

**DS 509 Maintenance, Periodic Testing and Inspection of Research Reactors (Revision of NS-G-4.2)**

COMMENTS BY REVIEWER						RESOLUTION			
Reviewer:			Page.						
Country/Organization:			Date: 24 October 2019						
Comment No.	Country/Organization	Sec.	Para / Line No.	Proposed new text	Reason	Accept	Accepted, but modified as follows	Reject	Reason for modification/rejection
1.	Germany	all	all	Care should be taken where the terms “staff” and “personnel” are used	We suggest to use term “personnel” in whole Guide, in accordance with IAEA Safety Glossary 2018	X			Fixed throughout the document
2.	Finland	all	all	The maintenance and security especially data security should be considered in the guidance. At least appropriate reference to relevant guidance should be made.				X	Safety guides cannot provide guidance on security issues. The need to consider the interface between safety and security when developing maintenance program documentation is included in para 8.5

3.	Finland	all	all	IAEA should consider rewriting the safety standard so that the content of SSR-3 is considered so that repetition is avoided, and the terminology would be consistent between the documents. Also the overlap with SSG-10 and the repetition in the safety guide itself should be avoided.				X	The primary reason for this update of NS-G-4.2 was to reflect the content of SSR-3. The two documents are now consistent. Overlap with SSG-10 has been avoided as far as practicable.
4.	Finland	all	all	Risk informed approach is missing.		X			New para 3.19 added, based on equivalent guidance for NPPs in NS-G-2.6 "The use of risk informed maintenance strategies should be considered, to provide a reasonable balance in the mixture of corrective and preventive maintenance and to facilitate proactive maintenance rather than exclusively

									reactive maintenance."
<b>Section 1</b>									
5.	Korea	1	1	<p>1.1. <u>This publication supersedes the Safety Guide on Maintenance, Periodic Testing and Inspection of Research Reactors that was issued in 2015 as IAEA Safety Standards Series No. NS-G-4.2</u><del>This Safety Guide is a revision of IAEA Safety Standards Series No. NS-G-4.2, Maintenance, Periodic Testing and Inspection of Research Reactors<sup>1</sup>, which it supersedes.</del></p>	Propose the unified format of Background of each Safety Guide for the uniformity and consistency with other Safety Guides.		"This Safety Guide is a revision of IAEA Safety Standards Series No. NS-G-4.2, Maintenance, Periodic Testing and Inspection of Research Reactors <sup>1</sup> , which it supersedes."		The proposed wording was provided from IAEA publication department and will be applied consistently for all 8 safety guides in DS509

6.	Korea	1	3	1.3. ... programmes of maintenance, periodic testing and inspection <u>for fulfilling the requirements established in Ref. [1].</u>	It is appropriate to specify the objective of Safety Guide and recommendation in this Safety Guide.			Accepted the comment with minor editorial changes
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7.	Korea	1	4 and 8	Propose to change 'research reactor' to 'research reactor facilities'	It is appropriate to use same terminology, research reactor facilities as that of SSR-3.	X			
8.	Korea	1	6	1.6. The recommendations and guidance provided in this Safety Guide are intended to be applicable to most types of research reactor <u>facilities, critical assemblies and subcritical assemblies.</u>	It is appropriate to specify the nuclear facilities to which this safety guide is applicable in section 'SCOPE'.		Scope section to be updated consistently across all guides		Para 1.8 describes the applicable nuclear facilities.

9.	Germany	1	8	<p>This Safety Guide deals with maintenance, periodic testing and inspection for all types of heterogeneous, thermal spectrum research reactor having a power rating of up to several tens of megawatts including critical and subcritical assemblies. Research reactors of higher power hazard potential, specialized reactors (e.g. homogeneous reactors, fast spectrum reactors) and reactors having specialized facilities (e.g. hot or cold neutron sources, high pressure and high temperature loops) may require additional guidance.</p>	<p>According to SSR-3 2.17 and SSG-22 2.7 thermal power is only one of the factors to characterize the hazards originating from a research reactor. The more general term “hazard potential” is more suited. E.g. a research reactor using plutonium as fuel has an increased hazard potential as a RR using uranium.</p>		X	<p>This Safety Guide deals with maintenance, periodic testing and inspection for the full range of heterogeneous, thermal spectrum research reactor facilities from reactors with a power rating of up to several tens of megawatts to critical and subcritical assemblies.</p>	<p>The paragraph has been revised for consistency with USA comment on 1.8</p>
10.	USA	1	8	<p>This Safety Guide deals with maintenance, periodic testing and inspection for all types <b>the full range</b> of heterogeneous, thermal spectrum research <b>reactors having a from reactors with a power</b></p>	<p>Plural needed and reworded to make sense</p>		X		

				rating of up to several tens of megawatts to and critical and subcritical assemblies.					
11.	Korea	1	9	Propose insert below sentence in para. 1.9. <u>'Each case in which the application of recommendation is graded shall be identified, with account taken of the nature and possible magnitude of the hazards presented by the given facility and the activities conducted.'</u>	In order to clarify the graded approach concepts, safety guide have to address that background and rationale shall be identified and justified when the graded approach is applied to the facility and activities under consideration. (we can find a good example in the revised para 1.4 of SSG-37)		X	Each case in which the application of guidance is graded should be identified with account taken of the nature and possible magnitude of the hazards presented by the given facility and the activities conducted.	Scope section to be updated consistently across all guides
12.	Germany	1	9	<del>Low risk</del> Research reactors having a <u>low hazard potential</u> <del>power rating of up to several tens of kilowatts</del> , critical and subcritical assemblies, may need a less comprehensive maintenance, periodic testing and inspection programme than that outlined here.	According to SSR-3 2.17 and SSG-22 2.7 thermal power is only one of the factors to apply a grading to a research reactor. The more general term "hazard potential" is more suited.	X			

13.	Finland	1	9	SSG-10 deals with aging management and the interface between aging management program and maintenance program.	Please add the interface to aging management.		Added in COORDINATION AND INTERFACES 6.8, "and ageing management (if the programme is implemented by a separate group)"		6.8 is the best place in the document to include this guidance.
14.	USA	1	10	Structure	Readability and therefore understanding would be improved if this section was a bulleted list			X	This is a consistent format across all safety guides
<b>Section 2</b>									
15.	Korea	2	1	Further requirements for the management system are established in <a href="#">Requirement 4 of SSR-3 [1]</a> <del>SSR-3 [1]</del> , Requirement 4, and ...	Unified format of referring the requirements and/or paragraph of SSR-3 is necessary, for example, <u>paras 2.6-2.7 in Requirement 1 of SSR-3, paras 2.6-2.7 of SSR-3, and Requirement 3 of SSR-3.</u> And it is appropriate to specify the number of relevant paragraph to contents of Safety Guide.		X		Accepted format is to simply refer to the requirement #, but where the extra precision on a paragraph number is necessary for clarity, it is added in the format, "Requirement XX para YY from SSR-3..."



16.	USA 3	2	5	Management organization – ADD a bullet for - Scheduling and tracking maintenance activities to ensure all required maintenance is performed as required by the OLCs and regulatory body.	Management sets and maintains preventative maint. schedule	X			
17.	USA	2	11	The reactor manager should be an active participant in tracking, executing, and evaluating, and recording the work in maintenance, periodic testing and inspection	Assign management responsibility for maint. To reactor manager (as delegated responsible authority per 6.16)			X	Repetition. Covered in detail in 6
18.	USA	2	12	“The management system shall ensure that: ... The equipment, tools, materials, hardware and software necessary to conduct the work in a safe manner are identified, provided, checked, and verified, and maintained.”	Check quote (seems like an extra “and.”	X			

19.	USA	2	15	2.15 appears to be a repeat of 2.12. recommend combine and delete 2.15	Unnecessary repetition			X	2.12 states a requirement from SSR-3, whereas 2.15 is addressing the adequacy of the tools.
20.	France	2	21	Before the commencement of operation of a research reactor, an in-service inspection programme should be prepared for implementation during the operating lifetime of the facility for the detection of safety significant deterioration. Pre-operational inspection data should be available to serve as baseline data. The data collected in the ageing management programme (using IAEA Safety Standards Series No. SSG-10, Ageing Management for	The deterioration of a SSC may be known thanks to the ageing management programme			X	This para is dealing with the establishing of the in-service inspection programme, during the reactor commissioning phase.

				Research Reactors [6]) may be used.				
21.	Pakistan	2	23	Please include the list of SSCs important to safety or provide the reference if SSCs are enlisted in other IAEA safety standard.	Para 2.23 give the requirement related to monitoring of SSCs important to safety however, neither the list of SSCs is provided nor the reference of any other safety standard is provided. For example, items important to safety are given in DS 509; Instrumentation and Control Systems and Software Important to Safety for Research Reactors (Rev. of SSG-37).	X		Added text "(see SSR-3 [1] Annex I)"  SSR-3 Annex I contains a list of typical SSCs important to safety

22.	South Africa	2	24	Requirement 4 of SSR-3 [1] states that "Suppliers shall be audited, evaluated and selected ...Such criteria should be developed and documented within the operating organization's procurement process and quality management system.	Supplier qualification according to the organization's quality management system is an integral part of ensuring that the product that a supplier deliver conforms to qualify standards and hence ensure a high level of safety of the SSC.		"Such criteria should be developed and documented within the operating organization's procurement process."	"operating organization's" has been added to the text in this para. "audited" was not added as it is a direct quote from SSR-3 paragraph 4.19
23.	Pakistan	2	27	Management review Experience Feedback	This para may be modified to reflect the intent of requirement 13 of GSR Part-2. Requirement 13 of GSR Part-2 is on the measurement, assessment and improvement of management system through which effectiveness of the management system of an organization is monitored and measured however, para 2.27 refers GSR requirement but does not explain the proposed areas.		The reference to GSR Part 2 has been removed from this paragraph	

24.	Finland	2	27	<p>. Requirement 13 of GSR Part 2 [4] states:  “Measures should be established for assessments to determine whether, and for review and verification to ensure that, maintenance, periodic testing and inspection activities are accomplished as specified in the appropriate procedure. These measures should include:</p> <ul style="list-style-type: none"> <li>- Review of procedures;</li> <li>- Verification by inspection, witnessing and surveillance;</li> <li>- Review and verification of maintenance, periodic testing and inspection records, results and reports, including those on the status of non-conformance control and corrective actions;</li> <li>- Follow-up of the adequacy and timeliness of corrective actions.</li> </ul>	<p>Please correct the reference  GSR Part 2 Requirement 13: Measurement, assessment and improvement of the management system  The effectiveness of the management system shall be measured, assessed and improved to enhance safety performance, including minimizing the occurrence of problems relating to safety.</p>		<p>The reference to GSR Part 2 has been removed from this paragraph</p>		
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25.	South Africa	2	30	<p>The frequency and severity of failures of SSCs should be recorded and analysed to identify the causes of the failures and to look for common mode failures. This information should be used as input to the preventive maintenance programme as well as to revise the scope and frequency of periodic testing. Near misses should also be recorded e.g. cracks that were detected but are still within acceptance criteria or modifications that does not perform to design criteria.</p>	<p>The scope and frequency of periodic testing may need to be revised as a result of failures of SSCs. The information from “near misses” should also be utilised (i.e. the SSC has not failed yet, but some flaw or non-compliance were detected)</p>	<p>2.30. The frequency and severity of failures of SSCs should be recorded and analysed to identify the causes of the failures and to look for common mode failures. This information should be used as input to the preventive maintenance programme as well as to adjust the scope and frequency of periodic testing to ensure adequate reliability. Near misses and nonconformance should also be recorded.</p>	<p>The purpose of adjusting the frequency of periodic testing is included, in keeping with Req. 77, Para 7.72 of SSR-3.</p>
<b>Section 3</b>							

26.	USA	3	1	The programme for maintenance, periodic testing, and inspection should also cover the SSCs ( <del>mobile or permanently installed</del> ) that could be necessary in response to design extension conditions.	Delete "(mobile or permanently installed)". If it is an SSC it should be covered. Its mobility is not relevant and is confusing in this context.			X	Useful guidance to avoid mobile equipment from being overlooked. Text coherent with NPP guidance in DS497E para. 2.1.
27.	France	3	1	The objective of maintenance, periodic testing and inspection is to ensure that the SSCs function in accordance with the design intents and requirements, and in compliance with the SAR and the OLCs (Requirements 1 and 77 of SSR-3 [1]), to ensure the safety of the reactor. The programme for maintenance, periodic testing, and inspection should also cover the SSCs (mobile or permanently installed) that could be necessary in response to design extension conditions.	DEC is part of safety of the installation according to SSR-3	X			

Section 4									
28.	South Africa	4	4	Appropriate accessibility should be achieved by <b>taking into account and ergonomic considerations</b> such as providing sufficient space around SSCs to facilitate good working conditions and convenience in working on, removing and replacing them.	Recommendation: Summarise description of requirements into a main requirement e.g. Ergonomic considerations			X	Sufficient space is the term used in DS497E revision of NS-G-2.6 for NPPs, and for consistency similar terminology is adopted for RRs
Section 5									
29.	Korea	5	2	<b>Maintenance</b> inspections, periodic testing and <b>inspection</b> maintenance conducted on	Correction of typo-error by re-ordering			X	
30.	Finland	5	5	In accordance with Requirement 77 from SSR-3 [1] <u>Para. 7.68</u> , "Maintenance ... periodic testing and inspection shall be conducted to ensure that structures, systems and components are able to function in accordance with the design intent, in compliance with the OLCs." The following	Please add the paragraph that is quoted. just mentioning Req. 77 is misleading.			X	



				should be available for the preparation of the programme for maintenance, periodic testing and inspection:					
31.	South Africa	5	5	Add new bullet (k): Information from Baseline test activities such as NDT results performed as part of Pre-service Inspection	Information from Inspection, testing and inspection as part of manufacturing and installation should be taken into account.		(k) Pre-service inspection data and reports		For consistency with DS497-revision of NS-G-2.6, para 10.45
32.	Korea	5	5	In accordance with <a href="#">para 7.78 in</a> Requirement 77 <del>of</del> from SSR-3 [1], "Maintenance ...			"In accordance with Requirement 77 para 7.68 from SSR-3..."		The correct reference is 7.68. A standard format has been used
33.	Korea	5	17	<a href="#">Para 7.72 in</a> Requirement 77 of SSR-3 [1] states that ...			"Requirement 77 para 7.72 of SSR-3..."		A standard format has been used
34.	Finland	5	17	Reference Requirement 77 <a href="#">Paragraph 7.72</a> of SSR-3 [1] <del>requires</del> states that "The frequency of maintenance inspection, periodic testing and inspection maintenance of individual SSCs structures, systems, and components shall be adjusted on the basis of experience and shall be such as to ensure	Please add the paragraph. The reference is misleading if it is made to Req. 77 only.	X			

				adequate reliability" ( <del>1</del> , <del>para. 7.60</del> ).					
35.	Korea	5	25	<a href="#">Para 7.75 in</a> Requirement 77 of SSR-3 [1] states that ...			"Requirement 77 para 7.75 of SSR-3..."		A standard format has been used
36.	Finland	5	25	Requirement 77 <a href="#">Para 7.75</a> of SSR-3 [1] states that, "Properly qualified personnel, who shall verify that the activities have been accomplished as specified in the appropriate procedure and shall verify compliance with the operational limits and conditions, shall assess the results of maintenance, periodic testing and inspection"	Please add the paragraph. The reference is misleading if it is made to Req. 77 only.	X			

37.	France	5	34	The decision to perform a non-routine inspection (or routine in-service inspection) should be made well before the predicted time of failure of the SSC. The scheduling should be based on conservative assumptions of the deterioration rate. The data collected in the ageing management programme (using IAEA Safety Standards Series No. SSG-10, Ageing Management for Research Reactors [6]) may be used for this evaluation.	The lifetime of a SSC may be known thanks to the ageing management programme	X	"The data collected in the ageing management programme may be used for this evaluation."	The ageing management programme is referred to several times in these paragraphs, so the parenthesis is not required
<b>Section 6</b>								
38.	Germany	6	1	[...] At some <del>small</del> research reactors <u>with low hazard potential, including critical and subcritical assemblies,</u> the operation group may be trained to perform maintenance tasks, periodic testing and inspection, fulfilling	According to SSR-3 2.17 and SSG-22 2.7 thermal power is only one of the factors to apply a grading to a research reactor. The more general term "hazard potential" is more suited.		"At some small research reactors, critical assemblies and subcritical assemblies <u>with low hazard potential,</u> the operation group may be trained to perform	accepted with minor rewording

				the role of a maintenance group.			maintenance tasks, periodic testing and inspection, fulfilling the role of a maintenance group."		
39.	Korea	6	12	<a href="#">Para 7.9(h) in Requirement 67 of SSR-3 [1]</a> states that ...			"Requirement 67 para 7.9 (h) of SSR-3..."		A standard format has been used
40.	Germany	6	13	(f) Operational experience, including information feedback from operating experience at other, similar <u>domestic and foreign</u> facilities, is carefully examined to detect any precursor signs of tendencies adverse to safety, so that corrective actions	Similar designs might be built in different countries therefore also foreign operating experience should be considered			X	"Similar facilities" covers domestic and foreign facilities, so addition not needed.

				can be taken before serious conditions arise, and to prevent recurrences of events;				
41.	Korea	6	16	<u>Para 7.71 in Requirement 77 of SSR-3 [1] states that ...</u>			"Requirement 77 para 7.71 of SSR-3..."	A standard format has been used
42.	Korea	6	18	<u>(b) Preparation of implementing procedures for programmes.</u>	It is clear to specify the object to be prepared.		"(b) Preparation of implementing procedures for programmes for maintenance, periodic testing and inspection;"	This original text had been deleted inadvertently

43.	USA	6	18	<p>??? States Preparation and then everything else is deleted.</p> <p>Suggest making it state: Preparation of scheduling and tracking system for maintenance, periodic testing and inspection to ensure they are completed as required by the maintenance programme.</p>	<p>Need to add this to Reactor manager responsibility to schedule and track completion of required maintenance activities. This coincides with responsibility 6.20(a) of maintenance supervisor</p>		<p>X Preparation of implementing procedures for programmes for maintenance, periodic testing and inspection;"</p>	<p>This original text had been deleted inadvertently</p>
<b>Section 7</b>								
44.	Germany	7	2	<p>In some small facilities <u>with a low hazard potential</u> <del>such as low power research reactor, critical and subcritical assemblies</del>, some of the maintenance, periodic testing and inspection activities may be performed by the operators.</p>	<p>According to SSR-3 2.17 and SSG-22 2.7 thermal power is only one of the factors to apply a grading to a research reactor. The more general term "hazard potential" is more suited.</p>		<p>In some research reactors, critical and subcritical assemblies, <u>with a low hazard potential</u> such as low power research reactor, some of the maintenance, periodic testing and inspection activities may be performed by the operators</p>	<p>accepted with minor rewording</p>
<b>Section 9</b>								

45.	Germany	9	6	[...] See also para 9.1 (g) on the need to for effective coordination for management of the interface between safety and security in work planning and implementation.	Typo	X			
<b>Section 10</b>									
46.	Finland	10	8	Reference Requirement <u>77 Paragraph 7.73</u> of SSR-3 [1] requires states that "Equipment and items used for periodic testing and maintenance shall be identified and controlled to ensure their proper use"	Please add the paragraph. The reference is misleading if it is made to Req. 77 only.	X			
47.	Korea	10	8	<u>Para 7.73 in</u> Requirement 77 of SSR-3 [1] states that ...			"Requirement 77 para 7.73 of SSR-3..."		A standard format has been used

48.	Finland	10	10	<p>Special equipment and tools that may reduce radiation exposure and improve safety should be provided by the operating organization. Examples of these are:</p> <p>(a) Long handled tools;  (b) Remote handling manipulators;  (c) Remotely operated equipment for non-destructive testing;  (d) Remote viewing equipment such as binoculars, mirrors, telescopes, closed circuit television, remotely operated cameras and underwater telescopes;  (e) Special lighting equipment, including underwater light fixtures;  (f) Special communication systems (e.g. for use with respiratory protection masks);  (g) Containers for contaminated items;  (h) Shielded containers and transport equipment for irradiated items;  (i) Portable shielding;  (j) Clothing and equipment for radiation protection;</p>	<p>DEC equipment should be considered as part of the design and equipment to be maintained. The issue should be considered somewhere else in the safety guide.</p> <p>Para. 10.10 deals with tools to avoid exposure during maintenance, periodic testing of in-service inspections.</p> <p>Delete (l). of 10.10.</p>	X			
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				(k) Materials and equipment for controlling and containing radioactive contamination (e.g. plastic sheets and tents, paper floor covering, strippable coating material and vacuum cleaners equipped with filters); <del>(k)(l) Installed or mobile equipment necessary in response to use under design extension conditions.</del>					
<b>Annex-II</b>									
49.	South Africa	Annex-II	II-1	It is also important to note that the examples in Table II-1 do not fully apply to most of designs of subcritical assemblies.	Editorial: Spelling correction for “designs”.	X			
50.	Turkey	Annex	II	“Personal protective equipment” can be added to the list under the “Miscellaneous” heading of the Table II-1.	Operability check of the personal protective equipment is very important especially in terms of emergency response and should be added to the Table II-1.		Bullet added “Emergency personal protective equipment”		Table II-1 includes other items of portable equipment for use in an emergency. The operability check performed by personnel prior to using protective equipment in routine work is not a maintenance function.