TITLE: DS489 – Special Safety Guide on Storage of Spent Nuclear Fuel, Revision by amendments, Step 11 Resolution table for SSC comments, October 2018

		COMMENTS BY REVIEWER		RESOLUTION			
Comment	Para/Line	Proposed new text	Reason	Accepted	Accepted, but	Rejected	Reason for
No. 1. (1) 2. (2)	General	Additions made since the last version have improved advice on EPR arrangements throughout the document. In particular, the development of emergency plans by the operator.	Typically there is a balance		modified as follows	Rejected	modification/rejection THANKS! No actions need. 1.1 wasn't revised.
		managed following its removal	between safety and security that needs to be maintained and considered for the long term				This proposal is out of scope of DPP and can be considered in FSR
3. (7)	1.2 Last sentence	GSR Part 5 [1]. This safety guide shows at first each of the requirements of GSR Part 5 and then explains how the requirement for radioactive waste is applied to the storage of spent fuel. Each section of this guide begins with a quote of the relevant requirement(s) of GSR Part 5, followed by guidance on how these requirements should be applied for storage of spent fuel.	Existing wording less clear. Note that not all ("each") requirements in GSR Part 5 are quoted (Req. 8 is not). Also, current wording can be interpreted such that all ("each") requirement is listed in the <u>beginning</u> <u>of the document</u> followed by guidance.		This safety guide shows at first relevant requirements of GSR Part 5 and then explains how the requirement for radioactive waste is applied to the storage of spent fuel.		To keep the text closer to original
4. (8)	1.3	1.3. The safety of a spent fuel storage facility, and the spent fuel stored within it, is ensured by: appropriate confinement of the radionuclides involved, criticality safety, heat removal, radiation	To be in line with para 6.4		The safety of a spent fuel storage facility, and the spent fuel stored within it, is ensured by: appropriate		It doesn't need to be repeated word to word, but to avoid contradictions.

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No.	No.				modified as follows		modification/rejection
		shielding and retrievability			confinement of the		
		maintaining of subcriticality,			radionuclides		
		removal of heat, confinement of			involved,		
		radioactive material and shielding			maintaining of		
		from radiation and, in addition,			subcriticality, heat		
		retrievability of the fuel or spent			shielding from		
		fuel packages. These functions are			radiation and		
		ensured by the proper siting, design,			retrievability of the		
		construction and commissioning of			fuel or spent fuel		
		the storage facility, its proper			packages		
		management and safe operation. At					
		the design stage, due consideration					
		also needs to be given to the future					
		decommissioning of the facility.					
5. (2)	1.6	which requires a defined end point	End point doesn't ensure			Rejected	Endless active
		such as reprocessing or disposal in	safety, it just terminates				management can't be
		order to ensure safety.	active management				safe => FSR
6. (5)	1.7/3	<u>Tokyo Electric Power Company</u>	To use the official name.	Accepted			Changed several times
	(p.8)	(<u>TEPCO</u>) Tepco Fukushima Daiichi					during this revision by
7 (0)	1.0	Nuclear Power Plants Accidents,					amendment
7. (8)	1.9	1.9. This Safety Guide covers spent	Editorial suggestion			Rejected	It is clear.
		nuclear fuel storage facilities that					1.9 wasn't revised.
		may be either collocated placed					
		with other nuclear facilities (such as					
		a nuclear power plant, research					
		reactor or reprocessing plant) or					
		located on their own sites. However,					
		it is not specifically intended to					
		cover the storage of spent nuclear					
		fuel as long as it remains a part of					
		the operational activities of a					
		nuclear reactor					

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8. (6)	3.3, Para 3.9	Please include "Responsibilities of Regulatory Body under heading 3. ROLES AND RESPONSIBILITIES of table of contents.	 Sub-bullet found missing. Make in line as per section 3.3, 3.9 and requirement 3 of GSR PART 5. 			Rejected	Chapter and subchapter titles are kept as in SSG-15 in this revision by amendment. 3.3 includes OO&SFO
9. (2)	3.4 Page 11	3.4. A mechanism for providing adequate financial resources should be established to cover any future costs, in particular, the costs associated with the spent fuel storage and decommissioning of the storage facility and also the costs of managing radioactive waste.	Are the establishment of funding mechanisms really part of the safety standard? I recognize the importance, just not sure it should be considered a safety requirement.			Rejected	It's important for safety and kept as it was in SSG-15. It is nothing in FDA to enforce deleting it from the document.
10. (8)	3.4	3.4. A mechanism for providing adequate financial resources should be established to cover any future costs, in particular, the costs associated with the spent fuel storage and decommissioning of the storage facility and also the costs of managing radioactive waste including final disposal .	Previsions for final disposal cost should be clearly allocated			Rejected	Disposal is part of managing radioactive waste. It can be discussed in FSR. It is nothing in FDA to enforce deleting it from the document
11. (5)	3.11/7 (p.13)	The decommissioning plan should be updated <u>periodically</u> regularly by the licensee and	To be consistent with para. 7.5 of GSR Part 6.			Rejected	Not only "periodically", but "when specific circumstances warrant" (see below)
12. (6)	3.11/7	The decommissioning plan should be updated regularly after every five years by the licensee and updates should be reviewed by the regulatory	To make consistent with Para 7.5, line 2 of GS-R-6.			Rejected	AS PRESCRIBED BY THE REGULATORY BODY!

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		body					3.11 as in SSG-15	
13. (6)	3.12/4	The regulatory body should periodically verify that the key aspects of the operation of the storage facility meet the requirements of the national legal system and facility license conditions, such as those relating to the keeping of records on inventories and	Need to elaborate/explain what kind/type of inventories as it is not clear from the text.			Rejected	3.12 is about verification, but not about development of license conditions to be checked. Can be addressed in FSR	
14. (5)	3.18/2 (p16)	Prior to authorization of a spent fuel storage facility, the operating organization should provide the regulatory body with a safety case6 that 	The "safety case" appeared firstly at para 3.9 on page 13. Accordingly, the footnote 6 should have appeared on page 13.	Accept				
15. (6)	3.25/1	The operating organization should establish a process on how to authorize and make modifications to the spent fuel storage facility, storage conditions, or the spent fuel to be stored, which is commensurate with the significance of the modifications.	May be replaced with regulatory body.			Rejected	Sbchpt is for OA. Not all modifications are to be authorized (e.g. changing the color of the walls)	
16. (2)	3.26	maintain appropriate financial resources are available to undertake	Sentence was two fragments		to allocate and maintain appropriate financial resources to undertake		improved	
17. (6)	3.27/6, 3.29/5	Please include development of spent fuel management strategy in the responsibilities of the operator given at para 3.17.	In reference paras spent fuel management strategy is mentioned however, responsibility for the development of strategy is not mentioned.			Rejected	The government shall ensure that a national policy and a strategy for radioactive waste management are established. It is up to the national situation what organization or	

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							institution will develop proposals for it.
18. (8)	4.7	4.7 Arrangements for funding of future spent fuel management activities should be specified and responsibilities, mechanisms and schedules for providing the funds should be established in due time. The generator of the spent fuel should establish an appropriate funding mechanism that includes final disposal stage.	Previsions for final disposal cost should be clearly allocated			Rejected	"future spent fuel management activities" includes disposal. No contradictions. It is nothing in FDA to enforce this clarification (out of DPP)->FSR
19. (2)	5.1	an integrated approach to safety is adopted and that safety is optimized	Not clear what optimized safety means.			Rejected	NOT REVISED. Clarify in FSR
20. (2)	5.2 Pages 23-24	5.2. The various stages in the lifetime of the spent fuel storage facility (i.e. siting, design, construction, commissioning, operation and decommissioning) should be taken into account in the safety case(s). The safety case(s) should be periodically reviewed in accordance with regulatory requirements and should be revised as necessary.	Proposed changes in red text. Section 5.1 references that multiple safety cases may exist. This should be extended throughout the document if safety case is referenced in the singular.			Rejected	5.1 states that facility, cask, transportation MAY be assessed within multiple SCs. 5.2 is about facility, its lifetime and doesn't suppose multiple SCs. In a multiple case evolution of each of them to be considered. This can be clarified in FSR.
21. (2)	5.19	quantities, initial enrichment, discharge date, effective full power days in reactor, burnup, integrity, decay heat production	Extra terms are important for long-term management of spent fuel, and deriving other attributes; and decay heat is a more appropriate			Rejected Might be clarified in FSR	SNF physical and chemical features to be covered in SA, while the mentioned parameters are initial

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			description for fuel after power production, and is use in other places				data to be included into system description within SC	
22. (8)	5.21.	5.21. A SF storage facility specific safety case and supporting assessment should generally include aspects such as:	The list bellow in not generic but specific for SF storage facilities	Accepted			May be accepted to avoid general interpretation of 5.21	
23. (5)	5.21(c)/4 (p.27)	During the identification of hazards, consideration should be given to the combination of related events and hazards (e.g., earthquake and tsunami , collapse and fire) that may occur and consequential effects.	"Collapse and fire" is not appropriate and should be deleted for the combination as "related events". Because, there will be almost no combustible materials for fire event in spent fuel storage facilities.			Rejected Better sample can be discussed in FSR	Collapse and fire are here examples of conventional emergencies. It's impossible to exclude fire from concidaration for any SNF storage facility.	
24. (8)	5.21	(x) Storage facility maximum inventory of SF allowed by design	Suggestion for completeness			Rejected	One of LCC to be derived from SA	
25. (5)	6.28/2 (p.38)	A safety requirement on all designs for spent fuel storage facilities is to maintain subcriticality of the entire system under all operational states and credible abnormal conditions [3].	To be consistent with the revised paras 6.31 and 6.32, as well as Req.38 and 66 of SSR-4.	Accepted				
26. (5)	6.30/4 (p.38)	Consideration should also be given to the effect of burn-up <u>credit</u> , ageing, corrosion and handling on the fixed neutron absorbers.	Confirmation of the meaning of this text. Is this proposed amendment feasible to the intention of this para?		Marked for editorial check	Rejected	Effect of credit?	
27. (2)	6.32	The potential for rearrangement, including fuel pin pitch expansion or compaction of fuel pins	Pin pitch expansion typically results in reactivity increase.			Reject	It is nothing in FDA to enforce changing of this sentence -> FSR.	
28. (2)	6.33(i)	All fuel should be assumed to be at a burnup and enrichment value that	Seems that the sentence is saving that a fresh fuel		All fuel should be assumed to be at a		"(i)" wasn't revised. To keep the text	

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		results in maximum nuclear reactivity, unless credit for burnup is assumed on the basis of an adequate justification.	assumption is to be used unless credit for burnup is assumed Suggest changing red text to the following: All fuel should be assumed to be unirradiated (i.e., fresh fuel assumption) that results in maximum nuclear reactivity		burnup and enrichment value that results in maximum nuclear reactivity (i.e., fresh fuel assumption)		closer to existing wording. To be discussed in FSR	
29. (5)	6.36/last sentence (p.40)	Replace "packages" at two locations in the last sentence with "casks" as follows. "the design should include features to enable the use of nonpermanent equipment and consider passive measures, such as dispersing high decay heat fuel assembly packages casks uniformly among low decay heat fuel assembly packages casks."	For passive dry storage facilities, "packages" are not normally stored with the transport configuration, but stored without the impact limiters. Such things without the impact limiters are not called "packages", but should be called "casks". Editorial (In the latter part, "fuel" is missing.)			Rejected Can be discussed in FSR if needed.	Package not always is for transport and in 6.35 item it doesn't mean that SNF is in transport configuration. Dry SNF storage facilities not always use casks.	
30. (3)	6.40	In dry storage vault facility, it could be done by monitoring temperature and flowrate of the ambient air used to cool the storage cask.	The current sentence (In dry storage vault facility, it could be done by monitoring temperature and flowrate of the coolant gas.) is poorly written and communicates that an additional gas is used/introduced (i.e. monitor the flow rate of			Rejected	See the next comment	

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			the coolant gas). The vast majority of dry cask storage systems rely on natural convection to remove heat – and no additional coolant gas is introduced. The proposed/added text (see the column to the left) indicates that it is the ambient air that is the coolant gas.					
31. (3)	6.40	In dry storage vault facilities, it could be done by monitoring temperature and flowrate of the coolant gas.	To add clarity to the statement.	Accepted				
32. (3)	6.41, Line 5	Containment should be ensured by at least two independent static-barriers, one of which is the cladding or container for fuel with damaged cladding	It is not clear which barriers contribute to containment since this applies to both wet and dry storage. Typical US dry storage has intact fuel within a sealed canister in a ventilated overpack, so only cladding and canister shell provide containment. For US wet fuel storage, the cladding and water over the fuel are the principle containment/confinement barriers, plus a building with filtered and monitored ventilation. Comment 214,			Rejected To be addressed in FSR	6.41=6.42 of SSG-15, No revisions made. An issue is special, out of DPP and doesn't relate to FDA	

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			Step 8 was similar and rejected.					
33. (6)	6.44/9	Measures for spent fuel handling should be designed to avoid a buildup of contamination to unacceptable levels and to provide for remedial measures should such a buildup occur.	grammatical		Marked for editorial check	Rejected	No revisions made in SSG-15. Can be interpreted as "IF such a buildup occurs."	
34. (3)	6.45 (b)	Suitable shielding should be provided for normal operation and accident conditions. The wet storage facility design should include provisions to prevent unacceptable loss of liquid shielding during accident conditions, such as design features enable use of non- permanent equipment to retain minimum water levels for shielding in wet storage facilities. and- wWhere water may be is used for neutron shielding in dry storage, provisions for alternate neutron shielding should be included in the design if water could be lost.	Some U.S. dry storage and transfer canister overpacks use water tanks for added neutron shielding. Deletion of requirement related to dry cask neutron water shielding accepted for Comment Nos. 219 and 222 in Step 8.	Accepted				
35. (5)	6.56/22 (p.47)	The design <u>should may</u> consider the potential for pressure build-up in the facility during accidents including design extension conditions, and <u>should</u> provide for a means to prevent hydrogen gas concentrations which could give rise to disruptive explosions.	In the design of ventilation systems, measures to prevent hydrogen gas explosion should be considered in line with the requirement on management of industrial and chemical safety addresses concentration in air of hazardous gases such	Accepted				

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			as hydrogen gas in SSR-4 (para.9.117)					
36. (5)	6.56/The last text (p.47)	A period is missing.	Editorial.	Accepted				
37. (6)	6.70/1	For a wet storage facility facilities , the water level in it should be monitored and provisions to identify the potential for water leakage during both normal and accident conditions should be provided.	grammatical		Marked for editorial check	Rejected		
38. (7)	6.71	For wet storage facilities, the water level in <u>storage poolsit</u> should be monitored and provisions to identify the potential for water leakage during both normal and accident conditions should be provided.	Proper elements to be addressed by the guidance are storage pools.	Accepted				
39. (2)	Para 6.78 Page 51	 6.78. Arrangements for testing should include the following: (a) Regulatory requirements; (b) Progression through the stages of commissioning; (c) Reporting of results and approval for operation; (d) Retention of records. 	Not sure how items b-e are "tested"			Rejected	There are "arrangements" not elements to be tested. No revisions made to SSG-15 original text.	
40. (5)	6.79/2 (p.55)	However, Ssome of the commissioning processes may become a part of regular operation as new modules are brought into service.	Clarification. The repetitive use of "however" will not be necessary.	Accepted			Returned to the original SSG-15 text	
41. (7)	6.80	new spent fuel designs. Commissioning <u>of any new</u> <u>installations</u> during the operation of the facility should <u>to the extent</u>	With basic requirements for continuous improvements it will be impossible to foresee all	Accepted	Commissioning of any new installations (e.g. installation of			

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		possible be taken into account already during the design phase (e.g. installation of additional heat removal systems) so as to allow for appropriate commissioning activities at later stages.	potential future improvements or developments to the activity/facility at the time of design		additional heat removal systems) during the operation of the facility should be taken into account to the extent possible already during the design phase		
42. (6)	6.89/1	Instructions and procedures should be prepared for normal operations of the spent fuel storage facility, anticipated operational occurrences and accident conditions, including design basis accidents and design extension conditions.	Under heading 'OPERATION OF SPENT NUCLEAR FUEL STORAGE FACILITIES' there discussed only about procedures not for instructions. So need to describe the type of programmes, procedures and or instructions preparation by operator according to which operator will manage SF.			Rejected	"Instructions and procedures" are kept as in SSG-15. No contradiction with GSR Part 5. It is nothing in FDA to enforce changing of this wording -> FSR
43. (2)	6.97 Page 55	However, some of these events or a combination of events could also lead to severe accidents, which might be considered within design extension conditions.	Removed text that had been struck out in the draft.		However, some of these events or a combination of events could also lead to severe accidents, some of which might be considered within design extension conditions while others might go beyond these.		To be in consistency with SSG on Accident Management Programmes close to publication.

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					Whilst the probability of such events to occur is very low, operating procedures and accident management programmes should be prepared by the operating			
44. (6)	6. 98	In addition to providing operating procedures for normal operation and for emergency as described above, the operating organization should also develop an emergency plan in accordance with the requirements established in Ref. [20] (see para 3.28).	The text of para 6.98 is already given in para 6.97 so may be deleted to avoid repetition/ duplication.		organization.	Rejected	6.97 is on procedures while 6.98 is on emergency plan. Corrections to 6.97 proposed	
45. (2)	6.101, Table 1	Minimum tightness of spent fuel cask	It is not clear what this means. Additional text to clarify recommended (e.g., allowable leakage rate)			Rejected	Text as is in SSG-15. Nothing to FDA. Clarification to be made in FSR.	
46. (2)	Table 1 Page 58	TABLE 1: EXAMPLES OF OPERATIONAL LIMITS AND CONDITIONS FOR SPENT FUEL STORAGE	Table does not include structural requirements which should be part of the design/safety basis.			Rejected	The Table (as is in SSG-15) presents just some examples but not comprehensive list of LCC	
47. (6)	6.102/6	The operating organization may wish to set an administrative margin below the operational limits as an operational target to remain within the approved limits and conditions.	May be deleted.		may set an administrative margin as an operational target		6.102 (6.103 in SSG- 15) not revised. It is proposed to leave proposed changes for FSR	
48. (6)	6.106/1	A management system (see also Section 4) covering operation and	May be deleted b/c. procedure approved under			Rejected	Only approved procedures have to be	

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		maintenance, and using approved procedures, should be established for controlling:	MS.				used in a management system
49. (2)	Table 2 Page 61	TABLE 2: EXAMPLES OF EQUIPMENT FOR MAINTENANCE, INSPECTION AND TESTING	I don't see maintenance listed for pumps used to establish circulation in spent fuel pools to minimize corrosion.			Rejected	It isn't a bounding list but just an example. To be addressed in FSR
50. (2)	6.118(d)	Fuel history (e.g. cumulative burnup per cycle	This allows a determination of specific power during last cycle of irradiation which impacts decay heat calculations)			Rejected	6.118=6.119(SG-15), no revisions. Out of DPP, can be discussed during FSR.
51. (6)	6.153	Please include "Removal from Regulatory Control" after Decommissioning of Spent Nuclear Fuel Storage Facilities under heading 6. GENERAL SAFETY CONSIDERATIONS FOR STORAGE OF SPENT FUEL of table of contents.	Removal from regulatory control is one of the step of the process which reflects the end points of the Spent Nuclear Fuel Storage Facilities. Therefore, it may be reflected separately instead of mentioning under decommissioning.			Rejected	6.153 is 6.154 in SSG-14 and wasn't revised. It is nothing in FDA to enforce proposed changes. Changes will cause extension of this para into subchapter in FSR out of DPP.
52. (6)	I.2/1	For Facilities for which the safety assessment takes into consideration and makes allowance for the boiling of pool water during abnormal operating conditions, specific allowances should be provided in the design evaluations for the change in water moderator density in such conditions.	grammatical		Marked for editorial check	Rejected	I.2 not revised and kept as in SSG-15
53. (3)	I.4 Line 1	Active hHeat removal systems for wet spent fuel storage facilities should be designed to ensure the safe operation of the facility	The use of the word "active" implies that only pumped fuel storage pool cooling systems are	Accepted			

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			acceptable. Any reliable heat removal system is acceptable, and passive systems should be preferred. Similar to rejected comment 322 in Step 8.				
54. (4)	1.9	"Permanent or temporary equipment should be provided for the periodic, or as necessary, cleaning and removal of radioactive deposits and sludges from pool liner surfaces."	Sentence must be revised.		Marked for editorial check	Rejected	I.2 not revised and kept as in SSG-15
55. (2)	I.12	alert facility personnel	Spelling correction	Accepted			
56. (7)	1.36	Sand storms, volcanic fly ash re- settled by the wind and land sliding can all hinder the cooling of dry systems, for instance, by stopping the air flow through it. Sand or- volcanic fly ash can accumulate in- front of the inlet of a building and, due to convective transport- phenomena, it can drag inside the- facility and accumulate there. Further, some of these materials- become hard rocky ones, like- volcanic fly ashes after rain and- dryness that turns into a concrete- like material or mud left from land- sliding after dryness turns into a very old known insulating material. All these scenarios can hinder the- decay heat removal for a time period	The last part of the paragraph becomes very detailed and narrative, which does not correspond to the approach used in other parts of the document. (Also, I think these specific concerns was not a lesson learned from the Tepco Fukushima accident.)		Sand storms, volcanic fly ash re- settled by the wind and land sliding can all hinder the cooling of dry systems, for instance, by stopping the air flow through it. Sand or volcanic fly ash can drag inside the facility and accumulate there. All these scenarios can hinder the decay heat removal for a time period that depends on the features of the		Proposed to keep but shorten deleted text.

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		that depends on the features of the deposited or consolidated material.			deposited or consolidated material.		
57. (3)	Reference [15]	INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive Material, 2018 Edition, IAEA Safety Standards Series No. SSR-6 (Rev. 1), IAEA, Vienna (2018).	IAEA recently revised SSR- 6, so it is appropriate to include reference to the current edition (i.e., 2018). Note as well that in 6.120(c), the text reads, "Cask identification (e.g. serial number) and certification of compliance with current transportation regulations [15]." The reference ([15]) is not current unless it is changed to 2018.	Accepted			
58. (5)	References [27] (p.87)	IAEA Safety Standards Series No. SSG-18, IAEA, Vienna (20112003).	Editorial.	Accepted			
59. (5)	References [28] (p.87)	IAEA Safety Standards Series No. NS-G-3.6, IAEA, Vienna (2004 2005).	Editorial.	Accepted			
60. (5)	ANNEX IV (p.92)	 ANNEX IV Leadership and Management for Safety, IAEA Safety Standards Series No. GSR Part 2, <u>IAEA</u>, <u>Vienna (2016)</u> Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4 (<u>Rev.1</u>) 	Editorial	Accepted			

Comments presented by: 1-EPReSC, ARPANSA, Australia, Marcus Grzechnik 2-NSGC, USA, DOE/NNSA, Lori Brownell (DOE/NNSA), Richard Hale & John Scaglione (ORNL) 3-SSCs, US NRC 4-WASSC, Germany, BMU (with comments of BfE and GRS) 5-WASSC, Japan, Nuclear Regulation Authority 6-WASSC, Pakistan, PNRA 7-WASSC, Sweden, Bengt Hedberg/ Erica Brewitz, Swedish Radiation Safety Authority 8-WASSC, Argentina, Medici M, Alvarez D; ARN