`DS487 Design of Fuel Handling and Storage Systems for Nuclear Power Plants
Step 7 – Review Committees' Comments and Resolution

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
1	ENISS	1	General	Many of the recommendations deal with operation, labor protection or even scope of supply between supplier and utility. The safety guide should focus on nuclear safety, protecting third party.					This safety guide focuses on recommendations to fulfill the fundamental safety functions primarily via design provisions and measures.
2	U.K (editorial)	1	Footer all pages 1 to 54	*DS487 Design of fuel handling and storage systems for NPPs. Rev D7.0:*	The word "fuel" is important	X			The footer was made for convenience; it will be removed later.
3	U.K (editorial)	2	Para 1.5, Line 2 and Unnumber ed para after the (a) – (g) list	Replace "that remain part of" with "are applied in "	The systems are applied in the activities			X	We prefer to use the same sentence with that used in SSG-15 (published in 2016) to define the scope of the safety guide.
4	Germany	1	1.5 (a) Footnote 1	[…] new fuel includes fresh fuel manufactured from unirradiated material and ~~mixed oxide~~ fuel manufactured using a mixture of unirradiated and reprocessed material.	"Mixed oxide" usually suggests MOX, i.e. U-Pu-mixtures, typically not including uranium from reprocessing.	X			
5	Belgium	1	1.5 (f)	(f) "Storage, inspection and repair of **irradiated or** spent fuel[2] in the spent fuel pool and its preparation for removal from the spent fuel pool; and"	Since (f) is also applicable for irradiated fuel	X			
6	Germany	2	1.5 (f)	Storage, inspection and repair of irradiated or spent fuel in the	Some damaged irradiated fuels are repaired before re-insertion	X			

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				spent fuel pool and its preparation for removal from the spent fuel pool;	into the reactor core, thus not fulfilling the definition of "spent"				
7	Pakistan	1	1.5 (Modified)	Storage, inspection and repair of **irradiated and/or** spent fuel in the spent fuel pool and its preparation for removal from the spent fuel pool	Leaky fuel (once irradiated fuel) can be repaired and used in the next cycle.	X			
8	U.K (editorial)	3	Para 1.9, Line 9, Title of Chapter 2 and elsewhere	Replace "safety design" with "safe design"	A design (noun) is safe or not; "safety" is a noun and should not be used as an adjective.	X			
9	U.K (editorial)	7	Paras 1.9, 2.2, 2.14, 2.16 2.18 (b), 3.1, 3.2, 3.3, 3.27, 3.34, 3.37, 3.38, 3.57, 4.18, 4.26, 6.10, Appendix 1 title & Note 1	Replace "items important to safety" with "SSC important to safety"	Maintain consistency with established IAEA terminology			X	"Items important to safety" is used in SSR-2/1 Rev 1.
10	U.K (technical)	1	$ 2.1	Change: …*operational conditions* To: …*normal operation and foreseeable fault conditions*	Staff may need to remain on post carrying out emergency responses and foreseeable actions need to be reasonable. This should be explicit.		Replaced with "operational states".		The comment is for para. 2.4 (not for 2.1). To be consistent with the IAEA Safety Glossary and SSR-2/1 Rev 1.
11	U.K (editorial)	4	Para 2.2	According to … [1], the design should identify the fuel handling and storage systems which in all plant states provide the fundamental safety functions:	The current text includes unnecessary duplications and is difficult to read.		The proposed statement is slightly revised to read as: " …. the design should identify the fuel handling and storage		

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							structures, systems and components which in all plant states provide the following fundamental safety functions:".		
12	U.K (editorial)	5	Para 2.2, (b) & Subtitle between paras 2.5 & 2.6	Removal of decay heat from the irradiated fuel	The source of decay heat is known, hence "the".	X			
13	Germany	3	2.2	(a) Maintaining subcriticality of the fuel; (b) Removal of decay heat from irradiated fuel; ~~and~~ (c) Shielding against radiation; and (~~c~~d) Confinement of radioactive material~~, shielding against radiation~~ and limitation of accidental radioactive releases.	Usually shielding is dealt with as one separate important protection goal.			X	Bullets for the fundamental safety functions are consistent with the description of Requirement 4 of SSR-2/1 Rev 1.
14	ENISS	2	2.5	The design of fuel storage systems should be such as to maintain subcriticality margins preferably by use of geometrically safe configurations~~, taking into account optimum moderation including the potential effects of hazards~~. The design of fuel storage systems should also consider use of physical means or physical processes to increase the subcriticality margin in normal operation.	The sentence aims at giving a requirement on how to maintain subcriticality margin. The events to take into account should be treated separately and address not only hazards but also during any initiating event. Being at optimum moderation is not relevant for a wet storage (see §3.53)		The proposed modification is slightly modified to read as: 2.5 The design of storage systems for authorized fuel should be such as to prevent criticality preferably by control of geometry. 2.5A The design of fuel storage systems should also consider use of physical means or physical processes to		

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							increase the subcriticality margin in normal operation in order to prevent from reaching the criticality during postulated initiating events including the effect of hazards.		
15	ENISS	3	2.7 to 2.9	Shielding against radiation	Move these 3 paragraphs and their title after §2.13 in order to Keep the order of the safety functions defined in §2.2	X			
16	Germany	4	2.9	Design provisions should be implemented as necessary to prevent a loss of shielding from irradiated fuel resulting in high radiation doses for workers <u>for operational and accident conditions</u>	Clarification		The proposed wordings are slightly modified to read as: "for operational states and accident conditions."		To be consistent with the IAEA Safety Glossary and SSR-2/1 Rev 1.
17	U.K (editorial)	6	Paras 2.11 & 2.13, 2.19	Design provisions should be introduced to …	Avoid duplication	X			
18	Germany	5	2.13	Design provisions should be provided to collect and filter radioactive materials released in case of handling accidents, and to prevent <u>cladding damage, possibly accompanied by activity releases or</u> uncovering of irradiated fuel assemblies in the spent fuel storage in accident conditions.	Clarification / extension			X	Para. 2.13 (now 2.10) provides recommendation to cope with consequences of accidents (not prevent fuel damage).
19	Belgium	2	2.18	~~**As other considerations**~~ Beside safe storage, …	Make sentence more clear	X			
20	U.K (technical)	2	$ 3.1	Append: …cranes and mechanical	Completeness. These are central to the safety case detailed later.			X	Para. 3.1 is intended to list major

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				handling equipment.					equipment and components for fuel storage. The suggested wordings are for fuel handling systems and are captured in para. 4.1.
21	Pakistan	2	3.2 (Modified)	Prevention of high radiation doses, early or large radioactive releases **such that radiation doses kept as low as reasonably achievable (ALARA).**	ALARA principle.			X	Bullet (c) is intended to request the prevention of DECs. The wordings are consistent with those used in SSR-2/1 Rev 1.
22	Belgium	3	3.3 (f)	Typo to be corrected: " … criteria …"	Instead of "" … crieteria …"	X			
23	Finland	10	3.3 (f)	Criteria	typo	X			
24	U.K (editorial)	8	3.3 (f)	criteria	Typo error "crieteria"	X			
25	U.K (editorial)	9	3.4	The design should define provisions and devices necessary to facilitate the use of non-permanent equipment for the re-establishment of safe conditions in the fuel storage in case of multiple failures, which are not accounted for in the design basis.	Improve statement clarity.	X			
26	Belgium	4	3.4	" … in case of multiple failures beyond those considered in the design."	Better wording than "… in case of multiple failures that are not retained for."		Reworded to read as: " ….. , which are not accounted for in the design basis."		Close to Comment #25, U.K (editorial) comment #9.
27	U.K (technical)	3	$ 3.4	Replace: …*that are not retained for*. With: *…that exceed the design basis of the facility. This may include: The provision of flanges and*	Clarity and (English wording).		Reworded to read as: " ….. , which are not accounted for in the design basis. This may include the provision of flanges and sockets for		Close to Comment #25, U.K (editorial) comment #9.

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				sockets for the use of mobile equipment.			the use of mobile equipment."		
28	Germany	6	3.6	The design of spent fuel storage systems should include multiple, independent (redundant, as appropriate) means to remove decay heat from irradiated fuel and to maintain shielding and subcriticality margins in the various plant states considered in the design.	This puts more emphasis on the importance of these protection goals		Added the following sentence: "The need for redundancy, diversity and independency should be defined taking into account para. 3.7. Implemented combination of redundancy, diversity and independency among the various cooling means should be adequate to demonstrate that the uncovering of the fuel assemblies is prevented with a high level of confidence." Note that Para. 3.7 has been proposed by Comment #33, U.K. (technical) comment #10.		Shielding is not included because there is no shielding in series for defence in depth.
29	Finland	1	3.5	General comment	Reference to SSR-2/1 and the following paragraphs do not state how many DiD levels should there be for fuel pools, and how independent they should be. Must				"Multiple means" is the wording used in SSR-2/1 Rev 1 Requirement 7 bullet (f).

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					operational and accident cooling systems be separate?				The number of means depend on the safety function to be accomplished (fuel cooling or criticality) and on the nature of SSCs implemented (active or passive features). Effectiveness of DiD is assessed performing CCF analysis between the multiple means. This is the concern of para. 3.7. See revised para. 3.7 suggested by U.K (technical) comment #10 (Comment #33).
30	Finland	2	3.6	…should include multiple means to remove decay heat from irradiated fuel and to maintain subcriticality margin (if not maintained by geometric configuration)…	Are multiple means to maintain subcriticality required if subcriticality is assured by geometry?			X	Design relies on different means to maintain adequate subcriticality margins in the different plant states. Revised statements in paras 2.5 and 2.5A clarify multiple means for maintaining subcriticality margins.
31	Belgium	5	3.6	"… multiple means…" should be better specified	"… multiple means…" is too vague. Is it requested to have redundant and/or diverse means? How many? Does "multiple means" reflect pre-installed means only or can it include mobile means (not pre-installed)?			X	"Multiple means" is the wording used in SSR-2/1 Rev 1 Requirement 7 bullet (f). The number of means depend on the safety function to be accomplished (fuel

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									cooling or criticality) and on the nature of SSCs implemented (active or passive features). Effectiveness of DiD is assessed performing CCF analysis between the multiple means. This is the concern of para. 3.7. See revised para. 3.7 suggested by U.K (technical) comment #10 (Comment #31).
32	ENISS	4	3.6	The design of spent fuel storage systems should include multiple means to remove decay heat from irradiated fuel ~~and to maintain subcriticality margin~~ in the various plant states considered in the design.	The safety level is not characterized by the number of means included in the safety criticality demonstration: A purely geometrically safe configuration is usually considered as more robust than a configuration that would require both poisoning and geometry control parameters (as stated in §3.98-3.99). There is no need for a diverse system to maintain sub-criticality.			X	See comment resolution for Comment #14 (ENISS #2) - revised statements in paras 2.5 and 2.5A for multiple means to maintain subcriticality margins.
33	U.K (editorial)	10	3.7	The risk for common cause failures of the decay heat removal SSCs should be identified and the consequences assessed. In the cases that may result in fuel assemblies uncovering the identified SSC vulnerabilities should be removed to the extent possible.	Improve statement clarity.	X			
34	ENISS	5	3.10	For spent fuel storage, the ~~large~~ coolant inventory in the fuel	The adjective “large” is unclear. It is not consistent with the aim of	X			

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				storage area is essential to the fundamental safety functions of decay heat removal and radiation protection, and can ~~contributes~~ contribute to maintaining subcriticality margins.	the recommendation 3.10. "… contribute to maintaining subcriticality margins." It is not always the case (for instance in a storage that would be maintained subcritical in unborated water with sufficiently distant fuel assembly cells)				
35	U.K (editorial)	11	3.12	"… capabilities of the equipment …"	The mitigating equipment is already defined at this point, hence "the".	X			
36	U.K (technical)	4	$ 3.18	Append: *...above the anticipated design basis.*	This is intended to clarify the meaning.		Added "above the design basis".		
37	Germany	7	3.22	[…] should be excluded from consideration as hazards in the fuel storage area through prevention by careful design of the handling equipment, and of layout of the refueling, fuel storage, and cask loading areas.	Specification	X			
38	U.K (technical)	5	$ 3.26	Append: *In other areas flooded for spent fuel transfer, penetrations should be minimised.*	Drainage of the reactor cavity has the potential to uncover any fuel in transit.			X	Agree to the comment; however the recommendation is not sufficient to fix the issue of unplanned draining.
39	Germany	8	3.28	For spent fuel storage, the different cooling capabilities and each redundant division of a cooling system should be implemented in its own fire compartment or at least in its own fire cell, where implementing a fire compartment is not achievable. If subcriticality of a spent fuel	Water as fire fighting agent usually does not consist of makeup water including e.g. boric acid.			X	The dilution of the soluble absorbers in SFP is addressed in a new paragraph (para. 3.99A).

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				storage pool partially relies on soluble absorbers, potential coolant dilution by fire fighting agents should be considered.					
40	Belgium	6	3.35	“All buildings important for safety of fuel storage and cooling shall be designed against the loads of external hazards relevant for the site and against likely combinations thereof.”	We propose to limit 3.35 to buildings alone. Now 3.35 seems to offer an alternative: if protection of buildings is not effective, the alternative is to protect SSC. But for most (all?) hazards both are necessary. With the new proposal 3.35 covers the buildings while 3.36 and following cover the SSC.		Reworded according to comments: “3.35 The protection should primarily rely on an adequate layout and design of the buildings at the site. 3.36 For hazards or likely combinations of hazards, structures, systems and components whose operability or/and integrity is required to maintain during or after the hazard should be identified and specified. Where protection of the building is not effective, structures, systems and components should be designed to withstand the hazard loads and loads from likely combinations of hazards.”		
41	U.K (editorial)	12	3.41	“…and irradiated fuel cooling capability should be preserved”	Improve statement clarity.	X			
42	Germany	9	3.41	Margins provided by the design of the structures, systems and components in case of Design Extension Conditions ultimately necessary to avoid high radiation doses and a large radioactive release should be such that it can be demonstrated that the	A sharper distinction in the text here between Design Base Accident and Design Extension Conditions is preferable.			X	Para. 3.41 is related to external hazards. According to IAEA practice, external hazards are distinguished from DECs. Existing text is consistent with the

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				integrity of the structures, and the operability of those systems and components would be preserved in case of natural hazards causing loads exceeding those resulting from the hazard evaluation at the site.					trext of requirement 17 (para. 5.21A) of SSR-2/1 Rev 1.
43	U.K (editorial)	13	Between 3.41 and 3.42	Fuel storage capacity	The plural form “capacities” is not appropriate here	X			
44	Finland	3	3.42/line 6	At a minimum, the storage capacity should allow for storage of all expected discharged fuel assemblies plus additional storage for unloading one full core or for transferring fuel from other storage racks because of maintenance.	Why “low density storage”? Some extra capacity could be needed for maintenance of storage, this can be the same reserve as for unloading the core.	X	Removed “low density”.		
45	U.K (editorial)	14	3.47 (b)	“… or through the seals of gates; “	In this case water leaks through the seals (not of).	X			
46	Finland	4	3.47 (c)	Loss of cooling water flow, or dilution of soluble neutron absorbers (if used for subcriticality)	This is not about reactors.			X	Soluble absorbers are used in PWRs only.
47	U.K (editorial)	15	3.47 (d) & 3.49 (b)	“…normal operation fuel cooling system;”	Avoid duplication	X			
48	ENISS	6	3.47	Typical examples of postulated initiating events which are categorized as anticipated operational occurrences based on frequency of occurrence and radiological consequences, include: (a) Loss of off-site power; (b) Loss of coolant (small leaks) in the cooling and filtration/purification system or	Single misplaced fuel assembly or dropped fuel assembly, due to organizational means, is generally considered as a Design Basis Accident and not an Anticipated Operational Occurrence.			X	Many Member States consider single misplaced fuel assembly or dropped fuel assembly as an AOO event as long as the fuel cladding remains intact. If fuel cladding is failed, the event is considered as a DBA on basis of, for example , US NRC practice.

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				of the seals of gates; (c) Loss of cooling water flow, or dilution of soluble neutron absorbers (in pressurized water reactors); (d) Malfunctioning of a fuel cooling system operated for normal operation; ~~(e) Abnormal fuel assembly configurations with single misplaced fuel assembly or dropped fuel assembly (without cladding damage) in the fuel storage.~~					
49	ENISS	7	3.49	Single equipment failures and multiple equipment failures should be considered to define design basis accident conditions and design extension conditions, respectively. Typical examples of such failures to be considered include: *Design basis accidents* (a) Significant loss of coolant (e.g., breaks of piping connected to the spent fuel pool); (b) Failure of the cooling system operated in operational states; (c) Abnormal fuel assembly configurations (e.g. fuel assembly positioning errors and dropped irradiated fuel assembly with cladding damage);	Safety-criticality studies follow a dedicated approach described in SSG-27 (double contigency principle etc.), not to be put together with the DBC approach: in particular, safety-criticality rules, criteria, or categorization that would be based on Design Basis Accidents or Design Extension Conditions studies would not be consistent with the current safety-criticality approach shared worldwide.			X	Categorization is made on the estimated frequency and consequence of the event.

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				~~(d) Change of moderation conditions in fuel storage (e.g., dilution of soluble neutron absorber in wet storage area or flooding of dry storage area).~~					
50	U.K (editorial)	16	3.49, *Design extension conditions* (b)	"… system designed for mitigating the event of concern".	Improve statement clarity	X			
51	Germany	10	3.49 (d)	Change of moderation conditions in fuel storage (e.g., ~~dilution of soluble neutron absorber~~ dry-out in wet storage area or flooding of dry storage area).	Dilution of soluble absorbers does not change moderation; if formation of bubbles by boiling or something else was ment, this should be clarified.		Reworded to read as: "Significant change of moderation conditions in fuel storage (e.g., large dilution of soluble neutron absorber (pressurized water reactor only) in wet storage area, or flooding of dry storage area)".		"Dry-out" (i.e., formation of bubbles by boiling on the fuel cladding) is practically eliminated by design. Therefore, we do not include "dry out".
52	U.K (editorial)	17	3.52	"…stress limits defined by the codes …"	Improve statement clarity	X			
53	U.K (technical)	6	$3.54 (b)	Append: *…and provision made to move any fuel in transit to/from storage racks to a safe location.*	This requirement needs to be captured.			X	Related to fuel handling, and addressed in para. 4.31.
54	Finland	11	3.55	… to maintain spent fuel pool temperature at acceptable levels for operating personnel …	Is there really criteria for pool temperature in relation to the operating personnel.				Yes, but different temperatures are used by Member States. (Consensus on the limits was not reached.)
55	U.K (technical)	7	$3.55 (c)	Replace: *…water vapour…* With	This aspect needs to be covered in the safety case.	X			

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				…water vapour and entrained particulate (where appropriate)…					
56	Germany	11	3.55 (b,c)	(b) Maintaining forced cooling during design basis accidents; and for design extension **conditions relying on natural evaporation of coolant, makeup of lost inventory will provide for removal of heat and water vapor from the atmosphere**; or (c) **Providing for natural evaporation of coolant, makeup of lost inventory, and removal of heat and water vapor from the atmosphere** during both design basis accidents and design extension conditions.	Unclear; requires for further explanation and clarification.		Rephrased to read as: (b) Maintaining forced cooling during design basis accidents and relying on natural evaporation of coolant, supplemented by makeup to compensate lost of inventory for design extension conditions provide for acceptable diversity in the removal of heat in accident conditions; (c) For both design basis accidents and design extension conditions, relying on natural evaporation of coolant, supplemented by makeup to compensate lost of inventory provides another alternative for removal of heat in accident conditions.		
57	U.K (editorial)	18	3.58	"… the reliability of the design for spent fuel storage systems should be such that …"	Improve statement clarity	X			
58	U.K (editorial)	19	3.59	"… reliability of the SSCs designed to operate …	Maintain consistency with established IAEA terminology			X	The original statement clarifies the message.
59	U.K (editorial)	20	3.61	" … and maximum heat sink temperature. "	Improve statement clarity	X			

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60	U.K (editorial)	21	3.64	" … collect, locate and isolate any leakage through the pool metallic liners. "	Improve statement clarity	X			
61	U.K (editorial)	22	3.65, 3.66 and **throughout the text**	Replace "maximum" with " … maximal …"	Correct terminology: "Maximal temperature (heat load, impact, etc.)" is different from: "Maximum of a function at certain point"	X			
62	Finland	5	3.65/3.67	General comment (see the comment to para 3.5)	Are the systems for normal operation and accident conditions required to be separate and independent, as is the case for reactors? If so, according to 3.65 and 3.67 both would require 2x100 % capacity, which is not required at least in Finland.				Commenter's interpretation is different from our intention in this safety guide. The cooling system is used to cover normal operation, AOO and accidents. However, it is not sufficient to cover full range of accidents, and therefore the redundancy means (active or passive) is installed. See modifications for paras 3.6A to 3.7.
63	ENISS	8	3.68	The system required to remove decay heat in design basis accidents should be supplied with emergency power, if active.	Decay heat removal may be maintained by passive means, e.g. option c.		Reworded to read as: "The forced cooling system required to remove …..."		
64	Germany	12	3.68	The system(s) required to remove decay heat in design basis accidents should be supplied with emergency power.	Consistency e.g. to 3.67.		Reworded to read as: "The forced cooling system required to remove …..."		Clarified that this applies to the active cooling system. Close to Comment #63, ENISS comment #8.
65	Belgium	7	3.69	Delete 3.69	We do not see the added value of 3.69 compared to 3.67. The latter		Reworded to read as: "A single equipment		Para. 3.69 provides an example of single

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					covers normally as well active as passive single failures; so 3.69 is covered and therefore unnecessary.		failure or piping break in the forced cooling system should ….".		failure criterion stated in para. 3.67.
66	U.K (technical)	8	$3.71	Delete: *…is close to boiling.* Insert: *…subcooling is lost.*	Imprecise use of words. I believe my wording correctly defines the safety requirement.	X			
67	ENISS	9	3.72	Water storage pools should not be designed with penetrations below the minimum water level required for adequate ~~shielding and~~ cooling of stored irradiated fuel.	The shielding requirements are not the same between normal operation and accident conditions. There are generally other mitigation means that are not based on radiological shielding during accident conditions. Providing sufficient radiological shielding would at least in some BWR designs require adding several meters of extra water to the pool if it should be assumed that water is lost in the spent fuel pits. This would result in a several meter higher reactor building and possible a longer time schedule for the construction of the plant.		Reworded to read as: "Water storage pools should not be designed with penetrations below the minimum water level required for shielding and cooling of stored irradiated fuel in accident conditions."		
68	Germany	13	3.73	The volume of the spent fuel pool should be adequate to ensure that, in the event of loss of forced cooling, a sufficient period of time ~~(e.g., at least two hours)~~ to allow for	No informative benefit, rather confusing.	X			

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				implementation of corrective measures before the water reaches the boiling point.					
69	ENISS	10	3.73	The volume of spent fuel pool should be adequate to ensure that, in the event of loss of forced cooling, a sufficient period of time ~~(e.g. at least two hours)~~ to allow for implementation of corrective measures before the water reaches the boiling point.		X			
70	Belgium	8	3.73	"The volume of the spent fuel pool should be adequate to ensure that, in the event of loss of forced cooling, a sufficient period of time (e.g., at least two hours) **is available** to allow for implementation of corrective measures before the water reaches the boiling point."	A verb seems to be missing. We made a guess of the missing words.	X			
71	U.K (editorial)	23	3.74	"…leakage through a gate …"	Improve statement clarity	X			
72	ENISS	11	3.74	Design layout provisions should be implemented to prevent from uncovering the top of the spent fuel assemblies ~~and to maintain a sufficient radiological shielding~~ in the case of inadvertent or accidental leakage by a gate between the spent fuel pool and a drained fuel handling compartment(s).	See comment on 3.72			X	Close to Comment #67 (ENISS #9).
73	Germany	14	3.76	Such provision includes a permanently installed system that includes emergency makeup with provision for adequate coolant chemistry, to deal with	Specification.			X	Water chemistry is not required for accident conditions according to para. 6.68A of SSR-2/1 Rev 1.

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				coolant losses.					
74	U.K (editorial)	24	3.76	Such provisions include a permanently installed system that provides emergency makeup to deal with coolant losses.	Improve statement clarity	X			
75	Finland	6	3.77	Additional provisions should be implemented to facilitate use of non-permanently connected equipment…	Sub paragraph (a) includes permanently installed systems, which is in contradiction with the main paragraph.		Reworded to read as: "non-permanently or other permanently installed equipment"		
76	U.K (editorial)	25	3.77	" … to recover the coolant inventory and decay heat removal capability"	Improve statement clarity	X			
77	U.K (editorial)	26	3.77	Connecting devices should be provided outside of the spent fuel storage area.	Improve statement clarity	X			
78	U.K (editorial)	27	3.78	"The design should take account of …"	"demonstration" is not appropriate here	X			
79	U.K (editorial)	28	3.79	" … considered in the design …"	" … retained for design …" is not appropriate here	X			
80	U.K (technical)	9	$3.78	Append: *And the potential for degradation of reinforcement considered.*	In my experience, this is an important issue for structures of the projected life of these ponds.	X			
81	Germany	15	3.81	(d) Loads from neutron flux and corrosion, including effects on absorber effectiveness (as appropriate)	Additional load to a spent fuel storage system.			X	The suggested items are not related to loads considered for design of the racks.
82	U.K (technical)	10	$3.88	Delete: ..for which safety classified…	All pressure equipment has a safety function, at least in the context of hazards.	X			
83	U.K (technical)	11	$3.88	Delete: *…having a wide application in the design and manufacturing of nuclear components.* Insert: *…appropriate to their safety*	The standards quoted are not necessarily adequate for high-integrity components, where more exacting defect tolerance arguments may be required.	X			

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
				classification and the applicability of the selected design standard justified.					
84	Belgium	9	3.88	"Safety classified pressure retaining equipment should be designed …"	To improve wording compared to "Pressure retaining equipment for which safety classified should be designed …"		Reworded to read as: "Pressure retaining equipment should be designed and manufactured according to requirements established by national or international codes appropriate to their safety classification and the applicability of the selected design standard justified."		Closed to Comments # 82-83, U.K Comments 10 and 11.
85	Finland	12	3.88	Pressure retaining equipment for which safety classified should be designed…	The sentence is broken, please clarify. Should this mean "The safety classified pressure retaining equipment should be designed…" or "Pressure retaining equipment for which safety classification is applied should be designed…" or something else		Reworded to read as: "Pressure retaining equipment should be designed and manufactured according to requirements established by national or international codes appropriate to their safety classification and the applicability of the selected design standard justified."		Closed to Comments # 82-83, U.K Comments 10 and 11.
86	Finland	13	3.89	Specific structures or components for which safety classified should be designed …	Same as above		Reworded to read as: "Specific structures or components should be designed and manufactured according to requirements established by national		

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							or international codes appropriate to their safety classification and the applicability of the selected design standard justified."		
87	Belgium	10	3.89	"Specific structures or components that are safety classified should be designed …"	To improve wording compared to "Specific structures or components for which safety classified should be designed …"		Reworded to read as: "Specific structures or components should be designed and manufactured according to requirements established by national or international codes appropriate to their safety classification and the applicability of the selected design standard justified."		
88	Belgium	11	3.89	"…should be designed and manufactured according to well justified criteria and practices."	The present text "…according to criteria and practices widely used in similar applications by the international nuclear industry." is vague and might hinder innovation.		Reworded to read as: "Specific structures or components should be designed and manufactured according to requirements established by national or international codes appropriate to their safety classification and the applicability of the selected design standard justified."		
89	Finland	14	3.90 (a)	Structures ensuring subcriticality margins should be assigned	wording, clarity		Reworded to read as: "Structures ensuring		

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				safety class 1 according to recommendations of SSG-30;			subcriticality margins should be assigned in SSG-30 safety class 1;”		
90	U.K (editorial)	29	3.90 (a)	Structures ensuring sub-criticality margins should be assigned safety class 1 according to the recommendations of SSG-30;	Improve statement clarity		Reworded to read as: “Structures ensuring subcriticality margins should be assigned in SSG-30 safety class 1”		
91	U.K (editorial)	30	3.90 (c)	“… back-up of the system designated for design basis accidents … “	Typo error corrected	X			
92	Germany	16	3.96	For components subject to the effects of ageing by various mechanisms, a design life and, if necessary, the verification and, as appropriate, replacement frequency should be established.	Specification.		Reworded to read as: “For components subject to the effects of ageing by various mechanisms, a design life, inspection program and replacement frequency (if appropriate) should be established.”		
93	Germany	17	3.97	Qualification data and results should be documented and kept available as part of the design documentation.	Specification.	X			
94	ENISS	12	3.99	When subcritical margin cannot be maintained by means of safe geometrical configurations of fuel storage racks alone, additional means such as ~~fixed~~ neutron absorbers should be applied. If fixed neutron absorbers are used, it should be ensured by proper design and fabrication that the absorbers will not become separated or	Soluble neutron absorbers also permit to increase the subcritical margins and should be mentioned and described together with fixed neutron absorbers. (see 5.27 of SSG 27)		Added a new paragraph to address this comment: “3.99A When soluble absorbers are used to increase subcriticality margins, it should be demonstrated that criticality is not reached in a condition with pure		

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				displaced during operational states and accident conditions, and during or after an earthquake. If soluble neutron absorbers are used, it should be ensured by proper design that an accidental dilution would not lead to a criticality accident.			water."		
95	U.K (Regulatory)	1	3.102	Change: …*positions not approved for their storage.* To: …*positions not justified for their storage.*	According to the formal IAEA glossary approval should be interpreted as regulatory approval. In the UK we do not approve designs or safety cases – only activities (e.g. construction, commissioning, and modification, etc. and even then only using a graded approach based on safety significance). In this context you are in fact referring to the need for a safety justification to be available.	X			
96	ENISS	13	3.103 (g)	Credit should not be claimed for neutron absorbing parts (including soluble boron) or components of fuel storage racks unless they are permanently ~~installed~~ in place in normal operating condition.	Boron concentration should be considered "permanently installed" as a design limit in normal operating condition			X	This paragraph applies to components of the fuel racks.
97	Finland	15	3.103 (l)	Allowance should be made for the presence of burnable absorber ~~poisons~~ that are integral …	Instead of burnable poison we would prefer burnable absorber in conjunction with doped fuel. The motivation for this is that poison is in general something harmful and thus something to avoid. However, in the case of e.g. Gd-doped fuel (or other similar materials) the Gd is put	X			

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
					on purpose to avoid excess reactivity at the beginning of the lifecycle. Consequently, it is something wanted and useful. Thus, burnable absorber would be better				
98	U.K (technical)	12	$3.105	Change: …*operational conditions* To: …*normal operation and foreseeable fault conditions*	Staff may need to remain on post carrying out emergency responses and foreseeable actions need to be reasonable. This should be explicit.		Reworded to “operational states”		To be consistent with SSR-2/1 Rev. 1
99	Germany	18	3.107	For the design of shielding, bounding conditions should be considered for initial fuel composition ~~enrichment~~, burnup and cooling times for gamma and neutron radiation, the inventory at the maximum design capacity of the spent fuel storage facility, the effects of axial burnup on gamma and neutron sources and the activation of non-fuel hardware.	Specification, to additionally regard for MOX fuels whose source term, especially neutrons, may be much higher as for UOX fuels at same burnup level.	X			
100	U.K (technical)	13	$3.107	Change: *… and the activation of …* To: *… The mobility of activated CRUD, and the activation of …*	The radiological aspects of CRUD should be considered.	X			
101	Germany	19	3.111	The material used for the pool liner and other structure materials (e.g. racks) should have low sensitivity to corrosion phenomena taking into account coolant chemistry.	Specification.		The proposed wordings are revised slightly to read as: “and other structural materials in contact with coolant (e.g., …)”.		
102	Germany	20	3.122	Adequate means should be implemented for monitoring chemical parameters in the spent	Specification.	X			

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
				fuel pool in operational conditions, including soluble absorbers, as appropriate.					
103	U.K (editorial)	31	3.113	Materials used in the construction of fuel storage systems should allow for easy decontamination of surfaces.	Improve statement clarity	X			
104	U.K (editorial)	32	3.116 (b)	They are chemically compatible with the other rack components and are chemically stable when immersed in water.	Improve statement clarity		Reworded to read as: "Fixed solid neutron absorbers are chemically compatible with the other rack components and and are chemically stable when immersed in water"		
105	U.K (technical)	14	$3.126	Insert an additional requirement: *(f) Provision should be made to manage the event of foreign material entering the pond and to recover debris from damaged fuel pins.*	You need a vacuum cleaner to suck up bits of failed fuel pins.			X	The proposed bullet (f) is captured in existing bullet (a) for operational states. For accident conditions, how to remove potential debris should be analyzed case-by-case using non-permanent installed equipment.
106	Pakistan	3	3.132 (New)	Adequate lighting shall be provided in the spent fuel pool area of the nuclear power plant in accident conditions.	Requirement 75 of SSR-2/1 (Rev. 1)			X	Recommendations for the design of lighting systems are addressed in DS440.
107	Belgium	12	4.1 (a); 3rd bullet	" … at fuel storages (e.g., auxiliary crane **or hoist**, new fuel elevator …"	To be more complete	X			
108	Belgium	13	4.1 (b); 4th bullet	"Auxiliary crane **or hoist** in the fuel building; …"	To be more complete	X			
109	U.K	15	$4.11	Insert at the start of the	It is not realistic to exclude	X			

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
	(technical)			paragraph: *So far as reasonably practical…*	misloading. This is a frequent event.				
110	Belgium	14	4.12	" …fuel assembly hang-up **(and two-blocking)**, translation while hoisting or lowering, or opening the grapple under load. Mechanical damage resulting from excessive motion (e.g., continued lowering after seating of assembly or upward motion into a hard stop) **or speed (overspeed)** should also be considered.	To be more complete	X			
111	Belgium	15	4.30	To be added as fifth bullet: **(e) Emergency stop button**	To be more complete			X	We recognize the emergency stop button is needed for staff security, but for para. 4.30 it would not be appropriate.
112	Belgium	16	4.34	To be reworded	It is not clear what is a "computerized operational management system" and how it will prevent the inadvertent emplacement or incorrect movements of the fuel assembly.		Reworded to read as: "The design of fuel handling and refueling machines can include computerized operational management systems to manage and monitor fuel handling conducted in the reactor building and in the fuel building. The computerized operational management systems can be used to prevent the inadvertent emplacement of a fuel		

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
							assembly into an inappropriate position and incorrect movements of the fuel assembly. The reliability of this system should be appropriate to conduct fuel loading and unloading operation. The consequences of malfunctioning of this computerized operational management system should be considered."		
113	U.K (technical)	16	$4.34	Append to this paragraph: *…but the reliability assumed for this system should not exceed the level appropriate to its formal safety classification (probably low SIL) and the consequences of the system providing misleading information should be considered.*	Experience has shown that these systems fail and that operators are inclined to trust them.		Reworded to read as: "The reliability of this system should be appropriate to conduct fuel loading and unloading operation. The consequences of malfunctioning of this computerized operational management system should be considered."		
114	Belgium	17	4.40	"Protection devices **(electrical and/or mechanical interlocks)** should be provided for the movement of fuel handling machines to prevent fuel damage (for instance, **a safe load path that is clearly prescribed for each lift).**"	For better specification	X			
115	Belgium	18	4.41	We propose that the authors	Not all protection devices are		Rephrased to read as:		Clarification.

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
				reword this requirement, to put more focus on the application of the single failure proof aspect for major components of cranes (hooks, cables)	single failure proof, although diversity is often applied		"The design of electromechanical and electrical protection devices applied to major components of cranes (e.g., hooks, cables) should comply with the single failure criterion in order to prevent damage to fuel assemblies."		
116	Finland	7	4.42	In pressurized heavy water reactors..	This paragraph concerns only PHWRs	X	Deleted the commented wordings.		
117	U.K (editorial)	33	4.44	" … particular attention should be paid to situations …"	Improve statement clarity	X			
118	U.K (editorial)	34	4.47	" … to facilitate decontamination afterwards. "	Typo error corrected	X			
119	Finland	8	4.48	In pressurized water reactors, where the fuel pools are located outside of the containment, …	Not all PWRs (e.g. VVERs) do not have fuel pools outside of the containment.		Reworded to read as: "In a nuclear power plant with a fuel transfer system…"		See modification proposed by ENISS comment #14 (Comment #120).
120	ENISS	14	4.48	In plants with a ~~pressurized water reactors, the~~ fuel transfer system, the system should be designed to ensure adequate cooling of the fuel even during malfunction of the fuel transfer operation.	A fuel transfer system may be present in other reactor design beside PWR's.	X			
121	ENISS	15	4.49	When the spent fuel pool is outside the containment and the refueling take place inside the containment, design provisions should be implemented to meet the containment isolation requirements.	In many BWR's refueling is performed with an open containment.			X	Para. 4.49 is applicable to PWR only (changed the subtitle to read as pressurized water reactors).
122	Finland	9	4.52	…failure during handling operation (loss of subcriticality	Fuel damage itself is not a severe consequence (e.g. for new UO2			X	The same equipment is used for handling

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				margin, radiation exposure or release of radioactive materials).	fuel) from the safety point of view, more of a economical question.				new and spent fuel assemblies. The classification of the equipment should consider the worst consequences, which is damage of spent fuel.
123	Belgium	19	4.53	"…should be designed and manufactured according to well justified criteria and practices."	Same reason as for 3.89		Rephrased to read as: "Safety classified equipment should be designed and manufactured according to requirements established by national or international codes appropriate to their safety classification and the applicability of the selected design standard justified."		
124	U.K (technical)	17	$4.54	Delete: *Only normal operation…* from this paragraph and insert: *Any operating conditions for which the system provides a safety function…*	In general, continued functioning of the fuel handling machine may be necessary to return fuel to a safe location in (for example) a LOCA or seismic event.	X			
125	Germany	21	4.54	**Only normal operating conditions** should be considered in the qualification of fuel handling systems.	Unclear; requires for further explanation and clarification.		Reworded to read as: "Any operating conditions for which the system provides safety functions should		Close to Comment #124 (U.K #17).

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
							be ….”		
126	U.K (editorial)	35	4.59	Materials used in the construction of fuel handling systems should allow for easy decontamination of surfaces.	Improve statement clarity	X			
127	ENISS	16	Chapter 5 General comment	DESIGN BASIS FOR EQUIPMENT USED FOR SPENT FUEL INSPECTION AND REPAIR, AND DAMAGED FUEL HANDLING, AND DESIGN BASIS FOR HANDLING AND STORAGE SYSTEMS OF IRRADIATED CORE COMPONENTS	The requirements ought to consider the amount of fuel handled during inspection and repair, and the consequences if the equipment fails and the amount released to a compartment designed to handle radioactivity. The requirement will drive cost for these systems without improving nuclear safety. ENISS recommends to apply a graded approach when writing requirements on design basis for service equipment.		Para. 5.1 is rewritten to read as: “Recommendations for handling equipment used for inspection, repair (dismantling and reconstitution), and damaged fuel handling should be established considering those provided in Section 4 but by applying a graded approach taking into account the consequences should equipment fails..”		
128	Finland	16	5.7	The dismantling and reconstitution n equipment should be designed to preserve the integrity of the fuel elements. The design should prevent possible fuel damage by loads caused by the lifting of dismantled fuel assemblies or fuel elements, by other handling operations such as tilting or by changes to the fuel cladding.	Does fuel element refer here to fuel assembly or fuel rod? In IAEA safety standard DS 488 Design of the Reactor Core for Nuclear Power Plants fuel element was changed to fuel rod.		Reworded to “fuel rods”.		
129	U.K (editorial)	36	5.13	“Irradiated core components that do not contain fuel will be stored in the spent fuel storage and handled … “	Typo error corrected	X			
130	Belgium	20	5.13	“Irradiated core components that do not contain fuel will be stored	We suppose that “and” is missing.	X			

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
				in the spent fuel storage **and** handled with use of the same handling systems designed for spent fuel. …”					
131	Germany	22	5.13	A number of miscellaneous i~~I~~rradiated core components that do not contain fuel will be stored in the spent fuel storage handled with use of the same handling systems designed for spent fuel.	Clarification.	X			
132	U.K (technical)	18	$5.17	Add: …or a suitable safety case provided to ensure adequate shielding during storage.	Good practice is to load these into fuel assemblies.		Reworded to read as: “unless a suitable safety case is provided to ensure adequate shielding or decoupling between source and assemblies.”		
133	Germany	23	6.6	The probability of a cask drop accident should be reduced by means of an appropriate crane design and appropriate procedures for the inspection, testing and maintenance of the crane and the associated lifting gear, and also by means of adequate operator training. If the cask lifting system is such that failure of a single component could result in an unacceptable dropped load, damping devices should be used together with restrictions on the lifting height in order to be able to mitigate the potential consequences. ~~The probability of a cask drop accident should be reduced by means of an appropriate crane~~	Improved readability.	X			

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
				~~design and appropriate procedures for the inspection, testing and maintenance of the crane and the associated lifting gear, and also by means of adequate operator training.~~					
134	U.K (technical)	19	$6.9	Append to this paragraph: *…and reasonably practical monitoring systems should be provided to alert the operators in the event that administrative measures fail.*	The potential consequences of a misload could be severe (large early release). Relying on a good safety culture to prevent this is unwise.			X	We do not understand how such monitoring solves expected problems. Provide some examples.
135	U.K (technical)	20	$6.11	Change: *…effectively discounted* To: *…treated as a low-frequency event.*	Operational experience of high-reliability lifting equipment demonstrates that such an event cannot be discounted. Handling damage to fuel remains frequent.	X			
136	U.K (technical)	21	$6.11	Change: *Speed limitations* To: *Suitably diverse speed limitations*	In general, it is not adequate to rely on a limitation to a control system which is part of a control system which may be compromised in an event. (Some additional text to this effect could be considered)	X			
137	U.K (technical)	22	Appendix I	Delete this appendix or rewrite. Otherwise change the text so that integrity means that the passive functions of the system such as containment and structural integrity are preserved. Operability means that active safety functions continue to operate.	The logic is not clear. The tables make a distinction between operability and Integrity. The note suggests that Integrity means that safety functions are preserved. If this is the case, then further requirements are outside the scope of this document.		Appendix I is removed.		NS-G-1.6 is under revision and these contents will be included in the revised NS-G-1.6.
138	U.K (technical)	23	Appendix I	Refueling machine PWR: add and operability	There should be no distinction between the safety functions for BWR and PWR. They are		Appendix I is removed.		

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NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
					essentially identical.				
139	U.K (technical)	24	Appendix I	Fuel Handling machine: add and operability	There should be no distinction between the safety functions for Fuel Handling machine and Refueling machine. They are essentially identical.		Appendix I is removed.		
140	Belgium	21	Appendix 1	Under Structures, systems and components for fuel handling and storage, add: **“Emergency stop button”** with as Seismic design considerations **“Maintaining integrity and operability.”**	To be more complete		Appendix I is removed.		
141	ENISS	17	Appendix 1	Maintaining structural integrity and functional operability	Adaptation of the wording in order to avoid confusion. It has to be noted that none of these terms is defined in the Safety Glossary.		Appendix I is removed.		
142	Finland	17	Appendix I	Refueling machine	Where does the difference between BWR and PWR come from?		Appendix I is removed.		
143	U.K (editorial)	37	Appendix 1 I.2 (a), (b) & (c)	(a) Substantial coolant loss due to: (b) Reduction of sub-criticality margins due to: (c) Damage of the pool structure and fuel assemblies due to:	Improve statement clarity		Appendix I is removed.		