminate repetition with GS-G-3.1 and GS-G-3.5.
3	Add guidance on subcritical assemblies.
4	Add guidance on the interface with nuclear security.
5	Editorial.
6	Add guidance on subcritical assemblies. Add guidance on the interface with nuclear security.
7	Editorial.
8	Editorial.
9	Reorganize to reduce overlap with Sections 2 and 3. Add guidance on the interface with nuclear security.
10	Editorial.
Annex	Editorial.

NS-G-4.4, Operational Limits and Conditions and Operating Procedures for Research Reactors	
Section	Main Revisions
1	Standardize background, objective and scope. Align discussion of graded approach with the new text in SSR-3 referencing subcritical assemblies. Update structure to remove quality assurance.
2	Create new Section on management system for operational limits and conditions and operating procedures.
3	Editorial.
4	Add guidance for operational limits and conditions for subcritical assemblies and for extended shutdown.
5	Address the interface between safety and security in the development of procedures. <a href="#">A new subsection Interfaces between Facility Safety and Nuclear Security Procedures will be added to the end of Section 5</a>
6	Elaborate on procedures for use during accident conditions. <del>Align information on physical protection procedures with the current security recommendations for nuclear installations. The subsection titled "Physical Protection Procedures" will be deleted and replaced with a new subsection at the end of Section 5</del>
7	Editorial.
8	Editorial.
Appendix I	Add information on subcritical assemblies.
Appendix II	Add information addressing accident conditions and design extension conditions. Add information on subcritical assemblies.

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

<b>NS-G-4.5, The Operating Organization and the Recruitment, Training and Qualification of Personnel 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	The management system for research reactors should be comprehensively treated in this Section, as opposed to the other Guides which will provide summary information and specific guidance for the specific topics of the Guides. Revise to follow the structure of GSR Part 2, GS-G-3.1 and GS-G-3.5: Responsibility of Management, Management of Resources, Process Implementation and Measurement, Assessment and Improvement. Eliminate repetition with GS-G-3.1 and GS-G-3.5. Add guidance on subcritical assemblies. Elaborate guidance on programme for management of the interfaces of safety with security and the State system of accounting for, and control of, nuclear material.
3	Add guidance on subcritical assemblies.
4	Add guidance specific to training programmes for operating personnel for subcritical assemblies. Add training on design extension conditions and the interface between safety and security.
5	Editorial.
6	Editorial.
Annex I	Editorial.
Annex II	Add information on training operating personnel for subcritical assemblies.

<b>NS-G-4.6, Operational Radiation Protection and Radioactive Waste Management 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	Revise for consistency with GSR Part 3 terminology. Add guidance related to design extension conditions.
3	Add guidance on radiation hazards of subcritical assemblies.
4	Add guidance on subcritical assemblies.
5	Add guidance related to interfaces with nuclear security.
6	Add guidance on subcritical assemblies.
7	Add guidance on subcritical assemblies.
8	Add guidance specific to subcritical assemblies, especially for criticality monitoring.
9	Editorial.
10	Add guidance related design extension conditions.
Annex I	Editorial.
Annex II	Editorial.
Annex III	Editorial.

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

<b>SSG-10, Ageing Management 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	Revise to focus guidance on the specific topic of the safety guide following the structure of GSR Part 2, GS-G-3.1 and GS-G-3.5: Responsibility of Management, Management of Resources, Process Implementation and Measurement, Assessment and Improvement. Eliminate repetition with GS-G-3.1 and GS-G-3.5.
3	Include guidance for subcritical assemblies.
4	Elaborate guidance on how ageing management is considered in the process of planning for decommissioning.
5	Need to elaborate the interface with maintenance, periodic testing and inspection. Need to elaborate guidance on ageing management for design extension conditions.
6	Editorial.
7	Elaborate guidance related to SSR-3, Para. 6.84 on consideration of ageing effects in the qualification of items important to safety.
Annex I	Editorial.
Annex II	Editorial.

<b>SSG-37, Instrumentation and Control Systems and Software Important to Safety 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	Revise to fully address Req. 16 of SSR-3.
3	Editorial.
4	Elaborate guidance on treatment of design extension conditions in the design of instrumentation and control systems.
5	Editorial.
6	Editorial.
7	Editorial.
8	Editorial.
9	Editorial.
10	Editorial.
Annex	Add information related to Req. 55 of SSR-3.

Field Code Changed

Field Code Changed