

**Document Preparation Profile (DPP)**  
**Version ~~2-3~~ dated ~~28-2 June~~ October 2013**

## 1. IDENTIFICATION

**Document Category**    **Specific Safety Requirements**

**Working ID:**            **DS476**

**Proposed Title:**        **Safety of Research Reactors**

**Proposed Action:**      **Revision of Safety Requirements NS-R-4: Safety of Research Reactors (2005)**

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

**Technical Officer(s):** **A. M. Shokr, RRSS/NSNI**

## 2. BACKGROUND

The Safety Requirements document NS-R-4 on the Safety of Research Reactors was published in 2005. This document established requirements for all areas research reactor safety, with particular emphasis on requirements for design and operation. Pursuant to requests from end-users (mainly from Member States operating only research reactors or with a small nuclear power programme), the NS-R-4 also included requirements on regulatory supervision, management and verification of safety, site evaluation, and decommissioning.

The main objective of the NS-R-4 was to provide a basis for safety and ~~a basis~~ for safety assessment ~~for during~~ all stages in the lifetime of a research reactor. Another objective was to establish safety requirements on aspects relating to regulatory supervision, the management of safety, site evaluation, design, operation including experimental devices and utilization programme, and decommissioning of research reactors.

The requirements established by the NS-R-4 apply to research reactors of all types, sizes, and power levels. Research reactors with power levels in excess of several tens of megawatts, fast reactors, and reactors using experimental devices such as high pressure and high temperature loops, cold neutron sources and hot neutron sources may require the application of standards for power reactors and/or additional safety measures.

## 3. JUSTIFICATION FOR THE PRODUCTION OF THE DOCUMENT

The revision of the NS-R-4 is initiated in the frame of the Roadmap described in the long term structure of safety standards “Strategies and Processes for the Establishment of IAEA Safety Standards – SPESS” which was approved by the IAEA Member States in 2008. SPESS imposes that the IAEA safety requirements shall be governed by the objective and principles of the Safety Fundamentals publication (SF-1).

In addition to the SF-1, a number of safety standards documents, including General Safety Requirements, have been published since the publication of the NS-R-4 in 2005. Other General Safety Requirements are currently under development, which include aspects that were not originally covered by the NS-R-4 such as the integrated management system. The revision of the NS-R-4 is required to

ensure the coherency and consistency of its technical contents with the other relevant IAEA Safety Standards. The revision of the NS-R-4 will also account for the experience acquired by the IAEA and Member States from the application of the document. Furthermore, ~~the~~ revision process will be an opportunity to incorporate the relevant feedback and lessons learned from the accident at the Fukushima-Daiichi nuclear power plant. The operational experience feedback documented in the IAEA Incident Reporting System for Research Reactors (IRSRR) will be considered for deriving research reactor specific requirements and especially for revising the list of postulated initiating events in the appendix.

#### 4. OBJECTIVE AND SCOPE

The objective of the revised version of the NS-R-4 is to provide a basis for safety and ~~a basis~~ for safety assessment ~~for~~ during all stages in the lifetime of a research reactor, and to establish safety requirements on aspects relating to regulatory supervision, management of safety, site evaluation, design, construction, commissioning, operation including experimental devices and utilization programme, and decommissioning of research reactors.

The scope of the revised NS-R-4 will cover research reactors of all types, sizes and power levels, including critical assemblies, and will be expanded to cover sub-critical assemblies. The scope covers new research reactors and existing ones. Especially ~~r~~ research reactors with power levels in excess of several tens of megawatts, fast reactors, and reactors using experimental devices such as high pressure and high temperature loops, cold neutron sources and hot neutron sources may require the application of standards for power reactors and/or additional safety measures.

The revised NS-R-4 is intended for use by organizations engaged in the site evaluation, design, manufacturing, construction, commissioning, operation, utilization, and decommissioning of research reactors as well as by regulatory bodies.

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

The document will be a Specific Safety Requirements publication for Research Reactors. This document will interface with the following IAEA publications (the list is not intended to be final or exhaustive):

1. Fundamental Safety Principles, IAEA Safety Standards Series No. SF-1, (2006);
2. Code of Conduct on the Safety of Research Reactors, (2005);
3. Governmental, Legal and Regulatory Framework for Safety, IAEA Safety Standards Series No. GSR Part 1, (2010);
- ~~4. DS457: Preparedness and Response for a Nuclear or Radiological Emergency Safety Requirements, (Revision of the GS-R-2);~~
- ~~5. DS 456: Leadership and Management of Safety (Revision of the GS-R-3);~~
- ~~6-4.~~ Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards - IAEA Safety Standards Series No. GSR Part 3, (Interim Edition 2011);
- ~~7-5.~~ Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4, (2009);
- ~~8-6.~~ Predisposal Management of Radioactive Waste IAEA Safety Standards Series No. GSR Part 5, (2009);
- ~~9. DS450: Decommissioning and Termination of Activities (Revision of the WS-R-5);~~
- ~~10-7.~~ Site evaluation for Nuclear Installations, IAEA Safety Standards Series, No NS-R-3, 2003;
- ~~11. DS462: Revision through addenda of GSR Part 1, NS-R-3, SSR-2/1, SSR-2/2 and GRS Part 4;~~

- ~~12.8.~~ Strengthening the Global Nuclear Safety Regime, INSAG-21, 2006;
- ~~13.9.~~ The Interface between Safety and Security at Nuclear Power Plants, INSAG-24 (2010);
- ~~14.10.~~ Safety of Nuclear Power Plants: Design, IAEA Safety Standards Series No. SSR-2/1, 2012;
- ~~15.11.~~ Safety of Nuclear Power Plants: Commissioning and Operation, IAEA Safety Standards Series No. SSR-2/2, (2011);
- ~~16.12.~~ Regulations for the Safe Transport of Radioactive Material, IAEA Safety Standards Series No. SSR-6, 2012.

13. Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5), IAEA Nuclear Security Series No. 13 (2011)."

This document will interface with the following IAEA publications under development:

- ~~17.—~~
- 14. DS457: Preparedness and Response for a Nuclear or Radiological Emergency Safety Requirements, (Revision of the GS-R-2);
- 15. DS 456: Leadership and Management of Safety (Revision of the GS-R-3);
- 16. DS450: Decommissioning and Termination of Activities (Revision of the WS-R-5);
- 17. DS462: Revision through addenda of GSR Part 1, NS-R-3, SSR-2/1, SSR-2/2 and GRS Part 4

## 6. OVERVIEW

The table of contents is as follows:

### 1. INTRODUCTION

- BACKGROUND
- OBJECTIVE
- SCOPE
- STRUCTURE

### 2. APPLYING SAFETY OBJECTIVE, PRINCIPLES AND CONCEPTS

- SAFETY OBJECTIVES
- SAFETY PRINCIPLES
- CONCEPT OF DEFENCE IN DEPTH
- CONCEPT OF GRADED APPROACH

### 3. REGULATORY SUPERVISION

- LEGISLATIVE AND REGULATORY INFRASTRUCTURE
- REGULATORY BODY
- LICENSING PROCESS
  - Safety Analysis Report
  - Review and assessment by the regulatory body
  - Acceptance criteria
- INSPECTION AND ENFORCEMENT

### 4. MANAGEMENT AND VERIFICATION OF SAFETY

- INTEGRATED MANAGEMENT SYSTEM
- VERIFICATION OF SAFETY

### 5. SITE EVALUATION

- INITIAL EVALUATION AND SELECTION OF THE SITE
- GENERAL CRITERIA FOR SITE EVALUATION
- EXTREME AND RARE METEOROLOGICAL EVENTS

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FLOODING  
GEOTECHNICAL HAZARDS  
EXTERNAL HUMAN INDUCED HAZARDS  
SPECIFIC REQUIREMENTS FOR THE CHARACTERIZATION OF THE REGION UNDER  
CONSIDERATION  
MONITORING OF HAZARDS  
REASSESSMENT OF THE SITE

## 6. DESIGN

### PRINCIPLE TECHNICAL REQUIREMENTS

Fundamental safety functions  
Radiation protection  
Application of the defence in depth [concept](#)  
[Application of graded approach](#)  
Proven engineering practices  
Safety assessment  
Provisions for construction  
Features for facilitating radioactive waste management and decommissioning

### GENERAL REQUIREMENTS FOR DESIGN

Classification of Structures, Systems, and Components  
Codes and Standards  
Design Basis  
[Protection against internal and external hazards](#)  
Design for extension conditions  
Design for reliability  
Design for commissioning  
Provision for maintenance, testing and inspection  
Design for emergency planning  
Design for decommissioning  
Provision for radiation protection  
Human factors and ergonomics  
Provision for utilization and modification  
Ageing management  
Provision for extended shutdown  
Safety analysis

### SPECIFIC REQUIREMENTS FOR DESIGN

Buildings and structures  
Reactor core and associated features  
[Sub-critical assemblies](#)  
Reactor coolant systems  
Engineered Safety Features  
Instrumentation and Control systems  
Electrical systems  
Radiation protection [systems](#)  
Fuel handling and storage systems  
Radioactive waste systems  
Supporting and auxiliary systems  
Experimental devices

## 7. OPERATION

### ORGANIZATIONAL PROVISIONS

- Responsibilities of the operating organization
- Operating personnel
- Safety Committee

### TRAINING, RETRAINING AND QUALIFICATION

### OPERATIONAL LIMITS AND CONDITIONS

### COMMISSIONING

### OPERATING PROCEDURES

### MAINTENANCE, PERIODIC TESTING, AND INSPECTION

### CORE MANAGEMENT AND FUEL HANDLING

### FIRE SAFETY

### EMERGENCY PLANNING AND PREPAREDNESS

### RECORDS AND REPORTS

### UTILIZATION AND MODIFICATION OF THE REACTOR

### RADIATION PROTECTION

### RADIOACTIVE WASTE MANAGEMENT

### AGEING MANAGEMENT

### ~~AND~~ PERIODIC SAFETY REVIEW

### MANAGEMENT OF EXTENDED SHUTDOWN

### FEEDBACK OF OPERATING EXPERIENCE

## ~~8. INTERFACE BETWEEN SAFETY AND SECURITY IN DESIGN AND OPERATION~~

### ~~98.~~ PREPARATION FOR DECOMMISSIONING

#### DECOMMISSIONING PLAN

#### TRANSITION PERIOD BETWEEN OPERATION AND DECOMMISSIONING

### APPENDIX: SELECTED POSTULATED INITIATING EVENTS FOR RESEARCH REACTORS

### ANNEX I: SELECTED SAFETY FUNCTIONS FOR RESEARCH REACTORS

### ANNEXII: OPERATIONAL ASPECTS OF RESEARCH REACTORS WARRANTING PARTICULAR ATTENTION

### REFERENCES

**7. PRODUCTION SCHEDULE:**

	A*	B*	C*
STEP 1: Preparing a DPP	DONE	DONE	DONE
STEP 2: Approval of DPP by the Coordination Committee	July 2013		
STEP 3: Approval of DPP by the relevant review Committees	4 <sup>th</sup> Q 2013		
STEP 4: Approval of DPP by the CSS	1 <sup>st</sup> Q 2014		
STEP 5: Preparing the draft	4 <sup>th</sup> Q 2014		
STEP 6: Approval of draft by the Coordination Committee	1 <sup>st</sup> Q 2015		
STEP 7: Approval by the relevant review Committees for submission to Member States for comments	2 <sup>nd</sup> Q 2015		
STEP 8: Soliciting comments by Member States	4 <sup>th</sup> Q 2015		
STEP 9: Addressing comments by Member States	4 <sup>th</sup> Q 2015		
STEP 10: Approval of the revised draft by the Coordination Committee Review in NS-SSCS	4 <sup>th</sup> Q 2015		
STEP 11: Approval by the relevant review Committees for submission to the CSS	2 <sup>nd</sup> Q 2016		
STEP 12: Endorsement by the CSS	3 <sup>rd</sup> Q 2016		
STEP 13: Establishment by the Publications Committee and/or Board of Governors (for SF and SR only))	1 <sup>st</sup> Q 2017		
STEP 14: Target publication date	3 <sup>rd</sup> Q 2017		

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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*

**8. RESOURCES**

Secretariat: P staff (12 Man weeks) + 3 CSM (15 Man-weeks of non-staff)