Master Resolution Table for DS516
Criticality Safety in the Handling of Nuclear Material – Step 7
23-Oct-2019

No	State /No.	Para. / Line	Proposed New Text	Reason	Accept	Accepted but Modified as Follows	Reject	Reason for Modification / Rejection
1	BE01	01.003 -	Remove "enrichment"	This paragraph mentions "enrichment", which is removed throughout many other instances in the document. Remove it here as well for consistency	Y	Also added '*In this safety guide, the phrase "nuclide composition" encompasses all the parameters inferred by the terms "enrichment" and "isotopic composition"* ' to para 1.4. The word "*enrichment*" currently remains in para 4.12		
2	BE02	03.014 - d	Add "neutron" before "moderating materials"	For clarification purposes	Y			
3	BE03	03.014 - g	Add "neutron" before "reflecting materials"	For clarification purposes	Y			
4	BE04	03.017 -	Add "and hydrocarbon plastics"	Many hydrocarbon plastics are also excellent moderators	Y	Inserted *and hydrocarbon plastics*		
5	DEN 01	01.011 -	In cases where criticality safety is specifically addressed by regulations, for example, the transport of fissile material in accordance with SSR-6 (Rev. 1) [6], this Safety Guide supplements but does not replace the recommendations and guidance provided in the corresponding IAEA Safety	<2> Clarification	Y	This paragraph may be split into shorter sentences during technical editing.		

			Guides, e.g. ~~Standards Series No.~~ SSG-26, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material [10]					
6	DEN 02	02.005 -	A ~~graded~~ grading is required to be used in developing and implementing the approach to ensuring criticality safety of facilities or activities that involve handling of fissile material (see Requirement 11 of SSR-4 [1]). Application of a graded approach should be based on the type ~~and the~~ of facility or activity and its potential risk and should not compromise safety. …	<2> Clarification	Y	*A graded approach is required…..*		
7	DEN 03	03.032 - q	Procedures for training of operating personnel and criticality safety personnel.	<3> Wording	Y			
8	DEN 04	04.019 -	The applicability of reference data to the system of fissile material being evaluated should be justified. Any calculation method and code, and nuclear ~~cross-section~~ data used should be specified (i.e. code versions, cross-section data sets and release versions), together with any	<1> Also the calculation methods and codes used are an important information. The term “nuclear data” is more general, since not only cross sections but also thermal scatting data and maybe decay data or fission yield data (in case of burnup credit), etc. are used	Y	*The applicability of reference data to the system of fissile material being evaluated should be justified. The calculation methods, computer codes and nuclear data used should be specified (including their release versions), together with any cross-section pre-*		

			nuclear data~~cross-section~~ processing codes that were used.			*processing codes that were used.*		
9	DEN 05	04.021 -	The results of the calculations should be cross-checked by using independent nuclear data or different computer codes when available. In addition, the uncertainties of the calculated results due to the uncertainties of the nuclear data used should be determined. These uncertainties need to be taken into account if the calculated results are compared to the established upper subcritical limits (see para. 4.33).	<1> Even if conservative input data is used, there are still remaining uncertainties like uncertainties of the nuclear data which leads to uncertainties in the calculated results.	Y			
10	DEN 06	04.023 -	Verification of the calculation methods should be performed prior to validation and periodically thereafter. Verification is the process of determining whether a calculation method correctly implements the intended conceptual model or mathematical model (see Requirement 18 of GSR Part 4 (Rev. 1) [2]). Verification should test the methods, mathematical or	<2> Clarification	Y			

			otherwise, used in the model and computer codes, while ensuring that changes of the operating environment, i.e. operating system, software and hardware, do not adversely affect the execution of the codes. Verification of the calculation method should be managed as part of the management system.					
11	DEN 07	04.033 -	An upper subcritical limit (i.e. a direct limit on keff) should be established based on the bias and bias uncertainty of the calculation method, the administrative margin, and any related penalties (e.g. penalty for use of the calculation method outside of its area(s) of applicability). While comparing the calculated k_{eff} values with this upper subcritical limit, the remaining uncertainties of the calculated k_{eff} values (e.g. statistical uncertainties in case of Monte Carlo calculations or uncertainties due to the uncertainties of the nuclear data used) are	<1> Make sure that remaining uncertainties of the calculated k_{eff} are taken in to account	Y	Added ref to SSR-4 para 6.144.		

			required to be taken into account.					
12	DEN 08	04.035 -	Quality control of the input data and the calculation results is an important part of criticality safety analysis. This includes, for example, verification that Monte Carlo calculations have properly converged. All input data and nuclear data used in calculations, the assumptions, approximations and simplifications used to prepare the input data and the associated uncertainties as well as the derived results and their uncertainties (e.g. statistical uncertainties in case of Monte Carlo calculations or uncertainties due to the uncertainties of the nuclear data used) are required to be documented as part of the overall management system (see SSR-4, para. 4.18).	<1> Input data used in calculations should be documented to ensure traceability of the results	Y	*All input data and nuclear data used in calculations, the assumptions, approximations and simplifications used to prepare the input data and the associated uncertainties as well as the derived results and their uncertainties (see 4.33) are required to be documented as part of the overall management system (see SSR-4, para. 4.18).*		
13	DEN 09	05.070 -	For the storage of waste containing fissile nuclides, consideration should be given to potential changes in the configuration of the waste, the introduction of a	<1> For storage subcriticality should be ensured preferently by passive means	Y	*When a method for the prevention of settling of material is required to maintain a subcritical configuration, the method should be passive only. Such*		

			moderator or the removal of material (such as neutron absorbers) as a consequence of an internal or external event (e.g. movement of the waste, precipitation of solid phases from liquid waste, loss of confinement of the waste, a seismic event): see also IAEA Safety Standards Series No. WS-G-6.1, Storage of Radioactive Waste [32]. Active methods to prevent settling of material in order to maintain a subcritical configuration should not be used as a primary means to prevent criticality during long term storage. Instead, passive methods are to prefer.			*situations can arise in long term storage (or e.g. during the separation of fissile solids from aqueous mixtures).*		
14	DEN 10	05.071 -	Assessment of criticality safety for the period after the closure of a disposal facility presents particular challenges. Among these are the impacts of geochemical and geophysical processes on the disposal facility during very long timescales that need to be considered. …..	<2> Clarification what the processes during that timescale need to be considered	Y	*These include the significant effect of geochemical and geophysical processes on the disposal facility during very long timescales, which should be considered.*		

15	DE W01	02.002 -	Fission, caption and scattering cross-sections are basic input for the calculation of k_{eff} any change in these values changes k_{eff}. Therefore, a separate consideration besides the calculation of k_{eff} of these values is meaningless and might be misleading.	<1> Background	Y	A sentence has been added to para 2.2.		
16	DE W02	03.004 -	Include "changes in reflection and moderation" as this might change a favorable geometry to an unfavorable.	<1> Important factors which might be overseen.	Y			
17	DE W03	03.039 -	Please include a sentence to the hierarchical independence of criticality safety staff and clarify the relation to radiation protection staff.	<1> To clarify the position of safety staff	Y	Added to bullet (a) of para 3.40.		
18	DE W04	05.044 -	Consider adding a point on uncertainties in applying the burnup-credit-method and conservatism in assumptions	<1> Clarification, to highlight the importance of the uncertainties in the calculation	Y	Added "*Since calculations for burnup credit in spent fuel usually include many more nuclides than are present for fresh fuel calculations, any uncertainties in nuclear data and the conservatism applied should be justified*." To bullet (b)		
19	DE W05	05.048 -	Consider adding a sentence to Th-bearing fuels and	<1> Th-bearing fuels may increase in the future.	Y	See SSR-4, para 1.3 h) and further references on U233 in the text.		

			their complicated dissolution behavior.					
20	DE W06	05.065 - 5.59	Consider a para on the high neutron flux that may be generated by accumulation of minor actinides and that may contribute to the neutron balance.	<1> Influence on k_{eff}	Y	New bullet; "*Variations in neutron fluxes and spectra caused by other actinides*."		
21	EN01	01.005, l1	1.5 The objective of this Safety Guide is to provide recommendations on ensuring criticality safety, in order to prevent a self-sustained nuclear chain reaction. It also gives insights on how to minimize the consequences of this if it were to occur	Previous phrasing gives the same importance for the prevention and for the mitigation of a criticality accident. Even if progress has been made on the second aspect (leading to recommendations formulated in par. 6), one should recall that the safety-criticality demonstration remains mainly based on prevention (as recalled in par 6.2).	N		Y	The paragraph has been reworded to be more explicit. Recommendations relating to CAAS and escape are important.
22	EN02	02.002, l6	For this reason, and because of the large number of variables upon which the neutron multiplication factor depends, ~~there are many examples of apparently 'anomalous' behaviour in fissile systems of fissile material in which~~ the estimation of the effective neutron multiplication factor5 (keff) ~~changes in ways that~~ can sometimes,	It is not clear what the terms "behaviour" or "changes" are referring to, especially for non safety-criticality experts. It is thus proposed to simplify the sentence and add an example of systems where the reactivity does not behave as one would expect.	Y	*Because of the large number of variables upon which the neutron multiplication factor depends, there are many examples of apparently 'anomalous' behaviour in which changes seem counterintuitive. Nuclear data should only be used in full calculations of keff as attempts to estimate keff from trends in nuclear data can be misleading*.		

			especially in over-moderated systems, seem counterintuitive. For this reason, and because of the large number of variables upon which the neutron multiplication factor depends, ~~there are many examples of apparently 'anomalous' behaviour in fissile systems of fissile material in which~~ the estimation of the effective neutron multiplication factor5 (keff) ~~changes in ways that~~ can sometimes seem counterintuitive.					
23	EN03	02.003 -	The determination of what constitutes a credible abnormal condition should be based on deterministic methods, that can be completed by probabilistic ~~methods~~ insights	Requiring both a deterministic and a probabilistic approach for characterizing a credible abnormal condition will lead to complexity and interpretation. The current double contingency approach is considered as robust: PSA can give some insights on the type of failures to consider,	Y	*The determination of what constitutes a credible abnormal condition (outside normal operation) should be based on deterministic methods and complemented by probabilistic assessment where possible. In the identification of abnormal events facility design and the characteristics of the*		

				but a demonstration that would be based on PSA results would raise many questions on the equipments that could be credited in the demonstration etc.		*activity as well as operational experience feedback should be considered (see also Ref. [11]).*		
24	EN04	02.004 -	In accordance with Requirement 13 of SSR-4 [1], items that are ~~important~~ necessary for prevention of criticality accidents or for mitigation of the consequences of such accidents are required to be identified and classified according to the principles in SSG-30~~on the basis of their safety function and safety significance.~~	The notion of importance to the prevention is subject to interpretation and could lead to base classification on PSA results. It seems better to refer to SSG-30	Y	Whole paragraph reworded		
25	EN05	03.029 -	The adequate use of redundant, diversed and independent systems and components are required to be considered (Requirement 23 of SSR-4 [1]), ~~although it this does not prevent common cause failure~~.	Req 23 not only deals with redundancy but also with diversity and independence which limit common cause failure.	Y	*Independently redundant or diversified systems and components are required to be considered (Requirement 23 of SSR-4 [1]), which should be sufficient to limit the possibility of common cause failure.*		
26	EN06	03.044 -	Ensuring subcriticality in accordance with the ~~principles of redundancy, diversity and independence (as required by~~	Req 23 applies to the design of equipment.			Y	This paragraph concerns the principles of redundancy etc and DiD has a separate subsection in DS516.

			~~Requirement 23 of SSR-4 [1])~~ concept of defence in depth usually involves the application of a combination of different engineered and administrative safety measures.					
27	EN07	05.029 -	The preferred method of ensuring subcriticality during spent fuel operations is by means of geometrically favourable configuration of the fuel. Additional means, such as ~~fixed~~ neutron absorbers and/or the use of a burnup credit, could be applied where subcriticality cannot be maintained by means of favourable geometrical configurations alone (see IAEA Safety Standards Series No. SSG-15 Storage of Spent Nuclear Fuel Ref. [27]).	This change offers the possibility of using soluble boron.	Y			
28	FI01	general	The SSR-4 requirements should be quoted not rephrased. see para. 2.4, 2.5, 2.12, 2.19, 2.24, 2.25 … etc.	this safety guide cannot set requirements	Y	Safety Guides should not paraphrase the requirements. This issue will be addressed by the Technical Editors after		

						Stage 7 and before sending out for MS comments.		
29	FI02	general	The way of writing the safety guide should be in line with other IAEA SPESS. The requirements of the SSR-4 should not be rephrased. The development in SSR-4 should be systematically considered in developing this safety guide and overlapping should be avoided.		N	Safety Guides should not paraphrase the requirements		The development of SSR-4 was systematically considered, however this guide also provides guidance relevant to other facilities and activities.
30	FI020	05.044 - c	instead of "burnable poison" use "burnable absorber": "Specification and demonstration of a suitably conservative representation of the irradiation conditions, for example, the amount of burnup, the presence of soluble absorbers, the presence of burnable ~~poisons~~ absorbers, coolant temperature and density, fuel temperature, power history and cooling time. For fuel assemblies with burnable ~~poisons~~ absorbers, the criticality safety assessment should take account of the depletion of burnable ~~poisons~~ absorbers and should consider the	Poison is something that it not wanted, the burnable absorbers are put in fuel on purpose to reduce the reactivity in the beginning of the life cycle.	Y			

			possibility that the most reactive condition may not be for the fresh fuel.					
31	FI021	05.067 -	Waste management operations cover a very wide range of facilities, processes and materials. The recommendations in paras 5.58–5.77 apply to packaging, interim storage and	Please check the reference paras 5.58 to 5.65 are under the title Reprocessing	Y			
32	FI022	06.005 -	In accordance with para. 5.17 of GSR Part 7 [8], the government is required to ensure that~~, as~~ appropriate arrangements are in place for the following:		Y			
33	FI023	06.008 -	In some accidents, there have been instances where incorrect actions by operating personnel have inadvertently initiated a further ~~loss of~~ power excursion/increase after the initial criticality excursion.	I don't think this is a loss of power but rather a re-increase of power, where the power increases and creates a new spike after a decrease of power following the initial (or previous) spike. This refers to an oscillating power.	Y	Just "further excursion"		
34	FI03	02.003 -	Rearrange: 2.3 Criticality safety is required to be achieved through the assurance of subcriticality under normal operation and credible abnormal conditions in accordance with	Para 2.3 seem to start in the middle of the sentence	Y	*The operational states and conditions for a nuclear fuel cycle facility in these requirements, that are referred to as credible abnormal conditions or conditions included in the design basis, include initiating events with the*		

			Requirements 38 and 66 of SSR-4 [1]. To ¶ ~~2.3~~ meet these requirements, a list of credible abnormal conditions should be identified. These conditions are faults and condition …			*potential to cause criticality listed in the Appendix to SSR-4 [1].*		
35	FI04	02.004 -	In meeting accordance with Requirement 13 of SSR-4 [1], items that are important for prevention of criticality accidents or for mitigation of their consequences of such accidents are required to be identified and classified on the basis of their safety function and safety significance. This includes items performing engineered or administrative criticality safety measures.	Please rephrase. Use quotations from SSR.4, do not rephrase SSR-4.	Y	The whole paragraph has been reworded		
36	FI05	02.005 -	A graded approach is required….	Clarity: A graded is required is missing something Please consider rephrasing the whole paragraph. The SSR-4 text should not be rewritten. see also 2.4 and general comment.	Y			

37	FI06	02.005 -	Application of a graded approach should be based on the type ~~and~~ of the facility or activity and its potential risk, and should not compromise safety	There are too many and words and the meaning is not clear. see above.	Y			
38	FI07	02.006 -	check the us of commas	Current use of commas may be misleading	Y	Paragraph restructured.		
39	FI08	02.007 -	Feedback from operational experience, including An awareness of the anomalies and accidents known to date, should be utilized to contribute to ensuring criticality safety. A detailedUseful information on the causes and consequences and a description of many of the most important anomalies and accidents that have been observed in criticality safety is provided in Refs. 11[12], [13] and [14].	Please rephrase the paragraph and use reference to SSR-4 Req. 73. The safety guide should provide recommendations of implementation of SSR-4 requirements. SSR-4 is more precise and thorough.		Events relating to criticality safety should be analysed and, combined with such useful information, a programme for feedback from operational experience should be developed and maintained, see para. 2.4 of SSG-50 Operating Experience Feedback for Nuclear Installations [20]. The requirements for feedback from operating experience for nuclear fuel cycle facilities are established in IAEA safety standards, paragraph 6.7 of GSR Part 2 [3] and requirement 73 of SSR-4 [1].		
40	FI09	02.008	SUBCRITICAL LIMITS AND SAFETY MARGINS	Please add paragraphs concerning SSR-4 Req. 10 and 17 dealing with safety margins.	Y	Inserted "*SSR-4 requires use of conservative margins for safety (see Requirement 17 and paragraphs 6.21,*		

						6.56 and 6.57)" at the start of paragraph 2.9. And the text in 2.9 was modified as follows: Alternatively, consideration should be given to uncertainty in the calculation of other control parameters when applying safety margins to their critical values. This should include the possibility of any calculation method bias and bias uncertainty, and the sensitivity with respect to changes in the control parameter or k_{eff}		
41	FI10	02.016 -	2.16 The basis for exemption criteria should be documented and justified	Shouldn't the number be before the paragraph	Y	It looks like an empty para due to WORD track changes mode, if the change is accepted it gets associated with the previous paragraph.		
42	FI11	02.035 -	… These audits should be carried out regularly, and the results should be evaluated by the operating organization and corrective actions ~~be~~ taken to implement		Y	"*should be*"		

			recommendations and suggestions for safety improvements.					
43	FI12	03.002 -	The facility or activity should be designed and operated or conducted such that it provides defence in depth against credible abnormal conditions or accidents by the provision of different levels of protection with the objective of preventing failures. ~~, or, if~~ If prevention fails, it should be ensured ~~ensuring~~ that the failure is detected and compensated for or corrected through the successful application of measures in the other layers.	Too long and complicated sentence. Consider using shorter sentences. Even the suggested first sentence is very long and could benefit of splitting it into shorter ones,	Y			
44	FI13	03.017 -	polyethen, polyurethane and similar should perhaps also be mentioned, not just oils	they are efficient moderators	Y	Inserted *and hydrocarbon plastics*		
45	FI14	03.032 - q	Procedures for training to operating personnel and criticality safety personnel.		Y			
46	FI15	03.043 - b	(b) To develop a questioning attitude and strong safety culture; and (c) if unsafe conditions are possible in the event of a deviation from normal operations, to stop work and report the event as required.	Clarity: This is an own item and is a separate one for the supervisors	Y	b) *To espouse and contribute to a questioning attitude and strong safety culture.* c) *To stop work and report the event as required, if unsafe conditions are*		

						possible in the event of a deviation from normal operations,		
47	FI16	03.046 -	Safety measures include quality assurance measures, in-service inspection and testing, and maintenance to ensure that the safety functions are fulfilled and that criteria for reliability are met. Where administrative controls are required as part of a safety measure, these should be tested regularly.	Please consider rephrasing in line with SPESS.	Y	We assume this comment relates to need for use of "should"		
48	FI17	03.048 -	Changes due to ageing of the facility ~~are required~~ should ~~to~~ be considered and implemented:	see general comments	Y	*The ageing management programme, required by Requirement 60 of SSR-4, is required to be coordinated with the criticality safety programme required by requirement 66, see para 9.53 in [1].*		
49	FI18	05.034 -	Why is the sentence "For certain credible abnormal conditions, such as a drop of a fuel assembly, limited credit for soluble neutron absorbers might be allowed." in the middle of a		Y	*Fixed absorber materials used in spent fuel pools should be designed so that high radiation fields do not lead to detrimental changes in their physical*		

			paragraph discussing the degradation of fixed, solid absorbers?			*and chemical form. In existing facilities where ageing of neutron absorbers has already occurred, provision of soluble neutron absorbers for certain credible abnormal conditions, such as a drop of a fuel assembly, should be given only limited credit.*		
50	FI19	05.038 -	For spent fuel facilities on a single ~~reactor~~ nuclear site where the facility may contain more than one type of fuel element and/or have storage areas with different	Why is this restricted to a single reactor? The site might have several reactor units from which the fuel is transported to spent fuel storage facility. The units may have different types of fuels with regards to e.g. enrichment.	Y	*For fuel facilities that may handle more than one type of fuel element and/or have storage areas with different requirements for acceptable storage within the same facility, the possibility of misloading of a fuel element into the wrong location should also be considered in the criticality safety assessment.*		
51	IRE01	01.005 - Line before the last line	**"…**Disposal of Radioactive Waste [7]; and GSR Part 7…"	Editorial	Y			
52	IRE02	02.024 - First two lines	" The operating organization is required to ensure that criticality safety assessments and ~~analyses~~ analysis are conducted, the	This sentence is about conducting, documenting and **reviewing Safety assessment**. Requirements 20 and 22 of GSR Part 4 (Rev. 1)	Y	The comment is correct but the reference is wrong. The paragraph now reads; "*The operating organization is required to ensure that*		

			results and findings of the safety assessment are documented and the **processes** for producing the safety assessment are periodically reviewed: See…"	are about "**Documentation of the safety assessment**" and "**Management of Safety assessment".** According to Requirement 22, **The processes** by which the safety assessment is produced shall be planned, organized, applied,audited and **reviewed**. So requirement 22 is about **reviewing the process** and this sentence is about **reviewing the safety assessment**.		*criticality safety assessments and analysis are conducted, documented and periodically reviewed: see Requirements 24 and paragraph 4.65 of GSR Part 4 (Rev. 1) [2] and Requirement 5 of SSR-4 [1]"*		
53	IRE03	02.005 Lines 1, 2 and 3		The following sentence is not clear. Why at first line Approach has been deleted? " A graded ~~approach~~ is …"	Y	"Approach" inserted		
54	IRE04	03.034 - f	"Should be periodically reviewed in conjuction with other facility documents, such as the emergency plans and procedures; and the criticality safety assessment, …"	Please consider Subclauses 6.18 (Bullet e) and 6.36 of GSR Part 7.	Y			
55	IRE05	06.001 Lines 4, 5 and 6	"Requirements for preparedness and response to a ~~criticality~~ nuclear or radiological emergency, are established in GSR Part 7 [8]."	It is written: "Requirements for preparedness and response to a criticality emergency, are established in GSR Part 7 [8]." Not so agree with the abovementioned sentence. Considering subclause 1.10 of GSR Part 7: " The present	Y			

				publication establishes the requirements for an adequate level of preparedness and response for a nuclear or radiological emergency." There is no requirement in GSR Part 7 for preparedness and response only for a criticality accident.				
56	IRE06	06.004 - Third line	**"…emergency ~~response~~ plan.."**	"Emergency response plan" has not been used in GSR Part 7.	Y			
57	IRE07	06.007 - First line	"Consideration should be given to limiting or terminating off-site ~~emissions~~ release by shutting down…"	Not used in GSR Part 7	Y			
58	JPN01	01.002 -	Nuclear facilities containing fissile material, and activities in which fissile material is handled, are required to be managed in such a way as to ensure criticality safety under operational states and conditions that are referred to as ~~in normal operation and~~ credible abnormal conditions or conditions included in the design basis, in accordance with Requirements 38 and 66 of IAEA Safety Standards	To keep a consistency with Requirements 38 and 66 of SSR-4. If necessary, consistency with facility states in SSR-4 should also be considered.	Y	Consistency with the requirements of waste containing nuclear material also mentioned.		

			Series No. SSR-4, Safety of Nuclear Fuel Cycle Facilities [1].					
59	JPN02	01.003 L3 L5	The subcriticality of a system depends on many parameters relating to the fissile material, including its mass, concentration, geometry, volume, enrichment and density. Subcriticality is also affected by the presence of other materials such as neutron moderators, absorbers and reflectors. Subcriticality can be ensured through the control of an individual parameter or a combination of parameters, for example, by limiting mass alone or by limiting both mass and moderation. Such parameters can be controlled by engineered and/or administrative measures.	Clarification that these are related to neutrons. Clarification of single restrictions.	Y			
60	JPN03	01.008 -	In this publication, 'handling of fissile material' refers to all activities related to the handling, processing, use, storage, and transport of fissile materials as well as	To keep a consistency with other sentences in which "handling" is written in parallel with others (ex. 1.2, 1.12, 5.1, 5.31, 5.42, 5.69), the definition should include	Y	The proposed change would give the word "*handling*" two definitions, one broad and one narrow. To avoid narrower interpretation elsewhere in the text. We propose "*all activities*		

			the management of radioactive waste containing fissile material.	"handling" in the narrow sense.		*dealing with fissile material including its processing, use, inspection, storage, and transport as well as the management of radioactive waste containing fissile material*"		
61	JPN04	02.002 L3	Criticality safety is generally achieved through the control of a limited set of macroscopic parameters such as mass, concentration, moderation, geometry, nuclide composition, density, neutron reflection, interaction and ~~neutron~~ absorption. …	Clarification that these are related to neutrons.	Y			
62	JPN05	02.002 – L3	Criticality safety is required to be achieved through the assurance of subcriticality under operational states and conditions that are referred to as ~~normal operation and~~ credible abnormal conditions or conditions included in the design basis in accordance with Requirements 38 and 66 of SSR-4 [1].	The same as comment Japan comment 1.	Y			
63	JPN06	02.014 -	The secondary approach should be to demonstrate that the maximum amounts	The same as comment 1.	Y	Replaced by "*ensure subcriticality in accordance with IAEA Safety*		

			of fissile nuclides involved are so far below critical values that no specific safety measures are necessary to ensure subcriticality under operational states and conditions that are referred to as ~~in normal operation and~~ credible abnormal conditions or conditions included in the design basis.			*Requirements*". This will be reviewed again by Technical Editors before SPESS Step 8.		
64	JPN07	03.014 - g	3.14 The subcriticality of a system can be demonstrated by calculating k_{eff} and/or be controlled by limiting one or more parameters. The control parameters that may be considered for ensuring subcriticality include the following: … (g) Limitation on the amount and form of neutron reflecting material surrounding the fissile material.	Clarification that it is related to neutrons.	Y	Bullets (d) and (g) updated.		
65	JPN08	03.019. L3	If the presence of neutron absorbers is considered, the following factors should be assessed. Neutron absorbers	It is not an increase in neutron energy distribution, but an increase in the	Y			

			are mainly effective for thermal neutron systems. Therefore, any neutron spectrum hardening, i.e. an increase in the distribution of higher energy neutrons ~~energy~~, caused by operating conditions or credible abnormal conditions, should be considered, as this may result in a decrease in the effectiveness of the neutron absorption. …	distribution of higher energy neutrons.				
66	JPN09	03.022. L1 L5	Hydrogen-containing material (e.g. steam, water mist, polyethylene, concrete) located between or around fissile material may act not only as a reflector but also as a moderator and/or a neutron absorber and can therefore increase or decrease the neutron multiplication factor of the system. Any change in the neutron multiplication factor will be dependent on the type and density of the material positioned between or around the fissile material. The m~~M~~aterials with low density (such as steam or	Clarification that the material contains hydrogen. Clarification to refer to hydrogen-containing materials.	Y	Added to line 5 of 3.22; *Materials containing hydrogen and materials with low density…*	N	Definite article should not be necessary in line 5 because "*materials*" is a concept here.

			foam) can cause a significant change in the neutron multiplication factor. …					
67	JPN10	03.023 L1	Neutron i~~I~~nteraction between units of fissile material should be considered, as this interaction can affect the neutron multiplication factor of the system. …	Clarification that this is related to neutrons.	Y			
68	JPN11	03.032 - b	The use of administrative safety measures should be incorporated into the comprehensive criticality safety programme (see para. 2.17), and the use of such measures should include consideration of the following; … (b) Determination and demarcation of criticality controlled areas (i.e. areas authorized to contain significant quantities of fissile material) and specification of the control parameters associated with such areas; specification and, where applicable, labelling for materials (e.g. fissile material, neutron	Clarification that these are related to neutrons.	Y			

			moderating materials, ~~neutron~~ absorbing materials ~~neutron~~ reflecting materials); and specification and, where applicable, labelling for the control parameters and their associated limits on which subcriticality depends. A criticality controlled area is defined by both the characteristics of the fissile material within it and the control parameters used. …					
69	JPN12	05.015 - b	A typical control parameter used in fuel fabrication is moderation. Where moderator control is employed, the following should be considered in the criticality safety assessment: … (b) In order to prevent water leakage and unexpected changes in conditions of criticality safety control, air rather than water should be used ~~for~~ as heating and cooling medium in facilities for fissile material storage or processing. If this is not practicable, measures to	Clarification of heating and cooling medium.	Y			

			limit the amount of water that can leak should be considered.					
70	JPN13	05.044 - a, b	The application of burnup credit may significantly increase the complexity, uncertainty and difficulty in demonstrating an adequate margin of subcriticality. The criticality safety assessment and supporting analysis should reliably determine the k_{eff} for the system, by taking into account the changes to the fuel composition during irradiation and changes due to radioactive decay after irradiation. Spatial variations in the spent fuel composition should be taken into account in calculating k_{eff} for the relevant configuration of the spent fuel. The increase in complexity presents several challenges for the criticality safety assessment. In a criticality safety assessment carried out on the basis of burnup credit, the following should be addressed:	Correction of para. number. Avoid ambiguous expressions due to obviousness.	Y Y	Currently para 5.47, the paragraph numbering will be checked at a later stage “may now” deleted		

			(a) Validation of the calculation methods used to predict the spent fuel composition based on the recommendations provided in paras. 4.22–4.36. (b) Validation of the calculation methods used to predict k_{eff} for the spent fuel configurations based on the recommendations provided in paras. 4.22–4.36 (note that calculations for spent fuel ~~may now~~ include many more nuclides than are present for fresh fuel calculations).					
71	JPN14	05.047 -	Spent fuel reprocessing involves operations to recover the uranium and plutonium after removing fission products and minor actinides in fuel assemblies from spent fuel ~~from waste products (e.g. fission products, minor actinides in fuel assemblies) after the fuel has been irradiated.~~	Uranium and plutonium can be recovered from spent fuel in reprocessing and not be recovered from fission products etc.	Y	5.52 *Reprocessing facilities recover the uranium and plutonium from spent fuel by removing waste products (e.g. cladding, fission products and minor actinides) from the fuel after it has been irradiated.*		
72	JPN15	05.075 - 5.66.	**Waste management ~~and decommissioning~~** 5.66 The collection and storage of unconditioned radioactive waste before its	Separate titles.	Y			

			processing should be made subject to the same considerations in the criticality safety assessment as the processes from which the waste was generated. … **Decommissioning** 5.75 To account for criticality safety during decommissioning, a graded approach should be applied to consider the type of facility and therefore the fissile inventory present. …					
73	JPN16	06.008. L2	In some accidents, there have been instances where incorrect actions by operating personnel have inadvertently initiated a further ~~loss~~ increase of power after the initial criticality excursion. It should be ensured that operating personnel are aware that following the initial fission spike(s), the system might return to a state at or very close to critical but with a continuing low fission rate. This typically occurs in	Isn't the increase of power but not the loss of power?	Y			

			solution systems in which inherent negative reactivity feedback effects will tend to balance out the excess reactivity inserted in the initial stages of the event. In such situations, very small additions of reactivity could then be sufficient to initiate further fission spikes.					
74	JPN17	06.017 -	**Medical considerations**	A sub-title that these are medical considerations.	Y			
75	JPN18	06.023 -	Reconstructing the doses received will be critical to the medical response. Paragraph 5.102 of GSR Part 7 [8] states: "Arrangements shall be made to document, protect and preserve, in an emergency response, to the extent practicable, data and information important for an analysis of the nuclear or radiological emergency and the emergency response."	To keep a consistency with Paragraph 5.102 of GSR Part 7.	Y			
76	JPN19	06.024 -	**Dose estimate considerations**	A sub-title that these are dose estimate considerations. Although the current order of paragraphs is acceptable, the result of dose estimate is	Y			

				medical decision data, so it may be possible to move to before 6.17.				
77	JPN20	06.026 - e	6.26 Information on the event may come from a number of sources (e.g. radiation monitors, eyewitness accounts, facility records), and it is possible that a clear picture of the location and cause of the accident may not emerge for several hours. The key information needed for the dose reconstruction will be: … ~~(e) Potential for hydrogen generation from radiolysis;~~	This is not the key information needed for the dose reconstruction.	Y	Moved to para 6.8.		
78	KR01	02.001 -	… within specified operational limits and conditions that ensure ~~subcriticality~~substantial margin to criticality (during normal operation and for credible abnormal conditions)	OLCs should be established with safety margin to criticality, considering credible abnormal conditions as well as normal operation.	Y	*These safety measures should be implemented, maintained and periodically reviewed to ensure that operations and activities stay within defined safety limits (see para. 2.9) in operational states and credible abnormal conditions.* The phrase *"substantial margin"* is difficult to quantify.		

79	PK01	01.012 on page 5	.....For example, the ~~**storage and**~~ handling of fresh and spent fuel.	To make it in line with the section 1.8 as storage is part of term handling.	Y	May also mention sub-critical assemblies here.		
80	SE01	05.029 - a	May be justified in mentioning one more means, namely "burnable absorber (gadolinium) credit"	Gadolinium (or BA) credit has been applied at Swedish power reactor storage pools since the early 1980´s.	Y	Additional means, such as ~~fixed~~ neutron absorbers and/or the use of a burnup credit, could be applied…		
81	SE02	05.044 - c	The term "burnable poisons" should be changed to "burnable absorber"	Editorial comments	Y			
82	SE03	06.003 –	Consider the need for a paragraph about how to stop the divergent chain reaction (criticality event)	An important emergency response	Y	New para 6.37/ "*If the emergency plan specifies the use of special material to shut-down or stabilize the system, such as a neutron absorber, a sufficient quantity of the material should be available. The potential for corrective actions to make the situation worse and the hazards to recovery operators should be assessed before attempting corrective action.*"		

83	TR01	02.024 -	"Emergency communications" expression can be added to the second sentence of the paragraph.	Notification and alarming of the personnel and other related bodies during an emergency is the first and very important step for a prompt and effective emergency response. The arrangements for emergency communications should also examined during audits and this point should be mentioned here.	Y			
84	TR02	06.004 -	First sentence of the paragraph can be written as "... in place an emergency plan, procedures and capabilities ...". The "emergency response plan" expression in the last sentence can be written as "emergency plan".	Appropriate use of EPR terminology is required.	Y	*For each facility in which fissile material is handled and for which a criticality detection and alarm system is required (see para. 6.149 of SSR-4 [1]) an emergency plan, procedures and capabilities to respond to credibly criticality accidents are also required, see requirement 71 SSR-4 [1].*		
85	TR03	06.007 -	The term "releases" can be used instead of "emissions" in the first sentence of the paragraph.	Editorial comment.	Y			

86	TR04	06.010 -	The term "notification" can be added to the second sentence before the term "evacuation".	Prompt notification of people in the first place is very crucial in terms of successful evacuation.	Y			
87	TR05	06.013 - 6.12 and	Paragraphs 6.12 and 6.13 can be combined.	These paragraphs are both about the fast evacuation and they can be combined.	Y			
88	TR06	06.026 - 6.25 and	Paragraphs 6.25 and 6.26 should be checked in terms of repeating and overlapping information.	Editorial comment.	Y			
89	TR07	06.027 - INFRASTRUCTURAL CONSIDERATIONS FOR EMERGENCY PREPAREDNESS AND RESPONSE TO A CRITICALITY ACCIDENT	Requirement 24: Logistical support and facilities for emergency response "The government shall ensure that adequate logistical support and facilities are provided to enable emergency response functions to be performed effectively in a nuclear or radiological emergency." of GSR Part 7 can be mentioned under the "INFRASTRUCTURAL CONSIDERATIONS FOR EMERGENCY PREPAREDNESS AND RESPONSE TO A	Infrastructural considerations for the criticality emergencies should include the logistics to be used during emergency response as also mentioned by GSR Part 7.	Y			

			CRITICALITY ACCIDENT " heading.					
90	TR08	06.031 CAUSES AND CONSEQUENCES OF A CRITICALITY ACCIDENT	The heading "CAUSES AND CONSEQUENCES OF A CRITICALITY ACCIDENT " can be modified as "CAUSES OF A CRITICALITY ACCIDENT"	Nearly whole information under this heading is mostly about the causes of a criticality accident.	Y	Now “CAUSES AND STABILISATION OF A CRITICALITY ACCIDENT”		
91	TR09	06.031 -	Paragraph 6.31 should not be under the heading of "CAUSES AND CONSEQUENCES OF A CRITICALITY ACCIDENT".	This paragraph is about the demonstration of the adequacy of emergency arrangements and it should be under general considerations about the emergency preparedness and response part.	Y	Moved to 6.5.		
92	UA01	04.042 - 4.41 and new	New subchapter «Optimum moderation» 4.41 The nuclear safety assessments fundamentally depend on the ratio of neutron-multiplying materials and neutron-moderating materials that are proposed in the models used in the analysis. This ratio, which leads to the maximum neutron	Since the document has a section devoted to «burnup credit», Chapter 4 should be supplemented with a similar subsection focusing on analysis of «Optimum moderation». This requirement is more general as compared with «burnup credit» in «CRITICALITY SAFETY ASSESSMENT» since it applies to both fresh	Y	Text included with reference to SSR-2/1 on the basis these statements also apply to nuclear material outside the core of a reactor. We use “credible abnormal conditions” instead of “Design Basis”		

			multiplication factor, is called optimum neutron moderation. Optimum neutron moderation is analyzed regardless of whether the system has an actual moderator (for example, for dry storage facilities). 4.42 The criticality safety assessment should demonstrate that the system will remain subcritical in normal operation and design-basis accidents even in optimum neutron moderation. Water is conventionally proposed as the moderator in this analysis (but it may be required to analyze several moderatos depending on specific system characteristics). Optimum neutron moderation is determined as the fractional density (from 0 to 1 kg/cm^3) at which the neutron multiplication factor reaches the maximum value in the system.	and spent fuel. This will allow the document to be harmonized with the following IAEA standards: - IAEA Safety Standards Series. Safety of Nuclear Power Plants: Design Requirements. No. NS-R-1, 2000 - IAEA-TECDOC-1575 Rev. Guidance for the Application of an Assessment Methodology for Innovative Nuclear Energy Systems INPRO Manual — Safety of Nuclear Fuel Cycle Facilities. 2008				

93	UA02	05.024 - Heading before	Handling **and storage** of fresh fuel	Paras. 5.24-5.27 do not mention «handling…» at all but only discuss «storage area and storage systems»; hence, it is unreasonable to delete «storage» from the heading.	Y			
94	UA03	04.040 - 4.37 to	Insert the text from subparagraphs 5.43-5.46	Subparagraph «burnup credit» should be logically transferred to Chapter 4 since this is the method/approach for CRITICALITY SAFETY ASSESSMENT			N	Burnup credit is specific to spent fuel
95	UA04	05.046 - 5.43 to	Delete	Subparagraph «burnup credit» should be logically transferred to Chapter 4 since this is the method / approach for CRITICALITY SAFETY ASSESSMENT			Y	Burnup credit is specific to practices involving spent fuel.
96	US01	02.002	The word “enrichment” has been deleted from the first sentence. “Enrichment” should remain in the sentence.	“Enrichment” should be retained because enrichment is one of the parameters for criticality safety.			N	Other MS asked us to remove it. Definition of nuclide composition in Para 1.4*; In this safety guide, the phrase “nuclide composition” encompasses all the parameters inferred by the terms “enrichment” and “isotopic composition”.*
97	US02	02.005	A revision to the first sentence is suggested, as follows: “A graded approach is suggested to be used in developing and	To clarify the statement. If the comment is not accepted, at least add in the second “)” after [1].		Added second “)”	N	The graded approach is a requirement for facilities having; 1) low fissile

			implementing the approach to ensuring criticality safety of facilities or activities that involve handling of fissile material (see Requirement 11 of SSR-4 [1]).”					inventory 2) slightly enriched material. 3) heavy shielding
98	US03	02.008	Consideration should be made for adding “Enrichment” to the list of control parameters.	Enrichment is one of the control parameters for criticality safety.	Y	We consider enrichment as an expression of the main control parameter, which is nuclide composition, now explained in para 1.4		
99	US04	02.012	Consideration should be made for adding “Enrichment” to the list of process parameters.	Enrichment is one of the process parameters for criticality safety.	Y	*These parameters include mass, density, concentration and nuclide composition, as well as the geometry, neutron moderation or reflection of the system, and the neutron absorption characteristics of the fissile material mixture and other system materials, liquid flow rates and temperature. The parameters quoted in limits and conditions should be expressed in terms that can be readily be monitored and understood, such as enrichment, packaging rules and moisture or hydrogen limit.*		
100	US05	02.016	Either remove “2.16” or add “Reserved.”	There is no information in this section. If it is removed, the subsequent sections will need to be adjusted.	Y	It looks like an empty para due to WORD track changes mode, if the change is accepted it gets associated with the previous paragraph.		

101	US06	04.027	In the second sentence, remove "in this case", and end the sentence at "uncertainties".	The phrase, as currently structured, adds no value. Alternatively, add, "In cases" before "where . . .", and end the sentence at "uncertainties".	Y			
102	US07	05.038	"…possibility of misloading of ***fuel elements*** into ***wrong storage locations*** should…"	Multiple misloading events have occurred in US SFP operations, so misloading of more than one fuel element should be considered as a potentially credible event.	Y			
103	US08	02.038	"…include a means of incorporating lessons learned from operating experience and accidents at facilities in the State and in other States, to ensure ~~continuous improvement~~ **relevant significant implications for safety** in operational practices and assessment methodology~~: see para. 6.7 of GSR Part 2 [3] and Requirement 73 of SSR-4 [1].~~ **are understood, to the extent practicable."**	The referred-to sections of GSR Part 2 [3] (para. 6.7) and SSR-4 [1] (Requirement 73) do not discuss continuous improvement. Additionally, practical limitations are necessary to account for other important considerations, such as benefits and costs. Continuous improvement processes, at some point, may not result in practical improvements.	Y	*The management system is required to include a means of incorporating lessons learned from operating experience and accidents at facilities in the State and in other States, to identify relevant implications for safety (Requirement 73 of SSR-4 [1]) and should identify areas for improvement in operational practices and assessment methodology (para 2.23 of SSG-50). Recommendations for establishing a system for the feedback of operating experience are provided in IAEA Safety Standards Series No. SSG-50,*		

						Operating Experience Feedback for Nuclear Installations [20].		
104	US09	04.002	"It is also common to complement the deterministic approach to criticality safety assessment with a probabilistic approach**[Ref No.]**."	Section 4 provides recommendations on conducting criticality safety assessments, including the role of deterministic and probabilistic approaches. Specific references on ways to conduct these deterministic and probabilistic criticality safety practices need to be included in section 4.	Y	Ref: TecDoc-1267 Procedures for Conducting a Probabilistic Safety Assessment for Non-Reactor Nuclear Facilities, IAEA (2002).		