DS 510B Safety in the Utilization and Modification of Research Reactors (Revision of SSG-24)

COMMENTS BY REVIEWER **Reviewer:** **Page.** **Country/Organization:** **Date: 18 November 2019**					**RESOLUTION**			
Comment No.	**Country Comment No.**	**Para/Line No.**	**Proposed new text**	**Reason**	**Accepted**	**Accepted, but modified as follows**	**Rejected**	**Reason for modification/ rejection**
1.	USA 2 (USNRC)	Throughout entire document		For consistency recommend using either "modifications and experiments or "experiments and modifications" throughout the document.	X			
2.	Hungary 1,	All	It is not possible the separation of the utilization from any other research reactor systems, subsystems or components. The main purpose of the reactor operation is the research and it is based on the utilization*. *The devices/utilization devices must be classified in safety class and licensing process is done on the base of		X			Already provided in Para 3.4 and 3.5.

			classification.					
Section 1								
3.	Germany 1	1.3 Line 14	*The reference [3] should be updated*	SSG-22 is currently under revision (working number DS511) and supposed to be published soon.	X			
4.	Germany 2	1.4 Line 11	*The reference [4] should be updated* Same for para 5.26	SSG-20 is currently under revision (working number DS510A) and supposed to be published soon.	X			
5.	Germany 3	1.7 Line 2	[…] For some specific research reactors with <u>higher hazard potentials e.g.</u> power level in excess of several tens of megawatts, fast reactors and reactors using, highly complex experimental devices such as high pressure and temperature loops and cold or hot neutron sources, additional guidance may be necessary that is provided in IAEA Safety Guides for power reactors.	Thermal power is only one indicator for the potential hazard of the research reactor.	X	X "….with higher potential hazards.."		Consistent with SSR-3
6.	Germany 4	1.7 Line 15	[…] <u>Homogeneous reactors and accelerator driven systems are out of the scope of this publication.</u>	Add at the end of para 1.7 in order to provide further clarification on the scope of this guide. To be consistent with SSR-3, a sentence concerning		X "…~~For some specific~~ <u>R</u>esearch reactors of higher potential hazards, specialized reactors (e.g.		The text is revised for consistency with the revision of other research reactor safety guides (DS509).

				homogeneous reactors and accelerator driven systems should be added.		homogeneous reactors, fast spectrum reactors) and reactors having specialized facilities (e.g. hot or cold neutron sources, high pressure and high temperature loops) may need additional guidance……"		
7.	Italy 3		Nevertheless, when using a graded approach, all recommendations included in this Safety Guide should be addressed. ~~Hereafter, subcritical assemblies will be mentioned separately only if a specific recommendation is not relevant for, or is applicable only to, some subcritical assemblies.~~	It is suggested to remove the sentence because the aspects dedicated to the subcritical complexes are reported in paragraph 4.11 and the application of the Graded Approach for this category of Research Reactors is not evident.			X	Retained for clarity. The guidance unless specifically mentioned is applicable to subcritical assemblies with use of a graded approach that commensurate with their potential risk. In addition, there will be also SSG on use of graded approach.
8.	Germany 5	1.8	In the context of this Safety Guide, utilization is the use of the research reactor or of an <u>experimental facility.</u> ~~experiment or an experimental device during reactor operation. The experiment or experimental~~	Indeed, the experiments or experimental devices that are out of the reactor building may have a radiological impact on the personnel, but they shouldn't have a safety impact on the reactor.			X	In some modern research reactor facilities, some experiments such as beam tube experiments are located outside the

			~~device may be situated in the reactor core, the reactor reflector, the shielding or the experimental facilities3 connected to the reactor, but may also be located outside the biological shielding or outside the reactor building.~~	The message in 1.8 is very confusing. Footnote 3 ("An experimental facility includes any device installed in or around a reactor to utilize the neutron flux and ionizing radiation from the reactor for research, development, isotope production or any other purpose.") is sufficient. Compare also with definition for experimental devices in SSR-3 (footnote 5).				biological shielding or outside the reactor building. The original text is retained.
9.	Germany 6	p.7/ footnote 5	The reactor manager is the member of the reactor management to whom the direct responsibility and authority for the safe operation of the reactor are assigned by the operating organization and whose primary duties comprise the ~~discharge~~ <u>fulfilment</u> of this responsibility.	Keep original footnote like in SSR-3 (footnote 38). There is no reason for variation.	X			
10.	Pakistan (PNRA) 1	Scope 1.8 1.9	Paras 1.8 and 1.9 are the additional information but not reflecting the scope of the document.	May be deleted from scope and may be reflected at appropriate section in the document.			X	Paras 1.8 and 1.9 explain the terminologies and the whole document reflects utilization and modification.
11.	Belgium 1	1.9	… and operating conditions for the research	Dot is missing between "experiments" and	X			

			reactor as well as for experiments. Organizational changes are considered …	"Organizational"				
12.	Israel 1, (IAEC)	1.9	Footnote 5 This footnote addresses experiments and experimental facilities that have been approved in the past as not being considered to be modifications. We would like to suggest to phrase this footnote more "carefully", taking in consideration the possibility that there have been modifications in the reactor itself, since those experiments/facilities have been approved. And indeed, a similar addressing (in the original SSG-24) of repetitive nature experiments, has been deleted in paragraph 3.1 and also footnote 9 (related to paragraph 3.1) was completely deleted. Instead, the issue is dealt clearly and accurately in **paragraph 3.9** of the	Completeness	X			Footnote on repetitive experiments is retained and referred in para 3.5.

			current revision (requiring that for repeating experiments it should be proven that they can utilize earlier approved safety analyses). Similar approach can be found also in paragraph 3.2 which refers to the detailed checklist in Annex 1.					
13.	Italy 1	1.10	Depend on the type of research reactor		X			
14.	Italy 2	Page 4, note 4	Installed in or around a research reactor				X	Consistent with SSR-3 footnote.
Section 2								
15.	Pakistan (PNRA) 2	2.7	2.7. The operating organization should provide adequate resources to execute the utilization or modification by: **-Determining the number of required personnel to perform the assigned task;**	**Please add the bold text.** The para should be modified, as maintaining the minimum operational manpower is a challenge for research reactor operating organizations with the retirement of qualified personnel.			X	Covered in para11.5.
16.	Israel 2, (IAEC)	2.8	It is required that personnel not directly working for the research reactor (e.g. belonging to contracting organizations), should work under the	Clarity			X	Already covered in the text of para 2.8 "…..same controls and to the same work standards…."

			same control as reactor personnel. We suggest to add there (maybe as a footnote) an explicit mentioning of the need to monitor radiation exposure (e.g. using personal dosimeters) of those non direct workers (as done for the reactor personnel).					
17.	Italy 3	2.15	Review and verification of records, results and reports relating to the design, the implementation of projects and the operation of the research reactor itself		X			
18.	Germany 7	2.19 Line 6	[…] The advice of external specialists and consultants may be sought to support the project manager in performing his or her duties.	To be consistent (compare with para. 2.23)		X …to support the project manager in performing ~~his~~ duties.		See USA comment 1.
19.	USA 1 (USNRC)	2.19, last sentence	The advice of external specialists and consultants may be sought to support the project manager in performance of duties.	Recommend removing gender specific term "his".		X …to support the project manager in performing ~~his~~ duties		Resolved with Germany comment 7 and made consistent with para 2.23.

Section 3								
20.	Germany 8	3.4	~~For utilization projects, the relevant experimental devices should be classified in accordance with the structures, systems and components (SSCs) classification system.~~ For utilization of a research reactor as well as experimental devices, a safety classification system should be developed, based on the possible safety implications of the utilization. This classification should also be used as a first step in the safety categorization of the utilization project. In developing a safety categorization system for utilization project, the potential impact on main safety functions and the potential for challenging safety functions should be considered.	Utilisation of research reactor refers not only to experimental devices. Use original text as in SSG-24.		X For utilization projects, the relevant experimental facilities and devices should be classified...		The text is revised to cover both experimental facilities and devices.
21.	Pakistan (PAEC) 1	3.4	For utilization…….taken into account: — Criticality aspects; — Reactivity aspects; — In-core and out-of-	The term operating and experiment personnel is more relevant (as they are exposed to exposure) compared to site personnel.			X	The term site personnel is used in context of the glossary that defines

			core…; — Experiments within or…..; — Physical conditions and ……; — Chemical conditions and…..; — Heat generation and thermal…..; — Mechanical and thermal…; — The potential for a significant dose to operating and experiments personnel; — ~~The potential for a (significant) off site dose to members of the public.~~	There is no potential of significant dose to the public in research reactor experiments.				**site personnel** All persons working in the *site area* of an *authorized facility*, either permanently or temporarily. In some high potential hazard facilities, there could be potential for off-site consequences.
22.	Pakistan (PAEC) 2	3.6	The proposal for the classification and categorization process for modification and utilization projects, including the proposed review and approval routes, should be submitted to the reactor operational safety review committee for review and approval, following the approval of OSRC, the proposal	The term operational safety review committee (OSRC) is more relevant compared to safety committee. Per industry practice, Reactor manager is part of OSRC.			X	Consistent with SSR-3.

			should be submitted to the regulatory body for review and approval, in accordance with the regulatory requirements					
23.	Italy 4	3.10	of each experiment or modification for research reactor itself				X	The original text is more appropriate.
24.	Germany 9	3.17	The safety documentation for the project should be reviewed by the reactor manager with respect to safety, operability and compatibility with other experiments in or at the research reactor and with reactor systems.	Some experiments might be outside the reactor.	X			
25.	Germany 10	3.18	Modifications and experiments having a major effect on safety should be reviewed by the safety committee(s). After the review by the safety committee it should be submitted to the regulatory body for review and ~~licensing~~ approval in accordance with the same procedures as those applied for the research reactor itself.	At this point approval should be sufficient. Recommendation on licencing is given in para 3.19. This unnecessary doubling is confusing.	X			
26.	Pakistan (PAEC) 3	3.23	An assessment of radiation exposure of the operating and experiment personnel expected during	The term operating and experiment personnel is more relevant (as they are exposed to exposure) compared to site			X	See resolution to Pakistan (PAEC) comment 1.

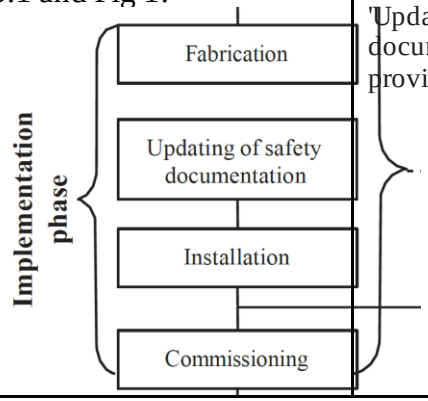
			or as a result of the project should be prepared. Measures to reduce radiation exposures based on the principle of optimization of protection and safety should be described for all reactor states, and any potentially necessary mitigation measures should be identified.	personnel.				
27.	Italy 5	3.26	With other experiments in the research reactor				X	See resolution to Italy comment 4.
28.	Germany 11	3.37	Modifications carried out on any equipment, including ~~safety~~ structures, systems and components important to safety, and nuclear security measures should be screened and assessed for potential impacts on safety and security, and the results be described in a separate document and may need to be kept confidential.	Clarification	X			
29.	Germany 12	3.41	*Examples of safety focused questions on proposed modifications to the physical protection system, and of security focused questions on proposed modifications important to safety are*	Para 3.41 contains no guidance or recommendation. It should be combined with 3.40 (don't make a separate point).	X			

			provided in Annex IV.					
Section 4								
30.	USA 3 (USNRC)	Section 4.3 1st sentence	In addition to the reactor operations, such as startup, steady state, intended transient operation and shutdown, other reactor conditions should be considered for their effects on the experiment or modification.	Change "pulsed operation" to "transient operation" because some TRIGA reactors use square -wave operation which is not a pulse nor steady-state operation. Pulse and square-wave operations are both intentional transients of the reactor.		X "…such as startup, steady state or transient state and shutdown…"		
31.	France 1	4.4, 4.5.	4.4 4.5. Modifications aiming to continuously improve nuclear safety such as modifications to design features ~~or equipment used for design extension conditions, including non-permanent equipment~~ should be performed in accordance with the approved facility modification processes, procedures and required safety assessment.	Design extension conditions should not apply for research reactors.			X	DEC is applicable to research reactors as per SSR-3 requirement 22.
32.	Germany 13	4.5. and 4.6.	*The order of paragraphs 4.5. and 4.6. should be changed.*	Paragraph 4.6 demands that "The operating organization's safety policy towards modifications should be based on the principle of continuous improvement." Paragraph 4.5.	X			

				already deals with modifications aiming to continuously improve nuclear safety. Therefore, the goal of continuous improvement should be defined first.				
33.	Germany 14	4.6	~~The operating organization's safety policy towards modifications should be based on the principle of continuous improvement.~~ For each modification adverse effects challenging: the protection of the barriers to radioactive release; the independence between the levels of the defence in depth and an adequate reliability of each level during operation, as a consequence of all modifications and related operational activities should be avoided. The influence of human and organizational factors, on one, several or all barriers and levels of defence in depth, should be considered in all activities, including design related to utilization and modifications. The operating organization's safety policy towards modifications should be	1. Sentences on safety policy (1 and 4) contains the same message. Delete first sentence. 2. Safety policy is a more general issue. Last sentence should be placed in chapter 2 rather than in chapter 4.		X "The operating organization's safety policy towards modifications should be based on the principle of continuous improvement and should be regularly reviewed ……."		To avoid duplication of text, the last sentence merged with first sentence.

			reviewed regularly in order to allow for a continuous improvement.					
34.	France 2	4.11.	~~4.11. For subcritical assemblies, any potential for criticality because of the reactivity worth of an experiment should be covered as a design extension condition and it should be assessed to identify whether the existing safety provisions remain effective or additional safety features to prevent or mitigate the consequences of such event need to be implemented.~~	Design extension conditions should not apply for research reactors.			X	See resolution to France comment 1.
35.	USA 5 (USNRC)	DS510B 4.12, last sentence	The safety requirements for radiation protection are established in IAEA Safety Standards Series No. GSR Part 3, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards [22].	For the purposes of consistency with structure used in other safety standards. Also, GSR 3 is typically referred to as the "Basic Safety Standards."	X			
36.	Germany 15	4.21 Line 15	[…] Means to reduce the reactor power or to shut down the reactor, as discussed in paras 4.8 – 4.10 and 4.17, should be analysed and ensured.	Paras 4. 8 – 4.10 are also relevant here and should be cited.	X			

37.	Belgium 2	4.24	… It should be ensured that pressures within the enclosures and chemical concentrations of the target material do not adversely affect the safety of the reactor or the experiment, or the safety of the personnel.	Incidents have happened when personnel is opening irradiated samples (due to pressure effects). Also the safety of the personnel is at stake.	X			
38.	Russia 1/ Rostechnadzor	4.26/7	•irradiation of materials which corrosive properties may become enhanced as a result of irradiation (e.g. mercury, rhenium, magnesium) should be performed in view of this effect;	Risk depends on experimental devices, prohibiting is not correct.		X "……..should be used with particular consideration to their properties."		For clarity
39.	Indonesia 1	4.26	(Adding new bullet): The use of liquid fissile fuel contained in a solid cladding in any kinds of research reactor utilizations should be assessed due to its leak potential. The leak of liquid fuel could pose some hazards, such as criticality, reactivity insertion, chemical reaction, corrosion,	Liquid fuels are easier to leak and contaminate the reactor coolant system. This contamination raises some hazards, such as criticality, reactivity insertion, change of power distribution in the core, corrosion, chemical reaction, increase of radiation dose due to the increase of activated substances, etc.			X	The comment is not relevant, the para deals with the selection of materials for design of experiments.

			explosion, increase of radiation dose, etc.					
40.	Germany 16	4.27	*Add it as a new bullet in 4.26:* <u>certain activated corrosion products (such as silver) tend to plate out (i.e. form a coating) on cooling circuit surfaces, thus creating contamination and the potential for radiation exposure during handling and maintenance</u>	Para 4.27 contains no recommendation. Include this information as a bullet in para 4.26.			X	The context of both paras is different. Para 4.26 is about materials selection for experiment design and irradiation during experiments
Section 5								
41.	Pakistan (PNRA) 3	5.1	5.1. ..... The ~~following~~ paragraphs **from 5.6 to 7.5** provide a detailed discussion of each aspect of Fig. 1.	More clear.			X	This level of detail is not needed here.
42.	Pakistan (PNRA) 5	5.1	5.1 and Fig 1: 	The detail explicit discussions on 'Updating of safety documentation' has not been provided in section 6.	X			

Section 6								
43.	Russia 2/ Rostechnadzor	6.7/1	During fabrication technical audits and quality audits should be conducted in order to verify all aspects of fabrication, such as deviations from specifications, quality control and the schedule and deadlines. The operating organization should define which inspections will be conducted during fabrication to verify that it is in compliance with applicable requirements, codes and standards. In particular, inspections during fabrication are important for the equipment which cannot be thoroughly inspected during installation.	This document is for the operating organization. If it is desirable to include recommendations for regulator also, it should be significantly expanded, because this note and note in item 6.19 are very fragmental. Other notes concerning communication between the operating organization and the regulator are good for this document.		X "…..schedule <u>and deadlines</u>." "<u>The operating organization should discuss with</u> the regulatory body and define which inspections will be conducted during fabrication to verify that it is in compliance with applicable requirements,		To make the text consistent with the other paras of the guide.
44.	Germany 17	6.7 Line 3	During fabrication, technical audits and quality audits should be conducted in order to verify all aspects of fabrication, such as	Clarification (missing comma is changing the meaning)	X			

			deviations from specifications, quality control and the schedule.					
45.	Germany 18	6.11 Line 5	[…] - Frequent meetings to inform on progress and exchange information with all ~~staff~~ site personnel (i.e. technical, operational and health physics ~~staff)~~	Staff was replaced by site personnel. Consistency within the document.	X			
46.	Russia 3/ Rostechnadzor	6.19/1	The safety of a modification or experiment to be implemented should be verified through a commissioning programme involving tests and checks, and measurements and evaluations prior to and during implementation of the modification or experiment. The requirements 73 SSR-3 [2] are also applicable for the commissioning of a modification or experiment.	See above.	X			The text is modified, see resolution to Russia/Rostechnadzor comment 2
Section 7 No Comment								

Section 8								
47.	Pakistan (PNRA) 4	8.5	8.5……., and appropriate radiation warning signs **and instructions** should be exhibited.	The safety instructions should be added, because pre-job briefing may also help to minimize radiation exposure.			X	Covered in para 8.4.
48.	Italy 6	8.9	Procedures relating to the startup of the research reactor				X	See resolution to Italy comment 4.
49.	Italy 7	8.15	to ensure the safety of the research reactor and the personnel		X			
50.	Pakistan (PAEC) 6	8.17	The reactor manager should enforce any safety rule or any limitations to experiments, if necessary, to ensure the safe operation of both the experiment and the research reactor, as well as to ensure the safety of staff operating personnel and experimenters. The Manager should terminate the experiment and place the reactor in safe conditions should external hazardous events (fire, seismic etc.) warrant declaration of emergency reactor site.	Termination of experiment in emergency situation when warranted by external events.			X	The comment is valid however that level of detail is not needed.
Section 9								

51.	Germany 19	9.8	All documentation describing the sequence of operations and the instructions for operating the equipment should be known to the operating personnel and should be available during the handling, dismantling, post- irradiation examination and storage of the irradiated equipment or components until release from regulatory control, further use or their disposal."	Some components might be feasible for clearance or further use.	X			
52.	Pakistan (PAEC) 5	9.9	The personnel performing the handling, dismantling, post-irradiation examination and storage of experimental devices should be given the necessary training in all aspects of these operations, including, radiation protection, sample handling, waste handling if necessary, exercises using mock-ups, before work with irradiated objects is commenced. A method for determining the effectiveness of training should be put in place	Radiation protection and sample handling should be important aspect of training.			X	Covered in para "training in all aspects …"

Section 10								
53.	Russia 4/ Rostechnadzor	10.1	deuterium		X			
Section 11								
54.	Germany 20	11.2	~~Requirements 68, para 7.11 of SSR-3[2] requires that "the proposed organizational changes to the structure and associated arrangements, which might be of importance to safety, shall be analysed in advance by the operating organization and submitted to the regulatory body for approval".~~ Changes to the operating organization should be considered as modifications and should be categorized according to their safety significance (see Req. 68, para 7.11 of SSR-3[2]).	It is not necessary to repeat the safety requirements, cite is sufficient.			X	The requirement of are stated sometimes in safety guides.
55.	Germany 21	11.5 Line 4	[…] In particular, it should be ensured that adequate provisions have been made to maintain a suitable level of trained and qualified ~~staff~~	Staff was replaced by site personnel. Consistency within the document.			X	The original text is retained consistent with NPP guide.

			site personnel in all areas important to safety, and that any new organizational structure has been documented with clear and well understood roles, responsibilities and interfaces. All needs for retraining should be identified by, for example, carrying out an analysis of training needs for each of the new roles, and planning retraining of ~~staff~~ site personnel where this is found to be necessary.					
Annex I No Comment								
Annex II No Comment								
56.	USA 4 (USNRC)	Annex II Section 4.2	Description of the procedures for installation and maintenance of radiation shielding;	Recommend including "maintenance" of radiation shielding.	X			
57.	Pakistan (PAEC) 4	4.2	Radiation shielding – Functional description…… – Description of the procedures for installation of radiation shielding	Verification of shielding installation per drawing and effectiveness of shielding are two important steps before commencing experiment;	X			

			– Verification of installation and effectiveness of radiation shielding; – Description of procedures….; – Detailed assembly drawing (including parts list, list of materials used and material specifications).					
58.	France 3	10.	10. Safety analysis In this section, the postulated initiating events for the experiment are to be presented and the consequences, including effects of experiment failures on the reactor, of the postulated initiating events are to be analysed for all operational states and accident conditions of the reactor. The safety analysis for the experiment also needs to include an analysis of the damage that would be caused to the experimental devices by the postulated initiating events of the reactor and the overall	Design extension conditions should not apply for research reactors.			X	See resolution to France comment 1.

			consequences (i.e. combined consequences of the reactor accident and resulting experiment failure). The postulated initiating events are not to be restricted to the experimental facility, but also possible internal and external hazards that affect both the experimental facility and the reactor (e.g. internal flooding or seismic events). Postulated initiating events for similar experiments at other research reactors are also considered and analysed. The safety analyses need to be such as to demonstrate adequate fulfilment of the safety functions and prove that neither conduct of the experiment nor any failure would result in unacceptable conventional hazards and/or radiological hazards to site personnel and the public, in major disturbances to the operation of the reactor and (other) experimental facilities, in damage to the reactor or experimental facilities or in reduced access to the reactor, experimental facilities or the reactor building. For the purpose of design basis accidents, the single failure criterion applied to the				

			safety systems and safety support systems are to be considered in the analysis. ~~For design extension conditions, additional failures may be assumed.~~					
59.	Italy 8	10	In this section, the postulated initiating events for the experiment are to be presented and the consequences, including effects of experiment failures on the research reactor, of the of the postulated initiating events are to be analysed for all operational states and accident conditions of the research reactor, in which analysis the single failure criterion is to be applied. The safety analysis for the experiment also needs to include an analysis of the damage that would be caused to the experimental devices by the postulated initiating events of the research reactor and the overall consequences (i.e. combined consequences		X			

			of the reactor accident and resulting experiment failure). The postulated initiating events are not to be restricted to the experimental facility, but also possible internal and external hazards that affect both the experimental facility and the research reactor.					
Annex III No Comment								
Annex IV No Comment								
Annex V No Comment								