`DS487 Design of Fuel Handling and Storage Systems for Nuclear Power Plants
Step 10 – MSs' Comments and Resolution and results of the technical editorial review

COMMENTS						RESOLUTION			
NO.	MS/Organization	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
1	USA	1	General	Recommend defining the term "storage system" for use in this document and to be consistent throughout the document.	Typically the term "dry cask storage system" is used in NRC correspondence. This document uses the term "storage system", "storage", "fuel storage", "spent fuel storage", "fuel storage system" to note the spent fuel pool and supporting SSCs. It should be clearly stated that storage systems means the spent fuel pool and use the same term to stay consistent.		Technical editing reviewed all used terminologies. Fuel storage (system) is used for both fresh and irradiated (spent) fuels, while spent fuel storage (system) is specific to irradiated (spent) fuel. Para. 3.1 describes important SSCs of fuel storage system.		
2	Germany	1	1.5 (e)	Reinsertion ~~(shuffling)~~ of irradiated fuel from the spent fuel pool when required;	Shuffling" describes the handling of fuel assemblies within the core (from one core position to another) and must be mentioned separately	X			
3	Germany	2	1.5 (e1) (new)	Shuffling of fuel;	Item is missing, see comment above			X	Movement from one position to another in the core is out of the

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									scope of this Safety Guide. It is covered in NS-G-2.5.
4	Germany	3	1.5 (f) footnote 2	Spent fuel means fuel removed from the reactor core following irradiation and that is no longer ~~economically~~ usable in its present form.	There may be other reasons than economics not to reuse a fuel assembly (in particular safety/ radiology).	X	The Footnote was deleted as the term explained in the Safety Glossary		
5	Germany	4	1.5 (g)	Handling of fuel casks ~~in the spent fuel pool.~~	Handling of fuel casks in other places of the plant (arrival of new fuel, transport of the cask to and from the spent fuel pool)-is to be taken in consideration as well-	X	Para. 1.5 describes sequential sages of fuel handling and storage. Examples of handling of fuel casks in the plant are considered at the listed stages as appropriate. Therefore there is no change in para. 1.5 (g). For clarification, however, the title of Section 6 is revised to read as “Handling of fuel casks ~~for spent fuel~~”.		

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6	Germany	5	1.5 (g1) (new)	<u>Transfer of spent fuel casks out of the reactor</u>	The former formulation in NS-G-1.4 “handling of the transport casks” was formulated in a more general manner. The transfer of a spent fuel cask normally involves lifting devices and is a heavy load operation with a potentially great impact on nuclear safety in case of failure. This should be taken into account.	X	<u>Transfer of spent fuel casks</u>		
7	Germany	6	2.5	The design of storage systems for ~~authorized~~ fuel should be such as to prevent criticality preferably by control of geometry.	“Authorized“ is used within DS487 only here.			X	Para. 2.5 is specific and valid for nuclear fuel authorized for use in the reactor. (See Footnote to para 2.5)
8	Germany	7	2.6	The design of fuel storage systems should also consider use of physical means or physical processes to increase subcriticality margins in normal operation in order to prevent from reaching the criticality during	Most of the criticality accidents occurred due to human errors.	X	… postulated initiating events including those postulated initiating events arising from the effect of internal and external hazards		Human errors are already captured by the wording “initiating events” in the text.

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				postulated initiating events including the effect of hazards and human errors.					
9	Germany	8	2.9	Design provisions should be introduced to prevent damage to fuel elements and fuel assembles during handling, and to collect and filter radioactive releases from the spent fuel storage in order to keep radioactive releases as low as reasonably achievable during operational states.	First, fuel element integrity has to be achieved, fuel damage (due to fuel melting or e.g. mechanical impacts) may be a topic in accident conditions.	X	Reworded “fuel” to “fuel (rods and assemblies)”.		
10	Germany	9	2.19	(a) Inspection of the fuel (fuel elements and fuel assembles);	According to com. Nr. 8 to Para. 2.9	X	Reworded “fuel” to “fuel (rods and assemblies)”.		
11	Germany	10	3.2	(c) Practical elimination ~~Prevention~~ of high radiation doses, early or large radioactive releases.	According to SSR-2/1 2.11, 4.3, 5.31 “plant event sequences that could result in high radiation doses or radioactive releases must be practically eliminated“. See also DS487 Para.3.59.	X	Reworded “Prevention of high radiation doses, practical elimination of early or large radioactive releases”		
12	USA	2	3.4	Revise to read:	States that the design should include provisions to			X	“Multiple failures” in the text

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				"The mention of beyond design basis events should define provisions and devices necessary to facilitate the use of nonpermanent equipment for the re-establishment of safe conditions for the fuel storage in case of multiple failures, which are not accounted for in the design basis. This may include the provision of flanges and sockets for the use of mobile equipment."	enable use of non-permanent equipment to re-establish safe conditions. This is a more precise wording to focus on the coping plan to address beyond basis accidents.				indicates "Design Extension Conditions (DECs), which was previously classified as BDBA. "BDBA" or "beyond design basis events" is not used in SSR-2/1 Rev 1.
13	Hungary	3.	3.6		Missing full-stop at the end of the paragraph.	X			
14	ENIS	1	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.	Multiple means to ensure subcriticality should not be a requirement. The application of double contingency principle should be the preferred approach in accordance with SSR-4 for the design.			X	Clarification is made in Paras 2.5 – 2.6 and 3.99, which are consistent with paras 6.143–6.144 of SSR-4.
15	Finland	1	3.6	should include multiple means to remove decay heat from irradiated fuel	Multiple means to maintain subcriticality is not required if subcriticality is assured by			X	Clarification is made in Paras 2.5 – 2.6 and 3.99:

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				and to maintain subcriticality margin (if not maintained by permanent structural means)…	permanent solid structures. E.g BWR reactor building fuel pool water is not borated, subcriticality is based on the rack structures and geometry.				subcriticality is maintained preferably by geometric configuration and subcriticality margin is maintained for use in abnormal conditions by neutron absorbers. Soluble absorber is not credited; refer to para. 3.104 (g).
16	Germany	11	3.7	The need for redundancy, diversity and independency should be defined taking into account para. 3.8. Implemented combination of redundancy, diversity and independency among the various cooling means should be adequate to demonstrate that <u>the coolant or fuel cladding temperature limits defined</u>	According to DS487 Para.2.7 the aim is: "not to exceed fuel cladding or coolant temperature limits defined for operational and accident conditions", uncovering of the fuel assemblies may be a topic for design extension conditions.	X	Accepted with a correction of "… for operational safety and accident conditions …" to read as "… for operational states and accident conditions …".		

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				for operational safety and accident conditions are not exceeded and uncovering of the fuel assemblies is prevented with a high level of confidence.					
17	Germany	12	3.7 (new, please add)	In the safety demonstration credit can be taken from the available time span until the permissible temperatures in the pool are exceeded.	In contrast to decay heat removal from the reactor core, decay heat removal from the spent fuel pool can take credit from the substantial time needed to reach high pool temperatures, even more until fuel uncovering. This should be stated explicitly in this paragraph.			X	The proposed comment is considered in the safety analysis; The comment is captured in para. 3.74.
18	Germany	13	3.8	The risk for common cause failures of the decay heat removal means should be identified and the consequences assessed. In the cases that may result in fuel assemblies uncovering or disturb decay heat removal function, the identified vulnerabilities of the decay	The second sentence implies that diversity/ redundancy is only required for "uncovering sequences", not for maintaining defined coolant temperature limits (i.e. for DiD levels 1, 2 or 3). This however would not reflect a "Defence in Depth approach", in particular if it	X			

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				heat removal means should be removed to the extent possible by the implementation of diverse and redundant provisions.	is taken into account that failure of one or two trains of cooling systems will be a postulated initiating event.				
19	Germany	14	3.23	Very heavy objects associated with refuelling operations (e.g., reactor vessel head and activated reactor internal structures) and fuel transfer or storage cask loading operations should be excluded from consideration as hazards in the fuel storage area through prevention, with a high level of confidence, by careful design of the handling equipment , and of layout of the refuelling, fuel storage, and cask loading areas.	To be consistent with DS487 Para.3.7.	X			
20	Germany	15	3.25	The design and layout of new fuel dry storage should provide protection against internal flooding, for example, by means of flood barriers, routing of	It is a requirement for existing reactors that flooding of the dry storage area with water shall not exceed the subcriticality margins. This should also			X	The comment is well noted. However, the suggested statement is related to

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				water piping through areas isolated from the fuel storage or adequate drains in order to keep the minimum subcriticality margins. Nevertheless, subriticality margins should not be exceeded when flooding of the dry storage with water, steam or fire fighting agents is postulated.	be required for new designs.				criticality analysis method. Note that this Safety Guide is intended for application to new plants (see para. 1.8)
21	USA	3	3.26	Revise to read: Equipment performing the fundamental safety functions should be protected against the effect of high- and moderate-energy pipe breaks.	States that equipment performing fundamental safety functions should be protected against the effect of high-energy pipe breaks. The inclusion of moderate-energy pipe breaks assures function of safety equipment in areas where high-energy pipe breaks are not the most limiting accident.	X			
22	USA	4	3.40	Revise to read: For spent fuel storage, in the event of external hazards, actions necessary	The term "short term" is ambiguous and lacks definition. The revised text assures that the plant has a plan to have the needed	X	For spent fuel storage, in the event of external hazards, short term actions necessary to maintain a sufficient		

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				to maintain a sufficient coolant inventory and an adequate cooling of the fuel, if any, should rely on on-site equipment until off-site equipment or services may be available or brought to the site. Appropriate plans to assure that equipment or services are available to assure that timely implantation may be achieved.	equipment and services available when needed.		coolant inventory and an adequate cooling of the fuel should rely on on-site equipment. Only long term actions should rely on off-site equipment or the availability of off-site services.		
23	Germany	16	3.43	….. For mixed-oxide fuel, the higher residual heat values that may further delay transfer into storage casks should be taken into account. <u>A wet storage option for new mixed oxide (MOX) fuel elements for cooling and shielding should be considered in case of a planned utilization of MOX fuels.</u>	New MOX fuel has a high radiation dose and evolves high surface temperatures due to radioactive decay of Plutonium. Storage of new MOX fuel in wet storage after reception is commonly applied.			X	New MOX fuels are practically stored in wet storage especially for radiation protection purpose, which is addressed in para. 4.57. Additional cooling requirement for new MOX fuel is not necessary.

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24	Hungary	1.	3.43(Fuel storage capacity)	At this point the following is written: „The maximum storage capacity should consider the availability of licensed away-from-reactor storage for spent fuel.” Proposal „The maximum storage capacity should consider the availability of licensed away-from-reactor storage for spent fuel **considering all** .”	It should also be noted that at one site generally several reactors (generally of the same type) work in parallel and the "away-from-reactor" storage pool (or pools) are designed to be commonly used, so their capacity is split between several reactors.			X	The original statement accounts for multiple units in a site as well. No need to add “considering all”.
25	USA	5	3.46(d)	Revise to read: (d) Controlling unacceptable radioactive gas leaks from defective fuel rods to the environment;	The revised text protects public safety.			X	Para 3.46 (d) is for design means for normal operation and address para. 2.9.
26	Finland	2	3.48 (c) and 3.50 DBA (b)		Please clarify the difference in between AOO and DBA: What is meant by loss of cooling water flow? Scenario behind this point is not understandable.				An example of loss of cooling water flow in para. 3.48 (c) is loss of flow accident due to trip of a pump.

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					Does this refer to e.g. loss of one normal operation cooling train and immediate start of another?				
27	ENISS	2	3.48	Typical examples[3] 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 through the seals of gates; (c) Loss of cooling water flow, or dilution of soluble neutron absorbers (only relevant to pressurized water reactors); (d) Malfunctioning of a normal operation fuel cooling system;	There is no operational feedback to justify that dropped fuel assembly should be considered as an anticipated operational occurrence. For instance, French feedback shows that no event of accidental fuel drop occurred and this event is considered as a design basis accident and not an AOO.			X	Based on operational experiences from MS, dropped fuel without cladding failure is classified as an AOO, while dropped fuel with cladding failure is classified as a DBA (see 3.50 (c)).

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				~~(e) Abnormal fuel assembly configurations with single misplaced fuel assembly or dropped fuel assembly (without cladding damage) in the fuel storage~~					
28	Hungary	4.	3.50 (d)		„water" instead of „watwater"	X			
29	ENISS	3	3.50	Single equipment failures and multiple equipment failures should be considered to define design basis accident conditions and design extension conditions, respectively. Typical examples3 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 normal operation cooling system operated in operational states;	Safety-criticality analysis follows a dedicated approach not to be put together with the DBC approach.		Bullet (d) is not removed as suggested. Instead, Footnote 3 modified in accordance with Comment #27 (ENISS Comment #2) is also applied to para. 3.50.		

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				(c) Abnormal fuel assembly configurations (e.g. fuel assembly positioning errors and dropped irradiated fuel assembly with cladding damage); ~~(d) Significant Change of moderation conditions in fuel storage (e.g., large dilution of soluble neutron absorber (pressurized watwer reactor only) in wet storage area, or flooding of dry storage area).~~					
30	USA	6	3.50	Revise to read: "Single equipment failures and multiple equipment failures should be considered to define design basis accident conditions or design extension conditions, respectively. Typical examples of such failures to be considered include:"	This revision is to make the criteria consistent with the "should" language used in paragraph 3.56	X	Single equipment failures and multiple equipment failures should be considered, in order to define design basis accident conditions and design extension conditions, respectively. Typical examples of such failures to be considered include the following		

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31	Finland	3	3.50 DBA (b)/3.68		Loss of normal operating cooling system as a DBA leads to requiring one system for DBA and requirement for DEC causes a need for one more, additional system. Both normal operating system and the DBA system are required to be single failure tolerant. All this leads to requiring at least 5×100% cooling. Is this really the intent of the requirement. It should also be considered that typically fuel pool cooling system is a hybrid of normal operating and accident systems (i.e. EDG & SBO back-upped systems, related I&C, safety classified.)				An example is that 2 normal cooling systems + additional one for DBA.
32	Finland	4	3.50	… *Design extension conditions* (a) Multiple failures leading to <u>a long-term</u> ~~the~~	Please clarify: What is loss of cooling vs. sustained loss of cooling?	X	Multiple failures leading to the loss of the forced cooling system for a long period;		

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				~~sustained~~ loss of the forced cooling system; (b) ….	Replace the sustained by a long-term.				
33	Germany	17	3.54	Criticality should be prevented in all operational states and accident conditions with specified margins. ~~Examples of good practices[4] are:~~ (a) For dry storage of new fuel, the effective multiplication factor calculated for optimum moderation conditions should not exceed a maximum value of ~~a value specified as per national regulations, (e.g.,~~ max 0.95 in normal operation ~~–~~ and min 0.98 in accident conditions (uncertainties included~~)~~; and…	IAEA should define a maximum value for $k_{eff.}$ That allows for national regulators to demand higher margins. Valid also for next paragraph, 3.54 (b)			X	The expert group tried but too much different values are used in MS. The decision was to leave it as "examples of good practices". For information: For coolant temperatures, MS uses the limiting values within two wide range, and even was not successful in presenting typical ranges in use.
34	Germany	18	3.54	(b) For wet storage of spent fuel, the effective multiplication factor calculated should not exceed max. 0.95 in	IAEA should define a maximum value for $k_{eff.}$ That allows for national regulators to demand higher margins.			X	The expert group tried but too much different values are used in MS. The decision

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				normal operation and ~~values specified as per national regulations (e.g.,~~ max. –0.95 ~~–0.98)~~ in anticipated operational occurrences and accident conditions (uncertainties included).					was to leave it as "examples of good practices".
35	USA	7	3.55	Revise to read: 3.55 For wet storage of spent fuel, adequate coolant inventory should be maintained over the top of the irradiated fuel assemblies in all operational states and accident conditions: (a) ... (b) In accident conditions, substantial coolant inventory should be maintained for radiological shielding, when necessary for control	Revised text is more precise for plant accident controls.			X	Radiation shielding is always needed.

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				of the accident conditions.					
36	USA	8	3.56	Revise to read: Maintaining forced cooling during design basis accidents, and relying on natural evaporation of coolant supplemented by makeup to compensate lost of inventory for design basis accident conditions and design extension conditions, provide for acceptable diversity in the removal of heat in accident conditions;	Revised text results in parallel construction with 3.56 (a) and 3.56(c).	X	Deleted bullet (c).		Bullet (b) is the combined case with an active system for DBAs and a passive system for DECs.
37	Germany	19	3.56	For wet storage of spent fuel, decay heat removal should be adequate to maintain spent fuel pool temperature at acceptable levels for operating personnel and for normal operation purification system under all normal operating conditions, including high decay heat loads associated with refueling. For anticipated	Clarification	X			

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				operational occurrences, decay heat removal capability should be promptly restored to return pool temperature to normal operating conditions without reaching boiling ~~steaming~~ conditions. In accident conditions, adequate removal of heat should be maintained relying on inherent safety features, on operation of active or passive systems, or their combinations, that is:					
38	Germany	20	3.56	(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 these ~~accident~~ conditions.	The design basis accidents should be managed with dedicated systems, without reaching boiling conditions in the reactor building or spent fuel pool.	X	Deleted bullet (c).		
39	Finland	5	3.56 (b) and (c)	to compensate loss~~st~~ of inventory	typo	X			

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40	USA	9	3.59	Revise to read: "… is limited or practically eliminated and …".	This makes the sentence consistent with the other portions of DS487.			X	See para. 6.68 of SSR-2/1 rev 1.
41	Germany	21	3.67	The cooling system should be designed to maintain the coolant temperature below the maximal temperature specified for anticipated operational occurrences also during the unavailability of cooling components for maintenance purposes or in the event of the loss of the off-site power.	Regular maintenance is part of normal operation, thus, these situations should be considered as part of the anticipated operational occurrence list.			X	The comment is related to a normal operating condition and is addressed in para. 3.66.
42	USA	10	3.73	Revise to read: Water storage pools should not be designed with penetrations below the minimum water level required for shielding of stored irradiated fuel in accident conditions.	The revised text addresses the situation for pools with active cooling systems where the minimum water level needed for cooling must include sufficient water level to ensure adequate NPSH for the cooling pumps, this requires piping penetrations be located	X	Water storage pools should not be designed with penetrations below the minimum water level necessary for shielding of stored irradiated fuel in accident conditions.		

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					below the minimum water level.				
43	Germany	22	3.74	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 is available to allow for implementation of corrective measures before the water reaches the coolant temperature limits ~~boiling point~~.	According to DS487 Para. 2.7 the aim is: "not to exceed fuel cladding or coolant temperature limits defined for operational and accident conditions".	X			
44	Germany	23	3.78	Additional provisions should be implemented to facilitate use of non-permanently or other permanently installed equipment to recover the coolant inventory and decay heat removal capability. Such provisions should be in an area where access can be ensured. Connecting devices should be provided outside of the spent fuel storage area.	Small leakages may occur due to drop of handling equipment into the pool. Normally such kinds of failures will be repaired by use of a plate to cover the damaged point.	X	The proposed (e) is added to para. 3.65. Means for the temporary repair of small leaks through the metallic liners of the pool.		

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				Typical provisions can include: (a) Connection to other permanently installed systems, for example, service water system and the fire water system; …….. (d) Adequate provisions to recover forced cooling of the spent fuel pool in the event with extended loss of AC power (i.e., station blackout). (e) Means should be in place for repair of small leakages through the metallic pool liners.					
45	Germany	24	3.83	Design loads that should be considered in the design of the spent fuel storage structure include: … (b) notwithstanding the requirements on the handling equipment in 3.23, ~~d~~Dynamic loads resulting from ~~the~~ cask	That is inconsistent, as cask drop should be excluded (see 3.23). If the cask drop should nevertheless be included as load, this should be stated explicitly.			X	Para. 3.83 concerns SF storage structure, while para 3.23 concerns fuel storage area (e.g. pool area).

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				drops should be taken into account to provide for defence in depth;					
46	Finland	6	3.91 (a)-(d)	should be assigned safety class x according to SSG-30, or should according to (or in line with) SSG-30 be assigned safety class x	wording, clarity should be assigned in SSG-30 safety class x, is a strange formulation	X			To avoid misunderstanding of the meaning of safety classes 1, 2 and 3, we refer them to SSG-30 safety classes 1, 2 and 3.
47	Germany	25	3.95	Environmental qualification should include the consideration of such factors as temperature, pressure, humidity, radiation levels, radioactive aerosols, vibration, water spray, steam, flooding, electromagnetic influence, contact with chemical agents, and their combination.	The add-on is of important regarding modern electronic items	X			
48	Germany	26	3.100	When soluble absorbers are used to meet the design limit for accident conditions, it should be demonstrated that	Postulated initiated events may encompass wrong positioning of more than one fuel element. A certain		When soluble absorbers are used to meet the design limit for accident conditions, it should	X	The proposed statement is addressed in para. 3.123.

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				criticality is not reached if condition with pure water were assumed in normal operation. Nevertheless monitoring of the boron concentration should be performed in appropriate time intervals.	boron concentration means certain safety margins.		be demonstrated that pure water will not cause criticality in all modes of normal operation.		
49	ENISS	4	3.100	When soluble absorbers are used to meet the design limit for accident conditions, it should be demonstrated that criticality is not reached if ~~condition with~~ pure water ~~were~~ is assumed for ~~in~~ normal operation conditions.	Suggestion to improve the wording.	X	When soluble absorbers are used to meet the design limit for accident conditions, it should be demonstrated that pure water will not cause criticality in all modes of normal operation.		
50	ENISS	5	3.104 (g)	Credit should not be claimed for neutron absorbing parts or components of fuel storage racks unless they are permanently installed; Limited credit for soluble neutron absorbers may be allowed for some scenarios.	As for fixed absorbers, the conditions allowed to credit soluble boron absorbers should be treated in this paragraph or at least make reference to SSG27 §5.28.	X	The proposed addition is not accepted. However, bullet (g) is revised to read as: "(g) Credit should not be claimed for neutron absorbing parts or components of fuel storage racks for normal		Close to Comment 49 (ENISS Comment #4).

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							operations unless they are permanently installed;” (refer to para. 3.100).		
51	USA	11	3.110	After Para 3.110 add the following paragraph: “3.111 The design should consider and facilitate use of remote and robotic technology for monitoring and measurement of potential high level dose rate particularly in case of significant release due to incidents or accidents.”	Completeness: Under certain unexpected conditions radioactive releases or leakages may occur; subsequently, dose rate could be high. Therefore, the design should consider monitoring of fuel handling and storage systems using remote or robotic integrated system.	X	Added as a new para under subsection of Monitoring: “3.128. The design of fuel storage facilities should consider and facilitate the use of remote and robotic technology for monitoring and measurement of potentially very high dose rates, particularly in the event of an accident. Design of water purification systems for the spent fuel pool.”		
52	Hungary	5.	3.117 (b)		double „and”	X			
53	USA	12	3.120	Revise to read:	Some irradiated fuel storage designs do not credit the monitoring of	X	“Adequate and qualified (as necessary)		

COMMENTS						RESOLUTION			
NO.	MS/Organization	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
				Adequate and qualified instrumentation (when necessary for the design) should be implemented for monitoring water temperature in the irradiated fuel storage in operational and accident conditions.	temperature during accident conditions. Therefore, the instrumentation used during the accident conditions does not need to be qualified.		instrumentation should be implemented for monitoring water temperature in the irradiated fuel storage for operational states and for accident conditions: see para. 6.68A (a) of SSR-2/1 (Rev. 1):”		
54	Germany	27	3.134	Operational areas for spent fuel handling and storage, including the pool area, should be provided with the necessary equipment for illumination (i.e., underwater lighting near work areas and some means for the replacement of underwater lamps) to permit the satisfactory handling and visual inspection and identification of the fuel assemblies. <u>During inspection of equipment</u>	This add-on results from operating experience. It is already considered in many plants.			X	The recommended statement is not a design recommendation but an operational guideline.

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				inside the pool streak formation should be avoided.					
55	Germany	28	4.1 (a)	Fuel handling systems used in light water reactors may include: • Refueling machine to handle the new or spent fuel assemblies for loading and unloading the core and move the assemblies between the core and either the fuel transfer system (for pressurized water reactors) … • System to transfer fuel assemblies between the reactor pool and the spent fuel pool through the fuel transfer tube (for pressurized water reactors);	Not all PWRs have fuel transfer systems	X	The suggest wording "may" is not added (not allowed to use in the Safety Guide). Instead, in the second bullet is revised to read as: • A system to transfer fuel assemblies between the reactor pool and the spent fuel pool through the fuel transfer tube (for typical pressurized water reactors);		
56	Germany	29	4.11	Fuel misplacement should be avoided in fuel movement activities by implementing interlocks of suitable reliability and	This is a more editorial note to allow identification of preventing, protecting and mitigating measures.	X	"Fuel misplacement during fuel movement activities should be prevented by implementing		

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				quality to ~~preclude~~ prevent such events.			interlocks of suitable reliability and quality.”		
57	Germany	30	4.12	Mechanical damage caused by excess handling system forces or drop should be considered among internal events unless ~~precluded~~ prevented by reliable interlocks….	Same reason as in comment No. 28 to para.4.11	X	“Mechanical damage caused by excessive handling system forces or by dropping of heavy objects should be considered unless these can be prevented by reliable interlocks.”		
58	Germany	31	4.23	Required reliability for individual handling equipment should be defined. This reliability should be specified taking into account consequences of the failure of the equipment. The following factors contribute to achieving the reliability: (a) Safety classification and the associated engineering rules for design and manufacturing of individual structures,	Operational experience has shown that many (fuel) handling events have occurred due to bad ergonomic design. This aspect should be considered in this guide Communication between different places must be possible during normal operation and in the case of abnormal events..	X			

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				systems and components; and (b) Design provisions for monitoring, inspection, testing and maintenance. (c) Design of command, control and monitoring devices as well as identification markings, actuating and connecting elements to safely perform and monitor the handling process. (d) Devices for communication between fuel pool, handling machines and control room					
59	Germany	32	4.38	Recommendations (a) and (d) should be fulfilled by the provision of automatic interlocks ~~where feasible~~. ~~If this is not feasible, strictly controlled administrative procedures should be applied.~~	For newly designed plants, the safety of fuel handling should be ensured by technical measures, if possible. The requirements (a) and (d) can be fulfilled; hence administrative procedures are not sufficient for new plants. The designers should be	X	Text included in the bullets.		The comment is valid; however some MS insist holding the conditional statement even for new builds.

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					required to develop feasible technical solutions.				
60	ENISS	6	4.41	~~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.~~	The “single failure criterion” concept does usually not apply to fuel handling equipment. Indeed, as indicated previously in the draft (3.22, 3.50, 3.82, 3.101, 4.5, 4.9, 4.10, 4.12, 4.27), a drop of a fuel assembly should anyway be considered in the design. One should not confuse with the concept of « single failure proof » which specifically applies to heavy load handling equipment with the objective to minimize the risk of drop of heavy load. Moreover, this § addresses the crane while it is under the section dedicated to refuelling machine.	X			
61	Germany	33	4.54	ENVIRONMENTAL QUALIFICATION Any operating conditions for which the system	Environmental qualification is also for fuel handling machines of great importance.	X			

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NO.	MS/Organization	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
				provides safety functions should be considered in the qualification of fuel handling systems. The recommendations 3.92 – 3.98 should be considered.					
62	Germany	34	Title 5.	5. DESIGN BASIS FOR EQUIPMENT USED FOR ~~SPENT~~ IRRADIATED FUEL INSPECTION AND REPAIR, AND DAMAGED FUEL HANDLING, AND DESIGN BASIS FOR HANDLING AND STORAGE SYSTEMS OF IRRADIATED CORE COMPONENTS	Inspection is also important for irradiated fuel, which will be used in the reactor core again, not only for spent fuel, which has reached the end of its service life.	X	DESIGN BASIS FOR EQUIPMENT USED FOR INSPECTION AND REPAIR OF IRRADIATED FUEL, HANDLING OF DAMAGED FUEL AND HANDLING AND STORAGE OF IRRADIATED CORE COMPONENTS		
63	Hungary	2.	5.10 (Damaged fuel handling equipment)	Comment	It is appropriate to distinguish (to determine separately) “damaged” and “leaking” fuel assemblies (elements). Handling of damaged (eg mechanically) or leaking (e.g. latently) assemblies may differ significantly. Placing of slightly (or latently) leaking assemblies in closed containers in the			X	The comment is reflected in paras 5.10 and 5.11. Para. 5.10 concerns leaking fuel rods. Canning the leaking fuel rods is stated. Para. 5.11 concerns damaged fuel assemblies.

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					spent fuel pool may be recommended in the cases if this solution leads to lower risk level from the safety point of view.				
64	USA	13	6.4/Line 2	The design should include systems for decontaminating the casks prior to transport or transfer to storage outside the spent fuel storage area.	Sections 1 to 5 use the term “storage” to refer to the spent fuel pool. It is inaccurate/confusing to use the term in this sentence.	X			
65	Germany	35	6.5	The transport route inside the plant should be ~~as short as possible~~ along a safe load path, consistent with safety.	A short transport route does not guarantee a safe transport route whereas a safe load path should prevent passage over spent fuel or safety systems.	X			
66	USA	14	6.5/Line 4	Stored fuel, the spent fuel pool liner and, cooling systems and reactor systems essential to reactor safety should be adequately protected from the dropping or tilting of a fuel cask.	Stored fuel, the spent fool pool, cooling systems, etc. should be protected from a drop of a fuel cask at all times not only after the cask is irradiated.	X			
67	Germany	36	6.6	The ~~probability~~ possibility of a cask drop accident should be ~~reduced~~	Should be put in consistence with Para. 3.23.: “Very heavy objects	X			

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NO.	MS/Organization	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
				prevented with a high level of confidence 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 …	associated with refueling operations (e.g., reactor vessel head and activated reactor internal structures) and fuel transfer or storage cask loading operations should be excluded from consideration as hazards in the fuel storage area through prevention by careful design of the handling equipment….. “				
68	Germany	37	6.11/7	Suitably diverse speed limitations on the horizontal and vertical movements of the cranes should be provided so as to ensure the safe handling of the cask. Suitably horizontal movement limitations should be provided to prevent passage over stored fuel.	Either by design, by interlocks or other measures horizontal movement of lifting devices along unsafe load paths can be prevented which is state of the art.			X	The comment is addressed in para. 6.5.
69	USA	15	References section	Delete Reference 19 and add the following reference to replace it:	The existing Reference 19 is not consistent with other safety guides and does not recognize the other sponsors of the document.	X			

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NO.	MS/Organization	Com. No.	Para/Line No.	Proposed new text	Reason	Accep-ted	Accepted, but modified as follows	Rejec-ted	Reason for modification/rejec-tion
				"European Commission, Food and Agriculture Organization of the United Nations, International Atomic Energy Agency, International Labour Organization, OECD Nuclear Energy Agency, Pan American Health Organization, United Nations Environment Programme, World Health Organization, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standard Series No. GSR Part 3, IAEA, Vienna (2014)"					