Canada's Comments on

***DS481** - Draft Safety Guide: Design of Reactor Coolant System and Associated Systems in NPPs*

COMMENTS BY REVIEWER Reviewer: M. de Vos, M. Vlatkovic, Z.C. Zeng, K. Ramaswamy, M. Ohn Country/Organization: Canada / Canadian Nuclear Safety Commission Date: October 21, 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	Generic Observation	Throughout the document, there are guidance statements being made that speak to generic design of SSCs beyond RCSAS. In all of these cases, the wording needs to be modified to express the guidance specific to the topic of this guide otherwise there is a significant risk of duplicating or contradicting guidance in other IAEA guides. Comments in this table identify these issues in the first half of the document, but with time permitted, it was not possible to offer alternative wording for every clause where this was encountered.					
2.	Generic Observation	Throughout the document lengthy sentences are used. Please re-write using short sentences.	Readers will be able to follow the documents easily.				
3.	1.5	No change – comment only	The writing team is to be commended for adding this statement as it will open the door to add sections for other technologies being developed for deployment at a later date. CNSC would like to point out that there is a need to develop a design guide that elaborates on the use of the Graded Approach for NPPs. Such a document already exists for research reactors and would				

			provide substantial clarity even for existing technologies.				
4.	2.2 / 3	Delete *element*. However fuel elements and control rods for controlling the core reactivity and shutting down the reactor ~~elements~~ are not addressed in this Safety Guide but in Ref. [2].	editorial	X			
5.	2.5	Suggest to reword to: They include systems designed to ~~that operate once the reactor is shut down and systems to~~ cool down RCS to cold shut-down condition including refuelling condition after shutdown for PWR and BWR	Editorial for clarity	X			
6.	2.8 and 2.9	Replace “till” with until	Incorrect word	X			
7.	2.10	“Ultimate heat sink is defined as a medium into which the transferred residual heat can always be…”	Consistency of terminology. Please clarify whether this sentence is speaking to all heat sinks, or specifically to Ultimate Heat Sinks. The latter appears to be correct.	X			to Ultimate Heat Sinks only
8.	3.1	Please add a single clarifying sentence to explain which aspect of GSR Part 2 applies in this case. (e.g. perhaps include specific clauses)	The rationale for including GSR Part 2 “Leadership and Management for Safety” is not clear in this clause.				Almost all the GSR part 2 requirements are applicable to organizations performing design activities for NPPs.
9.	3.5	Delete this clause:	Delete this clause as it has no regulatory meaning.			X	This clause is important to remind

		"~~A number of RCSASs are design dependent and may be different in their design principles (e.g. use of active or passive systems for emergency core cooling or for removing residual heat etc.). Nevertheless, systems having to accomplish the same safety function in different technologies should be designed in compliance with similar design requirements.~~"	Existing text, particularly the term "similar" does not provide sufficient guidance to establish criteria to measure that the guidance has been addressed. It is highly judgmental as to whether or design requirements are similar in some aspects versus others. Already existing practice in the industry is that, on a design by design basis, the designer is required to show how their systems meet national design requirements.				that general design requirements to be applied to systems should primarily derived from the plant state category for which the system is designed to operate. This clause is important in an IAEA safety guide whose recommendations cannot be design dependent to the extent possible.
10.	3.6 / bullet 8	Replace "Recommended instrumentation and monitoring" <u>With</u> "Monitoring and control capabilities"	The design basis should specify what will be monitored and controlled, not the recommended instrument and monitoring	X			
11.	3.8	From the list of the postulated initiating events (PIEs) established for the design of the plant, PIEs that affect the design of the RCSASs should	Incomplete sentence? Please explain what the PIEs should be categorized against/into		X …and grouped in categories on the basis of their estimated frequency of		

		be identified, and categorized, [against what?]			occurrence.		
12.	3.9	For each of the conditions above, the list of RCSAS systems necessary to bring the plant to safe and stable shut-down condition within the applicable [which?] acceptance criteria should be established.	Please frame this sentence in terms of the RCSAS subject matter. This clause looks like general design clause for all plant SSCs. Please also specific which acceptance criteria are being used in this clause. RCSAS operating envelope?		.".within the applicable acceptance criteria" is deleted		The concern of this clause is the identification of the systems
13.	3.10	Bounding conditions caused by the PIEs should be determined to define capabilities and performances of RCSAS equipment.	Please frame this sentence in terms of the RCSAS subject matter. This clause looks like general design clause for all plant SSCs.	X			
14.	3.11	Recommendations provided in [8] should be considered to understand the general concept for a complete identification of the relevant hazards and for an adequate protection of the systems against the effects of the selected internal hazards. Recommendations provided in [8] should be used to identify internal hazards to be considered in design RCSAS activities. The screening process used for identifying internal hazards should be documented in accordance with	Existing sentence is confusing. Alternative proposed. There is no need to use the word 'relevant' in the text as reference [8] speaks to the process of identifying and screening events.	X			

		a quality assurance process.					
15.	3.19	Move entire clause to above existing 3.18.	To create more logical flow of guidance between clause 3.18 and 3.19.	X			
16.	3.34	Move entire clause to above existing 3.33.	To create more logical flow of guidance between clauses 3.33 and 3.34.			X	More logic as it is
17.	3.35	Second sentence Performing sensitivity analyses can identify which key parameters present uncertainties to be considered in margins.	Second sentence grammar is confusing as written.		X Performing sensitivity analyses could also be useful to identify which key parameters present uncertainties to be considered in design.		
18.	3.39	"Following conditions could be considered as generic candidates" Combine 3.39 with 3.34 to provide a clearer regulatory message. Design extension conditions should be identified and used to establish the design bases of systems necessary to prevent postulated sequences with multiple failures from escalating to core melting. Examples of DECs that may	As stated, the guidance is weakly articulated where, in fact, it is connected with 3.34.	X			

		apply include: • Station Blackout; • Anticipated Transient Without Scram (PWR and BWR); • Total loss of the feed water systems (PWR and PHWR) • Small LOCA with failures in the emergency core cooling system; • Loss of residual heat transfer systems to the ultimate heat sink; • Loss of the ultimate heat sink					
19.	3.42	The following factors should be considered to achieve the adequate reliability of the RCSAS systems necessary to control reactivity of the core, to remove residual heat from fuel and to transfer residual heat to the ultimate heat sink: • Aging related degradation of SSC performance.	Please frame this sentence in terms of the RCSAS subject matter. This clause looks like general design clause for all plant SSCs. In addition, aging of systems should be clearly identified in the list rather than being implied by other bullets.		X Aging		
20.	3.45 / 4	Delete *for*. "The on-site AC power source (Emergency power source) should have adequate capability to supply power to	editorial	X			

		electrical equipment operated in DBA conditions for shutting down the reactor, cooling the core, removing and transferring residual heat removal to the ultimate heat sink and ~~for~~ maintaining the reactor in a safe state in the long term”					
21.	3.49 / 6	Reword to: The additional features for residual heat removal and ~~residual~~ heat transfer <u>to ultimate heat sink</u> should be designed and installed such that they should be unlikely to fail for the same cause	Editorial for clarity	X			
22.	3.51	See comment at right.	Grammar of existing sentence makes this clause difficult to interpret. Please repeat the clauses used for DBA and modify for DECs.		Modified		He issue of CCF between safety systems and safety features for DECs is addressed in the clause just above.
23.	3.52	For example: For the different plant states, alternative means of: • Shutting down the reactor, • Accomplishing residual heat removal and heat transfer to the ultimate heat sink Should be implemented within	Grammar of existing sentence makes this clause difficult to interpret. Please reword for clarity.		X		

		the defence in depth approach.					
24.	3.55	Instrumentation for actuation of RCSAS systems important to safety and for monitoring of plant status should be independent to the extent practical.	Please frame this sentence in terms of the RCSAS subject matter. This clause looks like general design clause for all plant SSCs.		X Instrumentation for actuation of RCSAS designed as safety systems		
25.	3.56 to 3.59	Delete these clauses.	They add no value to this guide. These clauses are already clearly captured in SSR-2/1 and expanded upon in SSG-30. No need to duplicate in this guide. Simply point to SSG for further guidance.			X	2 of them have been removed
26.	3.64	Reword to: The relevant environmental ~~and seismic~~ conditions that may prevail prior to, during and following an accident, the ageing of structures, systems and components throughout the lifetime of the plant, synergistic effects, and margins should all be taken into consideration in the environmental qualification [11].	There is a difference between equipment and environmental qualification. Equipment qualification consists of environmental qualification, seismic qualification and qualification against electromagnetic interference. Environmental qualification is a process followed by the nuclear industry which will generate and maintain evidence to demonstrate capability of SSCs important to safety to perform designated safety functions on demand under postulated service conditions, when exposed to	X			

			harsh environment resulting from a design basis accident (DBA). Service conditions associated with seismic qualification, severe weather (freezing, external floods), dynamic effects, electromagnetic interference and radio frequency interference qualification, toxic gas, rail line blast, and fire protection are examples of design issues related to equipment qualification outside of environmental qualification program scope.				
27.	3.70	Suggest to replace: "Qualification data and results should be documented as part of the design documentation." <u>With</u> "Documented evidence of environmental qualification, the applicable parameters and the established qualification needs should be contained in or referenced by applicable design documentation in an auditable form for the lifetime of the plant."	More specific information.	X			

28.	3.72	Loading conditions, loads and stresses should be calculated to establish confidence in the robustness of the design and margins to cover uncertainties and avoid cliff edge effects. following quality assured and accepted methodologies to perform calculations should take into account:	Please reword and connect the paragraph with the following list.		X Loading conditions, loads and stresses should be calculated applying adequate accepted methodology and rules to establish…		
29.	3.73	All loads (static and dynamic) that are foreseen to occur should be grouped on the basis of operating experience and engineering judgment in consideration of probability of occurrence where warranted.	The use of probability as a primary basis for grouping may result in mis-grouping if errors in PSA calculations exist. Probability should be treated as a supplementary tool to inform judgement and in some cases, may not even be necessary.		X		
30.	3.86	Materials used should enable efficient decontamination	Correction to Grammar	X			
31.	3.89 and 3.90	3.89 can be deleted if the following change is made to 3.90 The development of strategies and programs to address in-service inspection, testing, maintenance and monitoring is a necessary aspect of ~~the~~ RCSAS design ~~phase~~. The strategies and programs to be implemented for these	OPEX has shown that Human Factors Engineering is a major part of establishing strategies and programs to address in-service inspection, testing, maintenance and monitoring. This should be clearly acknowledged as an important part of the design process.	X			

		activities should be developed so as to ensure that RCSAS SSCs remain capable and available to perform their safety functions. Strategies and programs to be implemented should take into account Human Factors Engineering criteria in order to facilitate efficient conduct of activities and minimize the contribution of human error.					
32.	3.97	All pressure retaining components of the RCSASs should be protected against overpressure conditions generated by component failures or by abnormal operations in order to fulfil the pressure limits, in compliance with applicable ~~proven~~ codes and standards.	To be applicable, a standard is expected to be proven. No need to specify this.			X	
33.	3.99	Add to list: • Maintainability				X	Addressed in another clause
34.	3.100	The design of the layout of RCSASs should allow for the inspection, maintenance, repair and replacement of components, in consideration of of ALARA.	"need for the radiological protection of site personnel" really means ALARA	X			
35.	3.108	Provisions should also be provided for collecting and	Managing what happens with the leaked fluid is necessary in	X			

		managing inventories from leaks during normal operation. Leaks can occur from, among others, valve stems, valve seats, pump seals and inter gasket cavities during reactor operation.	the design. (e.g. clean it, process it, return it/release it rather than just collect it in a tank)				
36.	3.114-3.117	Reword the subtitle to: "Instrumentation and control systems"	"Instrumentation and control systems" is a preferred terminology			X	Restricted to instrumentation on purpose. The following clauses apply to the instrumentation only.
37.	3.114 / bullet 4	Reword to: Providing the operator in the ~~MCR~~ control facilities, including MCR and SCR, with appropriate and reliable information for the ~~post-~~ accident management.	1. This information should also be available in the secondary control room. Please refer to paras. 7.164 and 7.165 where manual actuation of safety features is required to be available in the SCR. 2. Accident management is a preferred terminology than post-accident management		MCR and TSC		
38.	3.114	Add bullet: • Supporting an understanding of maintenance state of SSCs	Although instrumentation is traditionally used for operations personnel, modern designs are increasingly incorporating instrumentation for maintenance status and aging management as part of predictive maintenance approaches. This needs to be	X			

			reflected in this guide.				
39.	3.115	Existing first paragraph is fine as written however bullets should be deleted as they are generic design considerations appropriate in an I&C design document instead.	Existing guidance is too generic and needs to be revised to reflect only RCSAS design. Guidance is recommended to add on Requirement 64, *Separation of protection systems and control systems*, of the SSR-2/1 because many control systems exist in RCSAS.			X	Recommendations for the I&C architecture are out of the scope of this Safety Guide
40.	3.116	Reword to: Instrument sensing lines should be ~~so~~ designed such that ~~the~~ characteristics of measurement ~~detected parameters~~ (e.g. magnitude, ~~frequency,~~ response time, chemical characteristics) are not distorted.	1. Instrument sensing line is the preferred terminology 2. Magnitude, response time, etc. are characteristics of the measurement (measured parameter), not the detected parameters	X			
41.	3.116 / Footnote 5	Refer to the correct reference in Footnote 5. 5 Instrument lines are part of the sensors as defined in Ref. [9].	The footnote refers to reference [9] which is SSG-30. However, no discussion on instrument sensing lines is provided in SSG-30. The footnote sentence is similar to the footnote 7 of NS-G-1.9 in which refers to reference [9] which is NS-G-1.3 containing similar statement (para. 5.12) to Footnote 5.		X		The foot note is useless

			It should also be noted that SSG-39 (reference [16]) superseded NS-G-1.3, but there is no discussion on instrument sensing lines in SSG-39.				
42.	3.117	Replace "Means for monitoring the activity in all fluids that could become radioactive should be provided in accordance with [16]." With "Potential leakage of radioactive materials into RCSASs should be monitored"	Rewording for clarity	X			
43.	3.114-3.117 (Instrumentation)	See comment at right.	RCS leakage monitoring is important for detecting degradation of pressure boundary (leak-before-failure). Please elaborate why the recommendation of para. 3.74 of NS-G-1.9 was not retained in this draft.		X		See new clauses 5.86 and 5.88
44.	3.118	Delete clause or reword to be more specific to RCSAS design. "Although it is agreed that safety systems must be unit	Text currently articulates generic design conditions			X	This clause does not apply to auxiliary systems.

		specific, certain auxiliary systems can be designed to be safely shared between units can be done safely if multiple unit accidents and common cause failures are addressed in the defence in depth approach for common system design."					
45.	4.4, 4.5	Delete clauses, or modify the clauses to apply only in the case where an ultimate heat sink "system" such as a man-made lake is purpose-designed to fit a plant's needs. This comment applies to Section 5 as a whole.	Ultimate heat sink assessment is already considered as part of the siting process under NSR-3 (soon to become SSR-1) long before the plant systems are designed to accommodate the site Very rarely is an ultimate heat sink "designed" and it is not a "system" under the control of the designer. The plant must adapt to the heat sinks available.				New text
46.	4.13	Reword to: In establishing the maximum heat rejection rate, the most severe combination of individual heat loads should be identified for all PIEs for which the system is called upon to perform ~~a normal operation or~~ a safety function.	The maximum heat rejection rate may not be relevant to normal operation.				New text
47.	Page 3.1.33, last	Most of the CANDU plant uses	Better clarity				481 gives recommendation for

	paragraph (after 4.19)	open loop system for the intermediate cooling system.					new NPPs
48.	5.74	Reword to: The design should also provide provisions for taking samples of secondary side water/steam.	Provision should include for steam sampling.		X Clause 5.74 deleted, only clause 5.79 is kept		
49.	5.79	Add an item after 5.79 to state "The design should include provision for water lancing to clean the shell side."	For cleaning of steam generator secondary side		X		
50.	5.123	See comment at right. This comment is applicable to all three type reactors mentioned in the document.	Clause 6.32 (a) of SSR 2/1 requires that safety system be design *to be capable of overriding unsafe actions of the control system*. Please elaborate why this requirement was not enforced in this draft.			X	This requirement applies to the Reactor Protection (I&C) system
51.	7 / Page 3.1.80	Add this text at the end of second paragraph: "Chemistry control of the heat transport system is maintained by the heat transport purification system and by chemical addition system (hydrogen and lithium hydroxide)"	HTS chemistry control			X	
52.	7 / Page 3.1.80	In the list of Connected	The SDCS should be removed in the connected system list	X			

		systems, shutdown cooling system should be removed.	because it is mentioned that at the first paragraph of page 80 the primary HTS includes the SDCS and also at the second paragraph, RCS includes SDCS.				
53.	7.3	Reword to: … to prevent fast crack growth during normal operational conditions, anticipated operational occurrences, design basis accidents and DECs ~~accidents~~ without significant core degradation.	editorial	X			
54.	7.6	Reword to: Systems performing similar safety functions ~~Groups 1 and 2~~ should be physically separated by distance or barriers to ensure that a single design basis event or common cause failures will not affect all the systems ~~disable systems in both groups~~. Or Add to the beginning of this item: “Safety systems are assigned to one of two separate groups, called Group 1 and Group 2.”	The concept of Groups 1 and 2 are introduced without explanation. General terms are recommended to use or definitions should be added.	X			
55.	7.26	Add into item 7.26, “Inspection	To evaluate conditions of	X			

		provision for the primary and secondary steam separators"	steam separators in steam generator.				
56.	7.33	Add two bullets into 7.33: • "Maximum permissible moisture content in steam" • "Provision for steam sampling"	Very important parameters for better performance of steam generator.	X			
57.	7.53	The pressure and inventory control of RCS should be designed to maintain the RCS pressure within limits specified for the operational states	Better clarity	X			
58.	7.67	Add the following into 7.67: "Over pressure protection devices should be designed in such a way to keep the water hammer effects as low as possible"	Water hammer effects to be considered in the design		X … Water hammer effects should be considered in the design		
59.	Page 3.1.90	revise the paragraph under "Reactivity Control" as: It focusses only on the systems which involve injecting a liquid solution into the primary heat transport system or into the moderator system.	No liquid solution is injected into primary heat transport system for reactivity control.	X			
60.	7.113	Delete: "It can also have to be used to bring the plant to a cold shut-down." And revise:	Cool down of heat transport system, with the required rate is not possible by auxiliary feed water.		X The auxiliary feed water system should provide sufficient capacity to fulfil		

		"these functions" with "this function" in next sentence.			this function efficiently		
61.	7.114	Add the sentence: "If connection to Reserve Feed Water Tank/dousing water is not possible, an alternate means to supply the auxiliary feed water to steam generators to be provided in the design (use of inter-unit feed water tie in multi-unit stations)"	In the multi-unit stations, no connection exist from the reserve feed water tank.	X			
62.	Pages 94 and 95 (7.116 – 7.120, Reactivity control)	Reword shutdown system 1 and 2 to the first and second shutdown system.	General terms are recommended to use.	X			
63.	Page 94 (Reactivity control)	In the section of Reactivity control in "SYSTEMS FOR ACCIDENT CONDITIONS", the guidance of the first shutdown system should be added.	The guidance only on second shutdown system (SDS2) is described.		X	X	
64.	7.150	Reword to: "This active EHRS should have ~~an automated~~ either manually initiated or automated emergency power supply (EPS) start-up"	In most of the CANDU plants, EPG/EPS is started manually		X		

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1	GENERAL	*See comment*	New NS-G-1.9 version shares many sections with updated NS-G-1.10 version. Why not directly merge them in line with IAEA goal of simplifying and reducing the number of guidelines? A significant proportion of the new suggested version exactly coincides with the updated NS-G-1.10.				NS-G 1.9 and NS-G 1.10 deals with the more important systems for safety, but NS-G 1.9 focuses more on systems necessary to prevent accident with core melting. My opinion is that it was already a mistake to merge in NS-G 1.9 all the coolant and cooling systems including RCS for which much more could be provided. IAEA has one SG for the spent fuel pool whose scope is narrow and one SG for all the containment systems or cooling and coolant systems!!!
2	1.7/-1.8	This Safety Guide covers the RCSASs, including the ultimate heat sinks as defined in Section 4. It covers design considerations for the RCSASs that are common for various reactor types, limited as mentioned in para. 1.5. The scope does not extend to the detailed design of specific components	Better wording given in former version: "This Safety Guide covers the RCSASs, including the ultimate heat sinks as defined in Section 4. It covers design considerations for the RCSASs that are common for various reactor types, limited as mentioned in para. 1.5. The	X			

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			scope does not extend to the detailed design of specific components".				
3	1.10	*Lack of consistency*	Current draft version has reformulated the former one by removing the sentence referred to 'general concepts'. However, the current version of Section 3 begins with the following sentence: "This section describes general **design concepts** and recommendations". Therefore, lack of consistency.	X	Section 3 modified		
4	1.10/3	*Remove* 'and'	N/A	X			
5	1.10/3	*Remove* 'designed to control the core reactivity…' *until the end of the para.*	Remove this added sentence for the two following reasons: 1.- Format reason: It is not very suitable to introduce fundamental statements such as the goals of the analysed systems constituting the main topic of the SG within the structure of the report. 2.- Content reason: lack of completeness: the complete list	X			

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			of the RCSASs functions is not mentioned. Moreover, "... without a molten core" should be removed in any case: it needs rephrasing and it is not part of the RCSASs function.				
6	1.13/1	*Remove the initial 'The'.*	Acronyms or referred terms should be used throughout the text in a consistent manner, e.g. always use RCSAS or replace the acronym by *reactor coolant system and associated systems*. The same applies to the rest of the acronyms such as SSC.	X			
7	2	*Comment*	A general list of all systems comprised within the RCSASs should be reincorporated in the updated version of the report, since it help users to better understand what this multi-system guide is pointing at. Last, the previous division between the RCS itself, connected systems, associated systems and UHS gave clear clues for the reader to understand in a structured way how and which systems had been addressed in this report. Such structure is suggested to be kept.			X	RCSAs (systems) are quite different between reactor technologies and also for a same technology if you consider the variety of designs currently proposed by the Vendors. But functions to be accomplished are invariable.

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8	2.1/2	*Comment*	1. This section is entitled 'extent of RCSASs' hence it should only address what RCSASs comprises, whereas the system functions should clearly belong to a different new independent section. 2. It can be beneficial to include a list of functions of the RCSASs. However, since there are many systems involved within the RCSAS, such new section should be significantly improved and structured in different subsections each of which will be devoted to collect the main functions of each RCSAS system. At least, this section related to functions should be comprehensive, hence it should collect all functions of the CVCS, CCWS, ECCS, etc., and for instance, CVCS functions or some RCS functions are currently lacking.			X	Paras 2.1 to 2.12 are clear enough to understand the safety functions to be accomplished. A Safety guide does not aims at addressing operational functions. DS 440 (to be published) will supplement the scope of systems
9	2.1/5	… to prevent significant fuel damage in design basis accidents and to mitigate the consequences of design extension conditions to the extent possible.	Clarification's sake.	X			

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10	2.1/7	"Remove the decay heat from the core and transfer it to the ultimate heat sink".	'Decay heat' and 'residual heat' mean the same.			X	Residual heat includes but not comprises Decay heat
11	2.1/10	Protect the RCS against overpressure in all operational states (including cold overpressure protection).	Clarification's sake.		X		
12	2.3/2	down the intranuclear instrumentation sleeves which are part of the pressure barrier.	Clarification's sake.			X	Too detailed
13	2.3/Addition	The limits of the RCS should include any additional fixed equipment and piping aimed at connecting portable devices to mitigate the consequences of design extension conditions.	Portable equipment is temporary connected to the RCSAS, therefore it should be addressed here.			X	Use of portable equipment is not addressed here
14	2.5/All	*Replace the entire para by the following one:* Heat removal systems are designed to remove the residual heat generated in the core and the sensible heat stored in the RCS driving the plant from the standby mode down to cold shutdown.	1. Wording 2. Sensible heat is also removed by these systems when transiting down from hot to cold shutdown.			X	Definition of residual heat which includes heat stored in the structures, systems, etc.
15	2.6/1	The safety functions accomplished by these systems are, among other, to compensate reactor coolant leaks, to control the reactor coolant inventory and its chemical composition, to monitor the reactor coolant activity	Comprehensiveness			X	Design dependent

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		or to inject water to the reactor coolant pump seals.					
16	Between 2.6 and 2.7	Emergency boration system	As currently entitled, 'core reactivity control' might comprise the control rod system. However, such system should not be part of the targeted systems in this report. Therefore, it is suggested to recall it in a clearer way as 'emergency boration system' since this function is carried out as one of the functions usually assigned to the CVCS during operational states.			X	The control of the power distribution is an operational function and it is different form the emergency boration
17	Between 2.7 and 2.8	*General comment*	The structure based on distinguishing systems upon the plant state during which they perform leads to frequent unnecessary duplicity.			X	Essential to justify the design recommendations which apply to the different systems
18	2.10/1	… into which the transferred residual heat generated in the fuel elements, both stored in the core or spent fuel pool, together with the energy losses generated by the working components, can always…	The energy absorbed by the heat sink comes not only from the fuel elements but also from the equipment.			X	IAEA glossary definition

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19			The driving criteria to structure and arrange the contents of current section 3 are not clear enough. This lack already existed in the previous version of the guide. Subsections from 3.7 on seem to give further explanation of some of the features comprised in a standard design basis. If this is the case, the presented structure should be clarified and explicitly mentioned so that it is easy for the reader to follow it.				
20	3.3/All	*Comment*	The mentioned list of issues are overarching topics suitable for every system installed in a nuclear power plant. Therefore, there is no added value here.			X	Essential to prove that recommendations are derived from SSR2/1 requirements.
21	3.4/1	*Comment on* 'above mentioned objectives*'*.	Where such objectives are mentioned? In 3.3? They are not objectives. If in the references, the objectives should be better explicitly mentioned here. It seems that such wording actually reproduces the beginning of former para 3.5 where, in that case, such 'above mentioned objectives' were functions and these functions had been indeed mentioned in sections 3.2 and 3.3. If the so-				

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			called objectives refer to the functions listed in section 2.1 or all section 2, this reference should be given in detail, i.e. including the section number since the objectives or functions are not directly 'above mentioned'. Moreover, there is no clear difference between an objective and a function in the context of nuclear systems.				
22	3.5/All	*Comment*	Former paragraph 3.4 conveyed in a more proper way what meant to say.			X	Former 3.4 para did not say anything. Here it is clear that the generic design recommendations should not be design dependent
23	3.6/Addition	*Comment*	The design basis should include other items such as those listed in former 3.8 as support systems (e.g. electric or hydraulic) or the single failure criterion.			X	Included in the bullet Engineering design criteria
24	3.6/4	The postulated initiating events and the assumptions taken on systems availability and plant initial and boundary conditions they have to cope with	Clarification's sake.			X	Do not confuse rules used for the safety demonstration and the design process

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25	3.8 – 3.10	*Comment*	Treatment of PIEs in former version was correct. Therefore, no modification in this respect is suggested to carry out.			X	PIEs and hazards wre mixed and it was a mistake
26	3.10/Addition	Alongside with the PIEs, scenarios leading to limited or extended fuel damage classified as Design Extension Conditions accidents (see IAEA SSG-2, Rev. 1) should also be deterministically imposed to check the system performance in mitigating the accident consequences to the extent possible.	The title of the current subsection should be updated accordingly.			X	Included in 3.8
27	3.8/2	and categorized according to their frequency of occurrence.	The end of the sentence is missing. Categorization criteria should be indicated.	X			
28	3.9/1	*Comment on* 'for each of the conditions above'	Which conditions are referred to?	X			
29	3.10/1	The most challenging consequences for the RCSAS performance caused by the PIEs evolution should be...	The concept of 'bounding conditions' should be clarified.			X	Bounding conditions is correct
30	3.13/Addition	RCSASs designed to mitigate the consequences of DECs should not be compromised with the DEC evolution including the derived environmental conditions	Since systems falling under RSCSAs should also cope with DEC scenarios, i.e. designed to mitigate the consequence of severe accidents, and PIEs do			X	The clause is clear enough

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			not embrace DECs (see IAEA SSG-2, Rev. 1), DECs should be independently mentioned.				
31	3.14/All	For those RCSASs performing safety functions, their design should prevent common cause failures deriving in the total loss...	'Protection' should be replaced by 'design'.			X	"Protection" is here also appropriate
32	3.17	*Comment on* 'physical protection'	The concept of physical protection is not sufficiently clear, e.g. when stating that 'when physical protection is not effective, the SSC should be designed to withstand...". What is then the difference between that physical protection and the SSC itself able to withstand the hazard but different with respect to that physical protection?				With the 1st option there is no need for equipment to withstand the loads
33	3.23/2	necessary to achieve the practical elimination of scenarios leading to early or early large radiological release,	It would be convenient to refer in first place to the relatively new Agency concept of 'practical elimination'.			X	Reference to SSR2/1 rev 1 Req 17 is given at the top of the para "External Hazards"
34	3.24/All	in the event of external hazards, the RCS integrity should only rely on RCSAS requiring human actions whose implementation time has been proven to fit with the emergency procedures implementation, accident evolution timing and environmental	Req. 5.17 does not actually limit such actions to rely on permanent systems but on onsite equipment (since preventing the use of offsite equipment). Nonetheless, IAEA SG on deterministic safety analysis		Has been modified		

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		situation consequence of the external hazard.	recommends not using non-permanent equipment during the very first hours after the onset of the accident. However, this condition is currently under review so a consensus has not been reached for the time being.				
35	3.25/All	RCSASs should be designed to meet with their safety functions without depending on offsite equipment during the short-term phase of the accident which it is usually taken as of the first 72 hours after the PIE.	This paragraph should be rephrased since core cooling is not the only RCSAS function that should be met before offsite equipment and associated actions can be effectively implemented.				What else?
36	3.26/All	PIEs relevant for RCSASs design should be analysed by each challenging safety function met by the system. The sequence evolution derived from the PIE should agree with the general design basis criteria for the systems performance to meet with the plant safety criteria.	Clarification's sake.			X	Your proposal is too general, a safety guide aims at providing guidance to identify the set of accident conditions to be considered for design
37	3.26/Addition	The RCSASs should be designed to meet with the acceptance criteria under Design Basis Accident conditions and to mitigate the consequences of Design Extension Conditions.	Clarification's sake.			X	3.26 is not the right cause for your point which is already correctly in this Draft

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38	3.27/List	PIEs to be considered for RCSASs include but are not necessarily limited to the following:	The list given in 3.27 is not about accidents but PIEs. Therefore, the text should be rephrased.		X		LOCA is an accident condition originated by a piping break (PIE)
39	3.31/1	… calculated the reactor coolant systems and each associated system.	Why the RCS should not be considered?				Clause 3.31 is correct. Your comment is not clear
40	3.32/All	RCSASs performance in compliance with the acceptance criteria by using accident sequence system codes should be demonstrated by application of one of the methods listed in IAEA SSG-2, Rev. 1.	Replace the text of 3.32 since it is not true that systems performance should necessarily follow a conservative approach: 'least favourable' in terms of ii.cc., bb.cc. and systems availability is only one among different acceptable approaches when demonstrating equipment performance accomplishing with the acceptance criteria.			X	Do not confuse safety analysis which is conducted according to a set of specified rules with the design process which aims at defining performances with margins
41	Between 3.32 and 3.33 / Title	Design extension conditions ~~(without significant fuel degradation)~~	This text should be removed since DEC-B like scenarios must be taken deterministically: there is no such argument stating that DEC-B has been achieved because of RCSASs total failure. Rather, RCSASs should mitigate the consequences of DEC, hence even DEC-B.			X	Systems for DEC-B mitigation are out of scope

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42	3.33/1	… accomplished by permanent systems and dedicated portable equipment.	1. Onsite portable equipment should be taken into account to mitigate DECs. 2. Otherwise an appropriate rationale supporting exclusion of such portable systems should be explicitly included. 3. Backfitting systems after Fukushima have extensively been based on such type of systems so credit should be given provided time and environmental restrictions are met in the design.		Modified		
43	3.31/Addition	Even if DEC with extended fuel damage implied RPV failure, there would be still the possibility for RCSASs to help mitigate the consequences of the accident by (i) injecting water into the containment via the RCS, or by (ii) removing heat from the containment by making use of associated systems such as suppression pool heat removal mechanism, or containment sumps recirculation and cooling. Therefore, such DEC scenarios should also be taken into account within the appropriate RCSAS design.	Rationale for considering DEC-B scenarios.			X	DS 481 is not a guide for SAM. New reactors should have permanent and dedicated equipment for DEC –B (see SSR 2/1 rev 1) and the safety demonstration submitted for the licensing should rely on this equipment only.

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44	3.34/2	… necessary to mitigate the consequences of limited or extended fuel damage scenarios"					See new text
45	3.39/2	… for the design of RCSASs (Cfr. IAEA SSG-2, Rev. 1)	This reference gives insights on how to approach the DEC identification task.			X	SSG-2 is not for safety demonstration and not for design
46	3.41	… for each operating state within the normal operation of the plant, and for the Design Basis Accident and Design Extension Conditions to the extent possible.	It is worth distinguishing between the convenience of setting different limiting conditions for operation according to different operational states or modes, and between them -belonging to the normal operation of the plant- and DBAs and DECs.				"…each plant state category" is correct
47	3.42 / 1	Reliability might be enhanced by due consideration given to the following factors: - Safety classification; - Redundancy and diversity to meet with the single-failure criterion and avoid common causes failures to the extent possible; - Probabilistic analysis results; - Human actions related to the system performance in all plant states; *(New para on* redundancy and diversity*)* Former para 3.29 and 3.30.	1. The introductory sentence should avoid mentioning some of the RCSASs functions because this is not the appropriate place to do it and because not all the functions, neither all the safety functions, are currently mentioned. 2. To provide with more detailed data and retain valuable information included in the former version of the SG.			X	Too general we need to provide guidance explaining which functions is targeted

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		(New para on probabilistic analysis results*)* In this context, probabilistic analysis results aim at demonstrating that the relative contribution to overall risk surrogates –e.g. Core Damage Frequency– features an adequate value commensurate with its degree of reliability. *(New para on* human actions*)* Operator actions under accident conditions should only be credited provided there is enough time to successfully perform the action according to the accident evolution timing. Credit for human actions should realistically account for the environmental factors affecting the human action acting as precursors of error. *Plus former paras 3.34 and 3.35*. *(New para on* failure dependencies*)*					
48	3.42/Addition	Even if passive safety systems do not rely on active support systems to fulfil their intended safety functions, their performance reliability should also be analyzed since under certain thermal-hydraulic circumstances such systems can fall short in meeting with the committed safety functions. Demonstration given in this respect	Passive safety system is a relatively new topic which should be explicitly addressed here. Even if their featured reliability is much higher than standard equipment, still it is not equal to 1, i.e. they can fail.			X	3.42 applies to any kind of systems (passive systems included): safety classification, engineering criteria, testing. This guide does not address the safety demonstration.

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		should be provided by dedicated comprehensive analysis of all the different thermal-hydraulic scenarios negatively affecting the expected system performance.					
49	3.43 to 3.51	- Equipment designed to mitigate Design Basis Accidents and Design Extension Condition scenarios should be able to fulfill their committed safety functions during the estimated mission time under the expected mild or harsh environmental conditions.	Even if the new NS-G-1.10 has also moved in the same direction in terms of adding a 'reliability' subsection (see new section 3.7), and even if both 'reliability' subsections contain the same exact information, I don't see clear benefits for the reader from just listing those items as they are too generic to give good indications on which aspects related to the system reliability must be in particular taken into account: - Para 3.43 is a reminder on RCSASs functions. Since it does not address particular aspects on reliability focusing on systems in charge of coping with a DBA, it should be removed. - Para 3.44 presents the single-failure criterion applied to the long term phase of the accident. However, such criterion stands for any safety equipment independently on the mission			X	Your proposal with "shall" and not "should" is a correct requirement. Not providing guidance on how to achieve the expected reliability for safety systems in this Safety Guide which includes most of the safety systems and safety features for DEC-A implemented in a NPP would be a mistake

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			time. Therefore, if kept, it should be upgraded (and extended by adding the DEC exception in this respect as mentioned in 3.51) - Para 3.45 refers to one of the several possible existing support systems of the RCSASs. However, there are many others equally important not mentioned in this sentence, e.g. DC, compressed air, etc. On the other way, AC may be not necessary for other RCSAS safety equipment. - Para 3.46 talks about redundancy and physical separation, topics that have already been presented before. No added value is been given here. At least this sentence should be upgraded and relocated before the dedicated subsections and this way be kept. - Para 3.47 is just a reference to other sections of the same report and should be removed. - Para 3.48 does not add any value. - Para 3.49 is about the identification of DECs with				

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			generic recommendations to adapt the system reliability accordingly. Regarding the identification of scenarios, it should more comprehensive to directly refer to paras 3.37-3.50 of the Deterministic Safety Analysis SG; otherwise much further clarification is needed to make the text a self-standing guide on this topic. Regarding adapting the reliability, no clear indication is included. - Para 3.51 does not add any significant value (save for the single-failure criterion already addressed above) in the comments.				
50	3.63 – 3.70	*Remove*	On the 'Environmental Qualification' issue, again I do not clearly see what valuable and new information is unfolded and provided here. To me, each of these general questions applicable to all type of nuclear systems should not limit to collect generic recommendations already available in other IAEA reports. This way the information is hardly useful to be used as a guide. Even if the guide is			X	So far there is no IAEA Safety standard dealing with environmental qualification

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			method-independent and design-independent, it should always include a more specific address to the main concerns dealing with the system in particular. For instance, in this case we might talk about SRV cycling and its capacity to work in presence of high primary temperatures typical of an extended fuel damage. Another example might be the environmental qualification of portable equipment which might be connected to the RCS –hence making part of it even if temporary: should those systems be also subjected to a harsh-conditions program? This kind of more specific questions are left open in the current guide, whereas the former version –limited to constrains given by the publication year– attempted to tackle with.				
51	3.71 – 3.81	*Remove*	Again, it is like if the entire subsection on 'loads and load combinations' had been taking directly from NS-G-1.10, where loads are crucial for containment design. However, within the RCSASs context,			X	Mechanical analysis of RCSASs is a crucial element for safety, Don't you remember that NRS had to clarify its position regarding the stress limits to be met in the case of

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			loads are not crucial aside from seismic issues –with the (non-mentioned) exception of the imposed mechanical loads in LBLOCAs on the faulted leg. Therefore, I find this entire subsection too generic and not specifically focusing on RCSASs, thus it might be removed. Moreover, valuable information is provided in Table 2 and 3 of NS-G-1.10 (together with the engineering criteria subsection), i.e. specific information point at significant issues concerning containment and its equipment, but no equivalent if found here so far.				faulted conditions? Containment integrity cannot be maintained if the safety systems do not work when required.
52	3.94 – 3.96	Former 3.75 – 3.80	In-Service Inspection subsection should be recovered and incorporated as an introduction to these paras.			X	Pre ISI and ISI are much more detailed wih clauses 3.80 to 3.96 in comparison with former clauses 3.75 -3.80
53	3.99 / Addition	Former 3.51	I find very important to insist in the RCS layout to foster natural circulation. Therefore, I would suggest recovering the former text in this respect.			X	Clause 3.99 is for all RCSASs and not only for RCS. Your concern is well addressed in the different sections 5, 6 and 7 (several clauses)

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54	3.111 / Addition	Former 3.65	Key aspect of RCS interface. It should be added.			X	Bullets 1 and 2 of the clause are not relevant for the systems addressed in DS 481. Bullet 3 is so vague that it does not help
55	3.112 (within the 'containment isolation' subsection) / Addition	Analysis of the consequences of an Interfacing System LOCA. Response actions to mitigate the accident consequences if leading to early and/or large releases should be demonstrated whenever falling under the type of scenarios to be 'practically eliminated'.	ISLOCAs significantly contribute to the practically eliminated scenarios. Such issue was addressed in para 3.66 of the former version of the report, so that more emphasis should be even paid now. Current updating does not mention anything is this respect.				
56	3.114 – 3.117	*Comment*	General comments that can be extrapolated to any other NSSS/BOP system, which reinforces the suggestion to merge this document with other SGs addressing nuclear system design provided the current proposed structured is kept.				_
57	3.120 / Addition	Accident analysis codes to demonstrate compliance of emergency cooling systems belonging to RCSASs with acceptance criteria should be carried out by internationally recognized, validated up-to-date codes. User's expertise in charge of such activity should have been checked by the competent authority in featuring the	3.119 and 3.120 are too generic and does not address the specific codes used to validate ECCS.		Partly in 3.28		3.120 deals with the use of codes for design and manufacturing not for codes for performing accident analyses

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		minimum knowledge both in nuclear physics and thermal-hydraulics together with a deep understanding of the relying models implemented in the code.					
58	3.122 / Addition	Among different applications, Probabilistic Risk Analysis modeling of the RCSASs should be developed for the following purposes: - To help in risk-informed decision applications such as in-service inspection or maintenance rule. - To help identify the RCSAS components contributing the most to risk. - To identify best-estimate RCSASs success criteria to fulfill safety functions and avoid further accident evolution leading to depart from the acceptance criteria. - To help implement risk-oriented, comprehensive operational safety performance systems. - To help improve the collection of limiting conditions for operation, e.g. by identifying key equipment contributing highly to risk. - To help find the optimal timing for maintenance activities, i.e. unavailability frequency as a compromise between system operability and unavailability.	Current version of the probabilistic subsection is too poor and should be improved and extended. The proposed new text is just a mere suggestion.			X	Applications for operation are out of scope of this Safety Guide.

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59	4/3	*See 'reason'*	The first para after 'ultimate heat sink' lacks of para's numbering.				No recommendation just an introduction
60	4.9/1	Regardless site conditions and hazards, a diverse ultimate heat sink fully independent of natural-water-based heat sinks is recommended.	PRA results and operating experience demonstrate the high benefits of having a redundant UHS independent of the sea, river or lake.				See new 4.5
61	4.19 / Addition	Heat load analysis to determine compliance with RCSAS design should be recalculated in case of power uprating modifications.	UHS performance can substantially be increased in case of power uprate.			X	Power uprate is out of scope
62	4.19 / remove and replace	RCSAS should be designed to cope in the long term with all heat loads resulting from DEC sequence definition to the extent possible as imposed in the DEC scenarios consideration.	Additional input energy like the exothermal energy generation by cladding oxidation should only be taken into account within the correct consideration of DEC sequence simulations performed with severe accident analysis codes.				See new text for UHS
63	4.19	*Gap*	The first para after 'residual heat transfer chain' lacks of para's numbering.				_
64	4.22/1	… not designed to operate under RCS stand-by operating mode conditions, the residual heat can be removed through the secondary side (in PWR and PHWR designs)…"	Standard RHR system can operate in the range of modes 4 – 6, i.e. from hot shutdown to refuelling going through cold shutdown.				The purpose of this clause is to highlight a possibility of diversity

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65	4.44/All	The RCSASs should be designed to allow for transferring heat to the ultimate heat sink even under DEC scenarios to the extent possible in terms of environmental qualification and performance conditions. For instance, systems performing safety functions should be able to transfer their heat –directly or indirectly– to the ultimate heat sink without relying on AC power or any other supporting system.	It is not clear why Level 1 PRA is important in DEC scenarios. Provided examples are not very clear. They will have to be rephrased and extended.			X	Your proposal is correct for a requirement but not helpful A Safety guide aims at providing guidance and examples of good practices
66	5	*General*	No clear description is given on which systems usually belong to the ECCS, i.e. how ECCS is usually taken into account according to different RCS pressures and considering different active and passive components.			X	See para **Core cooling in accident conditions**
67	5	*Gap*	The first para after 'reactor coolant system' lacks of para's numbering.				Introduction
68	5.35/Addition	Alternative means to ensure primary pressure depressurization through a secondary side depressurization under DEC scenarios, e.g. in the event of a total loss of main AC and DC sources, should be provided.	Secondary depressurization is one of the key actions to drive the plant to a safe state under prolonged SBOs or at least to mitigate the consequences of DEC scenarios and to avoid HPME –thus DCH–			X	Why through the secondary side? A safety guide does not aims t providing design solutions

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			phenomenon.				
69	5.45/Addition	Even if not a Postulated Initiating Event, an interfacing system LOCA caused by left-open valves located between the primary system and outside containment during the recirculation switch should also have to be analyzed and categorized according to its associated risk.	ISLOCA during recirculation switch can have a significant contribution in Level 2 PRA results in terms of large or early release frequencies.				5.45 deals with
70	5.52/Addition	The layout of safety equipment located in the auxiliary building and subject to the consequences of an ISLOCA should take into account the progression of the scenario in terms of maximum flooding elevation and pressure peak provided the equipment is useful to mitigate the consequences of the accident.	ISLOCA as IE might be classified under the practical elimination category. To provide with improvements in the plant response by assuming the onset of this type of accident and account for safety equipment in the long term might substantially mitigate the accident progression.				Comment not understood. This clause is a recommendation for the layout of RCS only
71	5.53/3	DBAs and DEC (among which ATWS should receive special attention)	ATWS does not constitute a different category than DECs.				Yes, but ATWS is probably the more severe DEC-A with regard to the primary pressure
72	5.57/Addition	For those RCSAS components located in auxiliary building locations subject to the consequences of an ISLOCA should be analyzed and environmentally qualified					

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		accordingly to the extent possible.					
73	5.71/Addition	Cooling of the RCP seals should be performed by means of two independent systems in normal operation conditions.	LOCA through the RCP seals constitute one the weakest points of the RCS integrity. At least two different means to keep them under safe stable conditions should be guaranteed.				
74	5.71/Addition	Cooling of the RCP seals should be guaranteed under DEC scenarios such as loss of offsite electrical power and standard diesel generators, and loss of UHS. RCP passive shutdown seals should be implemented to the extent possible.	Same reason than above.				
75	5.84/Addition	All types of break sizes in the hot leg, cold leg, steam generator tube, interfacing piping, vessel and vessel head should be analyzed with the help of best-estimate accident sequence analysis codes to check that the RCSASs involved in safety functions behave as expected and that the resulting frequency of not meeting with the acceptance criteria ranges around the average values of similar plant designs.				X	Various sizes of breaks and locations are postulated and analyzed but are part of the safety demonstration. Moreover this clause aims at drawing attention that a design with some piping designed and manufactured to have a leak before break behavior should not be a

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							justification not to postulate a 2A break
76	5.85/1	… used in the reactor pressure vessel…	'Reactor building' does not apply to PWR designs.				See new text
77	Between 5.86 and 5.87	*See 'reason'*	The first para after SYSTEMS FOR COOLANT INVENTORY AND CORE REACTIVITY CONTROL IN OPERATIONAL STATES' lacks of para's numbering.				Introduction
78	Between 5.86 and 5.87/1	The main functions typically performed by the Chemical and Volume Control System (CVCS) are the followings:	Since the functions are afterwards listed, why should some of them be introduced in the first paragraph?		X		
79	Between 5.86 and 5.87/2	Remove: "The CVCS is also designed to control RCS pressure when RCS pumps are shut down by spraying RCS pressurizer".	CVCS does not perform this function in many plants.			X	See 5.22 How do you decrease the RCS pressure when RCPs are no longer available?
80	Between 5.86 and 5.87/6	Remove: "control of the RCS pressure in shut-down modes".	I don't recognize this function as a standard CVCS function for many PWR designs.			X	See 5.22 How do you decrease the RCS pressure when RCPs are no longer available?

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81	Between 5.86 and 5.87/Addition	Provide high pressure flow for the emergency safety system during accident conditions	HPSI usually shares CVCS components like the charging pumps.			X	30 years ago but no longer for new PWRs (independence of levels of defense)
82	Between 5.86 and 5.87/Addition	Provide a means to fill up, drain and hydrostatic test of the RCS	This function is usually accomplished by the CVCS.			X	RCS test pressure cannot be reached with CVCS pumps
83	Between 5.86 and 5.87/12	… may be used to give adequate response to an accident condition and drive the plant to a safe shut-down state…	Further clarification.				–
84	5.93/Addition	The CVCS should store enough boric acid to bring the RCS to a cold shutdown boric acid concentration in the worst case where the highest reactivity control rod has failed to be inserted into the vessel.	Additional design criterion.			X	This safety function cannot be achieved by an operational system but is accomplished by the Emergency Boron injection system. For normal shutdown CVCS + boric acid make up system have this possibility. Will be addressed in the Safty Guide addressing the Auxiliary systems. Again, DS 481 is not a guide system oriented.

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Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
85	Between 5.93 and 5.94/Title	Systems for heat removal in normal operation	'Operational states' include AOO such as loss of normal electric power which might activate the reactor protection system thereby closing the MFW pump inlet valves.		X Additional clauses have been added	X	Headline is correct. The systems operated for these functions should also be capable to remove residual heat in operational states
86	Between 5.93 and 5.94/Replace the first para	The generated heat in normal operation conditions is transferred from the RCS to the steam generators through usually two independent systems called the Main Feedwater System (MFWS) and the Auxiliary (or Emergency if used under accident conditions) Feedwater System (AFWE or EFWS). During Low Power and Shutdown modes, the decay heat is first transferred by the AFWS and subsequently by the Residual Heat Removal System (RHRS) to the final UHS (atmosphere or water-based sink).	RHR uses to take over the heat sink function during modes 4 to 6 where the SGs are not working anymore.			X	DS 481 does not aims at describing systems current design options
87	Between 5.93 and 5.94/5	The Main Feedwater System (MFWS) is usually constituted by one turbine-driven pump per steam generator and provided with controlled and isolation valves. Once the neutron power decreases below a certain level, usually close to 1% – 2%, a different independent system called Auxiliary Feedwater System (AFWS) is connected whereas the MFWS pumps are stopped.	For clarification's sake.				No description

COMMENTS BY REVIEWER Reviewer: Juan Carlos de la Rosa Blul Page of 41 Country/Organization**: European Commission Joint Research Centr**e Date: Oct 26, 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
88	5.95/1	The AFWS should be designed to bring the RCS from the startup mode down to the hot shutdown mode where RCS pressure and temperature are compatible with…	For clarification's sake.				No description
89	5.98/1	The valves located at the impulsion of the MFWS pumps should be…	For clarification's sake.			X	Too detailed, recommendations should leave flexibility in the design options
90	5.101/1	Remove the entire sentence and replace it by the following one: "each SG should be able to be independently isolated by means of operator actions taken from the Control Room".	SG isolation actions are manual, i.e. they have to be performed by the turbine operator. Such isolation actions are also fundamental under SGTR scenarios. Since such actions are not part of the SG design basis since they are not automatically actuated, this sentence should be omitted.		X Each SG should be able to be independently and reliably isolated.		
91	5.104/3	*See 'reason'*	The bypass valves are usually designed to accommodate a 40% load rejection **without reactor trip**, i.e. such capacity is usually put in terms of avoiding reactor SCRAM. Therefore, please check the sentence.			X	A full load rejection transient is correct
92	Between 5.106 and 5.107/1	From hot shutdown mode down to refueling mode the residual heat is transferred to the UHS via the RHRS.	RHRS is usually started up in Mode 4, i.e. 350 F and 25 kg/cm2.			X	If we do not want to be too design dependent, the proposed text as an introduction to the para

COMMENTS BY REVIEWER Reviewer: Juan Carlos de la Rosa Blul Page of 41 Country/Organization: **European Commission Joint Research Centre** Date: Oct 26, 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							"in RHR mode" is correct. Generally RHR cannot be operated at hot shutdown conditions.
93	5.113/Addition	The RHRS should be able to transfer the borated water stored in the Refueling Water Storage Tank to the refueling cavity and the other way around at the beginning and end refueling phase.	Important function usually carried out by the RHRS.			X	This is an operational function and not a safety function which might be accomplished by other systems.
94	5.113/Addition	The RHRS helps control the primary pressure when solid and helps cleaning up the primary inventory during shutdown and startup by means of interconnections with the CVCS.	Important function usually carried out by the RHRS.			X	Too much design dependent. RCS operation is less and les recommended. Some new design operate RCS with a nitrogen blanket at low RCS temperature. Again your proposal is too much design oriented
95	Between 5.124 and 5.125 / 9	… by means of the so-called Feed and Bleed (F&B) mode of opening at least one pressurizer pilot-operated relief valve and at the same time injecting water to the RCS from the ECCS.	For clarification's sake.				–
96	5.125/3	Remove or correct "*(see items 5.144 and 5.145)*".	There is no clear relation between the text and the referred paras.	X			Reference to 5.144 and 5.145 was wrong

COMMENTS BY REVIEWER Reviewer: Juan Carlos de la Rosa Blul Page of 41 Country/Organization: **European Commission Joint Research Centre** Date: Oct 26, 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
97	5.126/4	Complementary decay heat removal by the steam generators. In case that the High Pressure Safety Injection belonging to the ECCS failed, the RCS should have to be depressurize whether through a rapid secondary side depressurization or through F&B mode.	For clarification's sake.				Correct
98	5.133/2	side, the ECCS should be designed to meet with the acceptance criteria under a so-called Feed and Bleed (F&B) mode, where the ECCS injects borated water into the RCS and the operators have opened at least one pressurizer pilot-operated relief valve to discharge the decay heat generated by the fuel elements.	For clarification's sake.				Text is correct
99	5.133/Addition	Alternative means to inject water into the RCS by equipment relying on different support systems is recommended to face DEC scenarios to the possible extent.	DECs should be taken into account by providing alternative and additional means to inject water into the vessel.			X	Systems to cope with DECs should be sufficient to cope with all postulated DECs. Or sequences not retained as postulated sequences, safety might be ensured by the use of non-permanent equipment
100	Between 5.142 and 5.143/remove	*See 'reason'*	Read the first comment above on the text placed between paras 5.93 and 5.94. In shutdown modes the heat is mainly transferred to the UHS via (or at least also by) the RHRS.			X	RHRS cannot be operated in hot shutdown conditions

COMMENTS BY REVIEWER Reviewer: Juan Carlos de la Rosa Blul Page of 41 Country/Organization: **European Commission Joint Research Centre** Date: Oct 26, 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
101	5.150 and 5.151	EFW isolation should be possible to be performed by the MCR in case of SGTR or MSLB events.	As currently formulated, both paras do not belong to design specifications since they refer to manual actions performed by the turbine MCR operator.			X	EFWS is automatically isolated by safety classified I&C sytem
102	5.151/Addition	The EFW should be provided with an automatic controlled water level.	Due to the high stress typical of accident conditions, and in order to relief operators from some of their loads in following the corresponding emergency procedure, the operating experience and PRA Level 1 results have demonstrated that such human action significantly contributes to the risk figure of merit, i.e. Core Damage Frequency.				SG water level is controlled between low and high water levels.
103	5.152	*Remove*	Steam-dump valves are located in the steam header, hence in the steam line downstream the SG MSIVs. Therefore, they cannot be isolated but the MSIVs should be rapidly closed after a SGTR is detected, at least and in the very first case the one belonging to the affected SG; otherwise the other MSIVs. Again, as in 5.150 and 5.151, even if this statement were correct, this is about a human action following an accident so it has nothing to do		X Main steam relief trains		Relief valves to the atmosphere not to the main condenser

COMMENTS BY REVIEWER Reviewer: Juan Carlos de la Rosa Blul Page of 41 Country/Organization: **European Commission Joint Research Centre** Date: Oct 26, 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			with aspects concerning the design.				
104	Between 5.152 (not included) and 5.156	*Remove*	All these statements have already been included above. Moreover, the current wording needs important improvements so that it should at least be deeply rephrased.			X	As recommendations are given on the basis of the functions to be accomplished and not on the basis of systems or design solutions, this functions must be addressed even if in some design that function is accomplished by a system designed for multiple functions
105	5.157/9	… from the core by means of a continuous feed and bleed strategy, i.e. using a large-capacity tank enough to inject borated water into the vessel during the first hours of the accident, usually 72 hours.	For clarification's sake.			X	For a primary side, the Feed and Bleed strategy is expected to be efficient for longer time (recirculation mode inside the Primary containment)
106	5.159/Addition	Strategy for a fast primary system depressurization through the secondary side depressurization under DEC conditions should be analyzed in detail as a better alternative than making use of pressurized pilot-operated relief valves since it reaches primary depressurization without loss of the	This is one of the most relevant actions to be performed in DEC scenarios.			X	For a fast RCS depressurization to prevent a DCH this recommendation corresponds to the MS practice

RESOLUTION

Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		primary inventory.					
107	6	*General*	Former structure of not splitting the report contents of PWR and BWR into dedicated sections was clearer. Otherwise large parts of both sections are duplicated, just like in the first paragraphs of sections 5 and 6 (at this first stage, at least all section from 6 to 6.9, 6.11, 6.12, 6.18, 6.19, 6.58, 6.59, 6.60, 6.76, 6.94 – 6.103 (with only few exceptions), listed PIEs in 6.41 (with limited few exceptions) and many other contents). In this respect, 6.22 or 6.33 are exceptions confirming the rule so that they should be specifically addressed and well accommodated within a common merged chapter for both PWR and BWR designs.				Not commented by Japan, Finland or US that operate BWR
108	6	*General*	All the non-PWR-specific comments made to section 5 are also applicable to section 6.				Not commented by Japan, Finland or US that operate BWR

COMMENTS BY REVIEWER Reviewer: Juan Carlos de la Rosa Blul Page of 41 Country/Organization: **European Commission Joint Research Centre** Date: Oct 26, 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
109	After 6/5	During normal operation the RCS transports the coolant out of the vessel under the form of steam until reaching the main turbine generator.	For clarification's sake since the steam exists only after the flow passes through the core.				Not commented by Japan, Finland or US that operate BWR
110	6.10	*Comment*	In line with the general comment above, why for instance 6.10 should not apply to PWR designs? The same goes for paras from 6.53 to 6.56.				Not commented by Japan, Finland or US that operate BWR
111	Between 6.31 and 6.2/1	*Remove all this text*	The RCPB term has already been used in many different locations throughout the text so it should not be defined here. Such definition should basically coincide with that used within the PWR context, i.e. before 5.38.				Not commented by Japan, Finland or US that operate BWR

COMMENTS BY REVIEWER Reviewer: **Moustafa Aziz** Page.... of.... Country/Organization**:** **Nuclear and radiological Regulatory Authority , Egypt** Date:				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	**Para 2.5**	**They include systems that operate once the reactor in shutdown and system to cool down RCS to cold shut-down conditions including refueling conditions in PWR and BWR.**	**is replaced by in to clear the meaning of the sentence.**			X	Sytems necessary to maintain the reactor in hot shutdown mode and systems necessary to coll down the reactor to cold shutdown conditions are different
2	**Para 2.10**	**The ultimate heat sink is usually a body of water , sea , the groundwater or the atmosphere.**	**sea is available ground water.**				Body of water includes sea rivers, lakes, etc.
3	**Para 3.33 to para 3.39**		**Para 3.33 to 3.39 discuss design extension condition without significant fuel degradation , my question if there is no discussion to the second type of the accident : Design extension condition with significant fuel degradation or core melt.**				Accident with core melting are addressed in DS 482
4	**Page 2**	**CONTENTS**	**The word "Contents " should be added to the top of page 2 to indicate the contents of the document**	X			
5	**Para 3.98 Page 25**	**The same code should be used for the design**	**The same replaces A same to clear the meaning**	X			

COMMENTS BY REVIEWER Reviewer: ENISS Country/Organization: ENISS		Page: 1 of 5 Date: 28/10/16		RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	3.12	Items necessary for a safe shutdown of the reactor and for the mitigation of the accident conditions should be protected against the effects of internal hazards, either at the origin of the accident, or occurring independently during the safe shutdown of the plant**.** That protection should also consider the consequences of the failures of items non-protected.	The requirements for protecting item against the effect of internal hazards should depend on the accident conditions whether they are caused by the internal hazards or not.			X	This supplement is not necessary, it is preferable to keep the recommendation a bit more general as propsed.
2	3.32	…, and the single failure which has the largest impact on the performance of the safety systems (see the overarching requirement 25[2]).	It is worth referencing SSR2/1 for the application of the single failure criterion to the DBA	X			
3	3.33	Short term (*) mitigation of design extension conditions (DECs) should be accomplished by permanent systems. (*) Current practice in some States is that credit is given in the safety analysis to the availability of non-permanent equipment after, for example, 8 hours for equipment stored on-site or 72 hours for equipment stored off the site	It should be authorized to use non-permanent systems for long term mitigation of DEC (see SSR2/1 para 6.45A). Proposal to add “short term” with a footnote.		X ***…should be accomplished by permanent systems to the extent possible. Short term actions should be implemented by permanent equipment.***		
4	3.35	Calculations performed to specify the design bases of RCSASs equipment may be less conservative than those used for design basis accidents ~~provided that margins are still sufficient to cover uncertainties.~~	Calculations with margins that cover uncertainties should be sufficient for design bases accidents. For DEC, best estimate calculations should be			X	A SG should provide some guidance. This recommendation outlines that whatever the accident category the design should be

		~~Performing sensitivity analyses could also be useful to identify the key parameters for which uncertainties should preferably be considered.~~	allowed. (see SSR 2/1 clause 5.27)				such that some margins have been considered to cover uncertainties.
5	3.44	Systems operated to maintain the reactor in a safe state in the long term should be designed to accomplish their function despite a single failure postulated in any of those systems, <u>unless it has been demonstrated with a high level of confidence that occurrence of such failure is very unlikely</u>.	See SSR2/1 para5.40 for passive single failure		A failure of a passive component might not be considered if justified.		
6	§4 – Ultimate heat sink - General	Reformulation of sub paragraph to include the ultimate heat sink with unlimited volume (river, sea) and not only the ultimate heat sink with limited volume of water (cooling tower).	Several paragraphs give recommendations for ultimate heat sink considering this is a limited capacity of water and don't take into account the fact that ultimate heat sink can be an unlimited amount of water (river, sea). In this case, recommendations are not exactly the same.	X	See new paragraphs		
7	§4 – Residual heat transfer chain	Reformulation of sub paragraph to keep open the possibility to use different kind of technology that ensures integrity of the system such as a double walled heat exchanger and not only recommend the use of an intermediate cooling system.	This formulation forces to have an intermediate cooling system, whereas some technologies could achieve the same level of confinement.			X	A safety guide also reflects good practices. Some BWR in operation do not have an intermediate and closed cooling system but this design option is no longer retained for new designs. This why this SG recommends the implementation of an intermediate and

							closed system.
	§4.1	“Where water is the medium selected as the ultimate heat sink, the following attributes should be considered: • The type of cooling water supply (e.g. ocean, lake, river or natural or human made reservoir); • The capability of the heat sink to deliver the necessary flow of cooling water at appropriate temperatures specified for the different plant states. **If ultimate heat sink is made of a limited amount of water, following attributes should be especially considered:** • The size of the water supply • Make up sources to the ultimate heat sink”	Reformulation of §4.1. Indeed, some attributes don’t apply in case of an unlimited water supply (river, sea).		See new paragraphs		
8	§4.3	**If an ultimate heat sink with limited amount of water is chosen,** design basis environmental parameters should be established in determining the necessary capacity of the ultimate heat sink.	Reformulation of beginning of §4.3 to indicate that this paragraph only deals with ultimate heat sink with a limited amount of water.		See new paragraphs		
9	§4.4	Recommendations and guidance on the consideration of external events in the design of the ultimate heat sink (~~seismicity,~~ extreme temperatures and conditions, floods, tsunamis, high winds, biological phenomena, collision with floating bodies, etc.) are provided in Ref. [5].	Deletion of “seismicity”. Indeed, according to §References, reference [5] excludes Earthquake.	X			
10	§4.5 / §4.11	Deletion of the nota 6 and 7: “An	These are the only			X	Examples of numeric

		autonomy of 7 days at the site should be considered as a minimum" – "In some States the acceptable minimum capacity of the immediately available sources of water, including water stored on-site in tanks or reservoirs, absorbs all heat loads generated in 30 days, unless a shorter time period can be justified by conservative analysis."	quantitative objectives in the document. Furthermore, other designs can have an equivalent level of robustness (use of a mobile make up for example).				system performances used by MS can be given in a SG (not in Requirement document) as examples of good practices. Relying on mobile equipment to demonstrate the reliability of the ultimate heat sink would be questionable.
11	Paragraph below Title "Residual heat transfer chain"	Residual heat transfer chain includes the intermediate cooling systems and the cooling system directly associated to the ultimate heat sink. The intermediate cooling system is designed as a closed loop system which transfers heat loads from heat residual systems to the cooling system directly associated to the ultimate heat sink. The cooling system directly associated to the ultimate heat sink ~~is an open loop system that~~ takes water from the ultimate heat sink ~~(pumping station~~) and provides cooling to the intermediate cooling system, and discharges transferred heat loads to the ultimate heat sink.	System directly associated to ultimate heat sink can be a closed–loop system.		See new paragraphs		
12	§4.34	An activity monitoring system should be designed to detect activity in the intermediate cooling system <u>if this system is used during normal operation.</u>	If system is only used during accident situations, monitoring of activity seems not necessary			X	It is the case (4.34 is in the para. "Residual heat transfer in operational states"
13	§4.36	Pumps of the cooling system directly connected to the ultimate heat sink should be protected against debris and	Reformulation of paragraph, as the two bullets are not directly			X	Same as above

		biofouling effects. For intermediate cooling system used in normal operation a monitoring of the heat exchangers fouling and a cleaning program should be implemented with appropriate frequency in order to limit the degradation of the system heat removal capability. A program of surveillance and control techniques should be implemented to reduce significantly the incidence of flow blockage problems from biofouling.	linked with first sentence, and because the surveillance and control only concerns system used in normal operation.				
14	References		There is no [6] document.				

COMMENTS BY REVIEWER Reviewer: M-L Järvinen, Page.... of.... Country/Organization: STUK Date:				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	3.103	Content of cobalt, antimony, silver and other easily activated nuclides of all materials in contact with the reactor coolant should be minimized to avoid activation in the core radiation field of entrained corrosion products leading to production of nuclides like cobalt 60, antimony 124, silver 110m.	Cobalt is important but it's not the only radiation source to be minimized/optimized through material selection.	X			
2	5.100	In the event of an uncontrolled and excessive SG depressurization (e.g. in the event of a main steam pipe or main feed water pipe break), the affected steam generator should be reliably isolated from other steam generators	Spelling mistake	X			

3	5.101	In the event of a significant activity level detected in one SG, the affected steam generator should be reliably isolated	Spelling mistake	X			
4	5.105	Main steam system should be designed such that one main steam line break could not lead to the depressurization of more than one steam generator despite a single failure in the SG isolation system	Missing word	X			
5	5.79	The design should include provisions for sampling of fluids from relevant locations of the secondary side.	Plural form is needed in the sentence	X			
6	new	The design should provide provisions for taking samples of all relevant systems and locations to ensure sufficient system integrity control and (radio)chemical parameter inventory.	In 5.74 it is said that the design should provide provisions for taking samples of secondary side water and in 5.79 that the design should include provisions for sampling of fluids from relevant locations of the secondary side. It is not clearly stated that the same should be provided for other systems (e.g. primary circuit, cooling circuits etc). To be more consistent, the demand for sampling points could be stated generally in a separate recommendation				5.74 is deleted (repetition of 5.79)

COMMENTS BY REVIEWER	RESOLUTION
Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments GRS) Page 1 of 12 Country/Organization: **Germany** Date: 14.10.2016	

Relevance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1	3.27	Main steam/SG feed water piping break (PWR, BWR and PHWR)	Not clear, why recommendation not relevant for BWR.				
1	2	3.39	… and measures and procedures to cope with those DEC should be described in operating manuals.	Missing recommendation.			X	DS 481 is for design
1	3	3.42	• Operation instruction and training to manage normal operating states and accidental conditions.	Important regarding reliable plant operation.			X	DS 481 is for design
1	4	Headline of 3.43ff	Systems designed to ~~mitigate~~ cope with design basis accidents	The plant should cope with design basis accidents and control them. Mitigation is too weak.	X			
2	5	3.52	Alternative and independent means belonging to different levels of defence, necessary…	Clarification.			X	Req. 7 requires for multiple means. Independence should be implemented to the extent possible For UHS, and the associated cooing chains, independence is usually not fully achieved.
2	6	3.83	~~Use of materials with~~ The sensitivity of the used materials for activation under neutron irradiation should be minimized to the extent practical.	Practically all materials have some sensitivity. Not the use of materials should be minimized but their sensitivity.	X			

2	7	3.84	Materials should be selected to be suitable for the service conditions expected in all operational states and accident conditions. ~~If the materials selected do not meet the specifications, t~~ They should be qualified by means of analysis, testing, the feedback and analysis of operating experience, or a combination of these.	There is no need to give guidance to an exemption from the rules. Besides, all materials should be qualified, not only those not meeting the specifications.	X				
2	8	3.87 First bullet	• Embrittlement due to neutron irradiation ~~(including Irradiation-Assisted Stress Corrosion Cracking (IASCC))~~ • Irradiation-Assisted Stress Corrosion Cracking (IASCC)	Embrittlement and IASCC are different phenomena and should be listed separately.	X				
2	9	3.88	The design should incorporate provisions ~~recognizing the need~~ for those in service activities~~, as well as to permit the repair, replacement and modification of those SSCs~~ likely to be required ~~such actions,~~ due to operational service conditions. These activities include repair, replacement and modifications. ~~of those SSCs~~ In addition, provisions should also be incorporated for activities which need to be carried out during the construction and commissioning phases ~~should be identified~~.	1. Clarification of the phrase. 2. Provisions should also be incorporated for construction and commissioning activities. Identification is not sufficient.		X			
2	10	3.93 Second bullet	• Non-destructive examination of the RPV and RCS welds and other representative areas utilizing volumetric (through wall) and surface examinations in what is commonly referred to as pre-service inspection (PSI). These examinations are important to establish the baseline condition to be used as comparison to the in-service ~~examination~~ inspection (ISI) results;	Other areas than welds that are considered representative in the sense of being most likely subject to degradation due to the impact of high stresses and/or corrosion should also be included in the ISI program and therefore also included in the baseline inspection program. Consistence of terminology for ISI.	X				

2	11	3.93 Fourth bullet	• Establishment of a surveillance ~~sample~~ program utilizing material samples that are installed in the RPV and removed on a scheduled basis. These samples when removed are subject to mechanical testing, including tensile ~~strength~~ and Charpy impact or fracture toughness testing. Other samples or monitoring materials are analysed to measure the irradiation ~~flux~~ fluence that the RPV wall and the samples are~~is~~ being exposed to.	Editorial: avoid duplication. All samples are for mechanical testing. The proper wording is "tensile testing". The historical Charpy impact test may be replaced or complemented by direct fracture toughness tests, e.g. with three point bending or small compact tension (CT) samples. The neutron dose to be analyzed is "fluence" not "flux". This may be done by (scratch) sampling from the RPV surface or from the mechanical samples or by using different monitoring materials (dosimeters) that are included in the surveillance capsules.	X			
1	12	3.93 Fifth bullet	• During the performance of the PSI program, design features to facilitate and simplify the implementation of the in service inspection (ISI) program during operation should be identified. This should include consideration that many areas will not be easily accessible once operation commences. Adequate provisions should be made for the inspection of these areas to the extent reasonably practicable.	Identification is not sufficient.	X			
1	13	3.94	The welds of the RPV and RCS should permit volumetric (through-wall) examination of the entire volume of the wall as well as surface	Volumetric and surface examinations should be applied at different	X			

			examinations. For example, ultrasonic, eddy current or magnetic flux methods could be used for such examinations.	locations, in particular at components with cladding. Eddy current and magnetic flux methods are surface examinations methods.				
2	14	3.96 3rd bullet	~~Sourcing of RPV welded and base metal coupons to be made into~~ Coupons of sufficient size representing relevant inspection areas of the RPV and other major components subject of recurrent ultrasonic testing (e.g. welded joints and base metal with cladding, bimetallic welds, nozzle areas) should be stored to produce ultrasonic testing calibration blocks;	Clarification. Bullet could be transformed to separate paragraph.	X			ISI results are compared with the size of the maximum acceptable defect
2	15	3.96 4th bullet	The maximum acceptable defects in operational states and accidental conditions;	The maximum acceptable defect may be smaller under accidental loads. This might be relevant if consequential failure of the component concerned is not assumed.			X	ISI results should be analyzed by comparison with acceptance criteria (e.g. Maximum size for acceptable defects in operational conditions)
2	16	3.96 8th bullet	All c~~C~~ontrols ~~of the~~ during manufacturing ~~at the shop: R~~ should be referenced and traceable~~ility~~ for the operational lifetime;	Clarification of the intention; Also the results of the controls on site (mostly for welds) should be available, not only those performed at the shop.	X			
2	17	3.96 9th bullet	~~Implementation of the surveillance sample program.~~	Inspection criteria are not related to the surveillance program.	X			
3	18	3.97	All pressure retaining components of the RCSASs should be protected against overpressure conditions generated by	Editorial improvement	X			

			component failures or by abnormal operations in order to fulfil observe the pressure limits, in compliance with applicable proven codes and standards.					
3	19	3.98	A The same code should be used for the design, manufacturing and overpressure limit analysis of a given component.	Editorial improvement	X			
2	20	3.99 2nd bullet	Protection against the consequences of pipe failure; (depressurization wave, pipe whip, flooding, high pressure jet);	Also the depressurization wave may be relevant for piping elbows, supports and internals.	X			
1	21	3.99 Extra bullet	Provisions for seismic events;	Seismic events are also relevant for layout of piping and support structures.	X			
3	22	3.99 8th bullet	Provisions to minimize stresses in the piping and to facilitate also considering thermal expansion;	Editorial improvement	X			
2	23	3.104	If advanced materials are used in the design of RCSASs, Samples of RCSAS materials should be subjected to a high neutron flux and exposed to the environment of the reactor core. They should be examined periodically throughout the plant lifetime to monitor changes in physical properties (in particular ductility and toughness) and to enable predictions to be made of the behaviour of……	Clarification.	X			
2	24	3.107 Add a new para	A measurement should be installed to detect accumulation of combustible (radiolysis) gases.	Important for monitoring functionality of design and layout provisions (3.106)	X			
3	25	3.108	Provisions should also be provided for collecting leakages during normal operation. Leaks can occur from, among others, valve stems, valve seats, pump seals and inter gaskets cavities during reactor operation.	Editorial improvement	X			
3	26	3.111	• Equipment and piping support • Snubbers, hangers and supports and their	Single listing is unnecessary; better suited for additional detail in the	X			

			anchors;	following bullet				
2	27	3.112	~~Piping that penetrates the primary containment boundary should be provided with adequate isolation devices [15].~~	This paragraph is less precise than the paragraphs 6.22, 6.23, and 6.24 of SSR-2/1.			X	Containment isolation is addressed in Ref 15.
2	28	3.113	For system piping crossing the containment wall(s) containment extensions should satisfy the design ~~recommendations~~ requirements for the containment [15].	Clarification. There are clear design requirement.		See modification	X	
1	29	3.114	Means should be provided (pressure, temperature measurement) to monitor the tightness of isolation valves between high and low pressure sections.	Gained from operational experience.		X See section 5. Clause 5.44		
3	30	3.115	Consequences of sharing of sensors for different purposes should be considered in order to preserve adequate independence ~~between~~ of the different levels of defence in depth. Following recommendations should be implemented to the extent possible:	Editorial improvement	X			
2	31	3.119 Add a new para	A failure of a shared system may not have adverse effects on the neighbor plant.	Clarification.			X	Beyond the SSR 2/1 rev.1 requirement
1	32	3.120	• Operation manuals and staff training	Topic is missing.			X	Operation is not addressed in this Safety Guide
2	33	5.3 1st bullet	Excessive plastic deformation	Clarification. This failure is by plastic deformation.	X			
3	34	5.3 4th bullet	Progressive cracking due to ~~initiation (~~fatigue~~)~~;	Editorial improvement: crack propagation due to fatigue loading is generally not addressed as “initiation”.	X			
2	35	5.44 New para after 5.44	Means should be provided (pressure, temperature measurement) to monitor the tightness of isolation valves between high and low pressure sections.	Gained from operational experience.	X			
2	36	5.62	• Pressure ~~and temperature~~ limits as well as	Clarification.	X			

		2nd bullet	allowable heating and cooling rates as a function of temperature should be established for the pressure vessel. Changes of the brittle-ductile transition temperature of the beltline material due to neutron irradiation and thermal embrittlement should be accounted for. • ~~and t~~The vessel wall should be designed to withstand all the cyclic loads that are expected to occur over the plant lifetime. The design documentation should include clear specifications of those loads that are necessary for the determination of the cumulative usage factor;	P (T) limits should be separated from fatigue in different bullets as these are not directly related.				
3	37	5.62 3rd bullet	The choice of material, the structural design, the welding and the heat treatment should be such as to ensure a sufficiently ductile state of the material of the pressure vessel throughout the plant lifetime. The ductility of the pressure vessel wall facing the core should be ensured by limiting the maximum neutron fluence and by the use of base material and weld metal of a chemical composition such as to keep radiation embrittlement ~~below~~ at an acceptable level;	Editorial improvement, “below an acceptable level” does not make sense.	X			
3	38	5.62 4th bullet	The design of the pressure vessel should be such that it can withstand pressurized thermal shocks without ~~incurring a failure of~~ losing its integrity.	Editorial improvement	X			
2	39	5.63	A surveillance program utilizing material samples that are installed in the RPV should be established (see 3.93). If advanced materials were to be used in the reactor pressure vessel, samples of these materials should be subjected to a ~~high~~ fast neutron flux with high lead factor compared to the vessel wall and exposed to the environment of the pressure vessel. They	Clarifications: A surveillance program should be established in any case, yet there are special recommendations for advanced materials. “High” is not very precise, “lead factor” is the		X allowing for corrective measures if necessary.		

			should be examined periodically throughout the plant lifetime to monitor changes in ~~physical~~ mechanical properties (in particular ductility and toughness) and to enable predictions to be made of the behaviour of the material in due time allowing for mitigating measures if necessary.	generally used term for the surveillance samples. Ductility and toughness are mechanical properties. The goal of the predictions should be defined.				
2	40	5.75	Loadings such as those due to water hammer, overfilling and thermal and/or hydraulic stratification should be addressed for the operating modes in which they may occur.	The steam lines should cope with water filling up.	X			
2	41	5.83	~~Whether~~ If a leak before break or break preclusion concept is claimed for the design and manufacturing of piping, the specific and additional design/manufacturing requirements should to be met should be defined~~, based on similar considerations as for non-breakable equipment~~.	Clarification. It is important that the additional requirements are defined, yet what is “non-breakable equipment”? Any vessel or piping made of steel could break, see 5.3. Nevertheless principles of LBB or Break Preclusion may apply to piping and vessels.	X			
2	42	5.84	In addition, and in spite of the very low probability of the piping failure, the consequences of the double ended break of a pipe should be analysed with appropriate rules regarding: • ~~Structural behaviour of RCS equipment and associated internals~~; • Core cooling capacity; • Pressure build up inside the Primary Containment. • Environmental qualification of equipment in the containment necessary for safe shut down of the reactor.	If an analysis of the “Structural behaviour of RCS equipment and associated internals” including pipe whip, jet forces, and depressurization wave onto RPV internals could show that the reactor may still be shut down safely, then there would be no need for LBB or Break Preclusion concepts. These effects were the incentive to introduce these concepts. For jet forces and the	X			I agree with your statement justifying the need for a LBB behavior of the primary legs. However I thought that it was of interest to checking that a 2A break analysed with a realistic model of the break and effects would

				depressurization wave appropriate smaller leak sizes have to be defined.				not lead to unacceptable damage.
2	43	5.90	Low pressure systems connected to the RCS should be provided with overpressure protection devices. Other portions and components where design conditions can be exceeded during operations also should be provided with overpressure protection devices. Activation of this overpressure protection devices may not cause radioactivity release in the vicinity.	Further recommendation added.			X	Clause deleted. This clause was not related to the control of the reactor coolant inventory
2	44	5.102	Adequate activity monitoring should be available to allow detection of steam generator tube rupture and tube leaks. The accuracy of this monitoring should be adequate to meet limits specified for radiological consequences in DBAs.	Leak detection is standard.	X			
2	45	6/	….appropriate margins regarding the ~~failure~~ acceptance criteria for all	Clarification.	X			
2	46	6/	…in service inspection that aims at proving that ~~no damage~~ quality and functionality is ensured ~~occurs~~…	Clarification.		X ..quality of equipment is maintained.		
2	47	6.4 1st bullet	Excessive plastic deformation	Clarification (see 5.3)	X			
2	48	6.4 4th bullet	~~Flow induced vibration (FIV);~~	This is no failure mode. Failure may be by fatigue, see next bullet.		X		To be consistent with section 5
3	49	6.4 5th bullet	Progressive cracking due to ~~initiation; mechanical and thermal~~ fatigue;	Editorial improvement: see 5.3. There is no reason to explicitly mention mechanical and thermal fatigue for BWR only. If it should be mentioned then for both reactor types.		X		To be consistent with section
2	50	6.4 6th bullet	~~Stress corrosion cracking, erosion, embrittlement, thermal stratification, etc. should also be addressed.~~	These are degradation mechanisms, but not failure modes. These might be	X			Degradation mechanism are deleted

				listed as a separate paragraph, but not as a bullet in 6.4. If they will be listed, they should also appear for PWRs as there is no principal difference in that respect.				
3	51	6.5	Equipment of the RCS should be designed so that the stresses imposed upon it remain below the values defined for structural materials to prevent a fast ~~growth~~ crack growth during normal operational conditions, anticipated operational occurrences and accidents~~ without significant core degradation~~.	Editorial improvement. There is no reason to exclude severe accidents at this point. Fast crack growth is mainly an issue at low temperature.	X			
2	52	6.6	~~At low operating temperature the ductility and pressure resistance of some materials may be significantly lower. Where such materials are used for the manufacturing, the allowable loadings at low operating temperatures should be defined, and the pressure and temperature ranges determined to prevent the risk of brittle fracture of the component. Allowances for changes in the nil-ductility transition (NDT) temperature of the RPV over the operational life of the plant should also be accounted for.~~ • Pressure limits as well as allowable heating and cooling rates as a function of temperature should be established for the pressure vessel. Changes of the brittle-ductile transition temperature of the beltline material due to neutron irradiation and thermal embrittlement should be accounted for. • The vessel wall should be designed to withstand all the cyclic loads that are expected to occur over the plant lifetime.	In principle there is no difference to the recommendations for PWR, therefore the same text is proposed, see 5.62, 2nd bullet. The same issue is addressed again in 6.12, 2nd bullet. Therefore it is proposed to shift this text to 6.12.	X			

			The design documentation should include clear specifications of those loads that are necessary for the determination of the cumulative usage factor;					
2	53	6.12 2nd bullet	~~Pressure and temperature limits should be established for the RPV and should be allow it to withstand all the cyclic loads that are expected to occur over the plant lifetime. The design documentation should include clear specifications of those loads that are necessary for the determination of the cumulative usage factor.~~	See 6.6	X			
1	54	6.94 Add new bullet	• Instrumentation should be provided to control temperature and water level of the suppression pool.	This instrumentation is of highlighted safety significance (like RPV instrumentation)	X			

COMMENTS BY REVIEWER Reviewer: MVM Paks II Ltd Country/Organization: **Hungary** / MVM Paks II. Ltd. Date: 18/10/2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
3.	Draft DS 481 5.47	The integrity of the Reactor Coolant Pressure Boundary should be maintained in the event of earthquake (~~SL2~~DBE).	Design Basis Earthquake (DBE) or Safe Shutdown Earthquake (SSE) shall be used as the definition of Seismic Level 2.			X	Seismic SL2 is the IAEA terminology for the Safe Shutdown earthquake
4.	Draft DS 481 5.112	RHR should be designed to keep its operability in the event of a ~~SL2~~DBE earthquake.	Design Basis Earthquake (DBE) or Safe Shutdown Earthquake (SSE) shall be used as the definition of Seismic Level 2.			X	Seismic SL2 is the IAEA terminology for the Safe Shutdown earthquake
5.	Draft DS 481 5.164	The RCS fast depressurization system should be designed to withstand ~~SL2~~DBE seismic loads.	Design Basis Earthquake (DBE) or Safe Shutdown Earthquake (SSE) shall be			X	Seismic SL2 is the IAEA terminology for the Safe

COMMENTS BY REVIEWER Reviewer: MVM Paks II Ltd Country/Organization: **Hungary** / MVM Paks II. Ltd. Date: 18/10/2016				RESOLUTION			
			used as the definition of Seismic Level 2.				Shutdown earthquake
6.	Draft DS 481 6.45	The integrity of the RCPB should be maintained in the event of a ~~SL2~~DBE earthquake.	Design Basis Earthquake (DBE) or Safe Shutdown Earthquake (SSE) shall be used as the definition of Seismic Level 2.			X	Seismic SL2 is the IAEA terminology for the Safe Shutdown earthquake
7.	Draft DS 481 6.66	The seismic design of the vessel internals should ensure that the ability to safely shut-down the plant following a Design Basis Earthquake is maintained. This means that the internals that are considered to be part of the core support are classified as ~~SL2~~Seismic Category I. Other parts of the vessel internal need not be classified as ~~SL2~~Seismic Category I. but should not fail in a manner that would prevent the plant being from able to reach and maintain a safe shut-down condition.	SL2 is a seismic load level, not a Seismic Resistance Category.	X		X	Seismic SL2 is the IAEA terminology for the Safe Shutdown earthquake
8.	Draft DS 481 7.23	The steam generators are parts of the primary pressure boundary. The primary side should be assigned to the safety category1 and be designed to withstand ~~SL2~~DBE seismic loads. The design and manufacturing codes should be specified.	Design Basis Earthquake (DBE) or Safe Shutdown Earthquake (SSE) shall be used as the definition of Seismic Level 2.			X	

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page 74 of 9 Country/Organization: Japan / NRA-**Japan** Date: 26 Oct, 2016	RESOLUTION

No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
1	2.7.	Those systems are systems designed to control the core power distribution ~~axial off set~~ in power operation and to control margins to re- criticality in shut-down modes.	Completeness. "Axial off set" is only used in PWR. "Power distribution" is generally used.	X			
2	3.3./l1	……requirements ~~46~~ 47 to 53 of [2].	Editorial. There requirements are focused on reactor coolant system.	X			
3	3.6./1st bullet	· The fundamental safety function(s);	Editorial.			X	At the system or component level it is better to define the role/function more accurately taking into account that equipment which implements fundamental a safety function in operational states are designed as equipment implements fundamental a safety function in accident conditions.X
4	3.12./l1	Items important to safety ~~necessary~~ for a safe shutdown of the reactor and for the mitigation of the accident conditions……	Use the glossary wordings.	X			

No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
5	3.15.	Methods, design and construction codes and standards used should provide adequate margins to justify that cliff edge effects should be avoided ~~would not occur~~ in the event of an increase of the severity of the internal hazards.	Better wordings.	X			
6	3.21.	Add the footnote. Structures, systems and components of the RCSASs should be classified and assigned to the appropriate seismic categories in accordance with the recommendations and guidance given in Ref. [7]. Irrespective of the safety class to which SSCs are assigned, safety systems and safety features for accidents without significant core degradation should be designed to withstand SL-2 seismic loads.[*1] [*1] Regarding a combination of accidents with SL-2, additional factor (e.g., probability of occurrence) should be considered.	Clarification. It is practical way for the seismic class of SSCs in the accident conditions. However, as for a combination of accidents with SL-2, an additional consideration of the probability should be taken into.			X	Keeping integrity and the possibility to operate safety systems and safety features for DECs after SSE is a good and safe recommendation
7	3.23.	Margins provided by the design of the associated systems ultimately necessary to avoid an early or a large radiological release (if any) should be ~~large enough~~ adequate so that it can be demonstrated that the integrity and operability of those systems would be preserved in case of natural hazards causing loads exceeding those ~~resulting~~ derived from the ~~site~~ hazard evaluation for the site.	To keep consistency with SSR-2/1 (Rev. 1).	X			
8	3.27.	· ~~Uncontrolled positive reactivity insertion~~ Reactivity and power distribution anomalies (Reactivity initiated accidents)	To keep consistency with related safety	X			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page 74 of 9 Country/Organization: Japan / NRA-**Japan** Date: 26 Oct, 2016				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
			guides such as DS491 and DS488.				
9	3.28.	Computer codes ~~Codes~~ and engineering rules that are used for design should be documented, validated and, in the case of new codes, developed according to up to date knowledge and recognized standards for quality assurance.	Clarification for "codes" here as used in para. 3.29. and 3.30.	X			
10	3.34.	Design extension conditions without significant fuel degradation should be identified and used to establish the design bases of systems necessary to prevent postulated sequences with multiple failures from escalating to core melting.	Clarification of the plant state here. Should be just focusing on DEC without significant fuel degradation.	X			
11	3.49./l2	If consequences exceed the limits given for DBAs, reliability of the safety systems should be improved (e.g. vulnerabilities for CCF should be removed) or additional design features should be implemented to prevent escalation to DEC with core melt ~~accident~~ in such events.	Editorial.		X to prevent such events from escalating to accident with core melting		
12	3.56.	The following recommendations provide guidance to fulfil Requirement 7 of [2] and its related safety guide [10].	Need to introduce the safety guide as SSG-30 "Safety Classification od Structures, Systems and Components in Nuclear Power Plants".			X	See para 3.60
13	3.75.	Design basis loading conditions should be assigned in different categories (e.g. Normal conditions, Upset	It is necessary to show the design			X	See para 3.72

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page 74 of 9 Country/Organization: Japan / NRA-**Japan** Date: 26 Oct, 2016				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
		conditions, Emergency conditions, Faulted conditions) according to their estimated frequency of occurrence or according to requirements of accepted codes and regulations. By using actual temperature and pressure, design base loadings should be evaluated conservatively.	base is conservative.				
14	3.78.	Normal service and upset conditions should be defined by modelling the plant response under realistic conditions. High cycle fatigue by mixing of low temperature water and high temperature water should be minimized.	Mixing condition should be considered.			X	Not relevant for 3.78. Fatigue due to cycling is considered for normal and upset conditions (see 3.76)
15	3.82./6th bullet	· Resistance to ~~temper~~ thermal embrittlement	Replace more commonly used words.	X			
16	3.82.	Add following bullet: · Resistance to Hydrogen embrittlement;	This is one of the major ageing phenomena.	X			
17	3.87.	Add following bullet at the last: · Helium accumulation due to nuclear transmutation.	Helium is also to be taken into account.			X	The bullet list does not pretend to be exhaustive.
18	3.94.	The welds of RPV and RCS should permit volumetric ~~(through-wall)~~ examination of the entire volume of the wall, surface examination and visual examination. For example, ultrasonic, radiographic, eddy current, magnetic flux or dye penetrant method.	Completeness.	X			
19	3.96./2n	· The expected crack growth and fracture toughness	Completeness. Embrittlement is	X			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page 74 of 9 Country/Organization: Japan / NRA-**Japan** Date: 26 Oct, 2016				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
	[d] bullet	in operational states and in accident conditions;	also taken into consideration of the inspection criteria.				
20	3.118.	In accordance with ~~According to~~ the overarching requirement 33 of [2], RCSASs for each unit should ~~is required to~~ have its own safety systems and its own safety features for design extension conditions.	Editorial. To keep consistency with SSR-2/1 (Rev. 1) requirement 33.			X	As no real guidance is given "should" cannot be used in place of the "shall" requirement. The current phrasing is kept.
21	3.121.	If probabilistic safety analysis is considered, probabilistic safety analysis should be combined with the deterministic approach for confirming the reliability of RCSASs in preventing significant fuel damage and for identifying the more likely CCF and multiple failures which could be considered as initiators of DECs.	Probabilistic design is not always common practices.			X	Use of probabilistic analyses or insights is recommended by the Safety Standards
22	4.5. Footnote 6	In some States, an ~~An~~ autonomy of 7 days at the site should be considered as a minimum.	The 7 days autonomy is one of the States' practices.				New text
23	4.9.	Depending on the site conditions and hazards, the need for a diverse ultimate heat sink should be assessed and considered ~~as necessary~~.	Duplication.				New text
24	5.3./4th bullet	Progressive cracking initiation (fatigue and stress corrosion)	SCC is also taken into account. SCC initiated at the cladding surface may penetrate into	X			

No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
			the base metal of the vessel. The description regarding fast fracture, SCC and others should be consistent with para. 6.4.				
25	5.4.	***To preserve the integrity of the RCS, any condition that would affect the geometry or structural characteristics of equipment, or cause the apparition of defects should be identified and prevented by design, manufacturing or operating and in service inspection provisions (in particular material ageing, chemical corrosion, stratification, etc.).***	It is desirable to let the readers know that material ageing such as thermal embrittlement should be taken into account.	X			
26	5.6./l1	At low operating temperature the ductility and ~~pressure~~ fracture resistance of some materials may be significantly lower.	Editorial. “Pressure resistance” may be “fracture resistance” as correct expression.	X			
27	Chapter5. General	The following sub-section should be described in the chapter 5 of PWR part as the same as in the BWR, which is explained in paras 5.9 - 5.11 of structural design of the reactor coolant system.	Completeness.				Comment is not clear, which clauses should be copied and pasted to section 6? Clauses 5.9 to 5.11?
28	5./l3	The RCS transports the coolant and thereby heat from the reactor core to the steam generators ~~(~~for	This section is for PWR.	X			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page 74 of 9 Country/Organization: Japan / NRA-**Japan** Date: 26 Oct, 2016				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
		PWR ~~and PHWR~~) ~~or directly to the turbine (BWR)~~.					
29	5.53./3rd bullet	• ~~D~~ Delta T max between hot leg and pressurizer	Editorial.	X			
30	5.83.	Whether a leak before break or break preclusion concept is claimed or the design and manufacturing of piping, the specific and additional design/manufacturing requirements should be met, based on similar considerations as for non-breakable equipment. For the piping made of cast stainless steel, reduction of fracture toughness due to thermal ageing should be taken account into a leak before break analysis.	Possible addition.			X	
31	5.132.	***The emergency cooling system should include capabilities to remove core decay heat ~~in the long term~~ until the core cooled taking into account that RCS integrity cannot be maintained. Those capabilities are part of the safety system.***	Clarification.		The emergency cooling system should include capabilities to remove core decay heat in the long term when RCS integrity is not assured. Those capabilities are part of the safety system.	X	"…in the long term" is preferred
32	5.135./l1	…… In order not to decrease the reliability of ECCS those isolation devices should be ~~be~~ designed to open quickly and without external service (e.g. check valves are widely used by Member States).	Editorial.	X			
33	5.143.	The Emergency Feed Water (EFW) and steam dump to atmosphere systems should have adequate performances to reliably accomplish residual heat removal and RCS cooling without exceeding limits for fuel, the reactor coolant pressure boundary and	Editorial.	X			

No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
		structures important to safety defined for DBAs.					
34	5.145.	The Emergency Feed water (EFW) System should be designed to supply secondary makeup water to the steam generators in DBA conditions where the main or auxiliary feed water system is unavailable.	Editorial.	X			
35	5.170. footnote 12 L3	***...... or (RCC-M2 orM3code JSME SNC2 1orSNC3, or similar standards),*** ***or*** ***…… or (RCC-M2 orM3code JSME SNC2 1orSNC3, or similar standards)***	To keep consistency with other chapters.				
36	Chapter 6. General	The following sub-sections should be described in the chapter 6 of BWR part as the same as in the PWR part. ・Control of cooling conditions in operational states（p.39 in the PWR） ・Pressure control and overpressure protection（p.39 in the PWR） ・Pressure tests（p.46 in the PWR）	The contents between PWR and BWR should be matched.				
37	6.5.	Equipment of the RCS should be designed so that the stresses imposed upon it remain below the values defined for structural materials to prevent a fast growth crack during normal operation operational conditions, anticipated operational occurrences, design basis accidents and DEC accidents without significant core fuel degradation.	To keep consistency with plant states in SSR-2/1 (Rev. 1).	X			

No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
38	6.6./l5	...... Allowances for changes in the ~~nil-ductility transition (NDT)~~ reference temperature (RT_{NDT}) of the RPV over the operational life of the plant should also be accounted for.	Major codes and standards apply RT_{NDT}.	X			
39	6.15.	The following provisions and design recommendations should be considered for the design of the pressure control* of the RCS: *. "pressure control" includes normal pressure control system and overpressure protection sytem.	Clarification. The recommendation written in para. 6.15 can be achieved by combination of normal pressure control system and over pressure protection system.				Not in contradiction with the 1st bullet "According to this concept, systems and components with variable capacity should be used for pressure control to ensure that counter measures are proportional to the severity of an anticipated operational occurrence or accident"
40	6.23.	RCS depressurization should be completed prior the onset of core melting by opening and maintaining open a set of ~~dedicated~~ SRVs.	Normally SRVs assigned to depressurization are used for overpressure protection as well.			X	Depressurization valves should be separated from safety valves
41	6.50.	***The layout and arrangement of the piping and equipment should be such that flow induced vibration, ageing effects acoustic excitation, thermal fatigue, erosion-corrosion, liquid droplet impingement and the accumulation of radioactive***	Erosion corrosion and liquid droplet impingement are also taken into account in the	X			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page 74 of 9 Country/Organization: Japan / NRA-**Japan** Date: 26 Oct, 2016				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modif./reject.
		material are minimized.	layout of piping and equipment of BWR.				
42	6.73.	***RCS piping should be of a suitable material such as stainless or alloy steel taking into account the mechanical property and the immunity to ageing phenomena.***	To clarify the purpose of material selection.	X			
43	6.101.	The amount of neutron absorbent material injected to the RPV should be enough to insert sufficient negative reactivity into the core to ensure the reactor remains subcritical in the most reactive state with sufficient margin for uncertainties for ~~all DBAs and AOOs~~ ATWS.	SLC is designed to achieve subcritical for ATWS. For AOOs and DBAs control rods are assumed to operate.		X SLCS should have capability to to shut down the core and to maintain sub criticality in the most reactive state with sufficient margin for uncertainties in the event of ATWS		

COMMENTS BY REVIEWER Reviewer: KINS Country/Organization: Republic of Korea / **Korea Institute of Nuclear Safety** Date: October 25, 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	§5.100 & 101	~~It the event of~~ In the event~	Typo	X			

2	§7.116	The reactor shut-down systems 1(SDS1) and 2 should be passive, fast acting, fully capable, diverse physically and functionally independent of each other.	SDS1 functions is just specified in 7.116. Some design information on SDS1 should be reflected in reactivity control paragraph. Add shut-down system 1(SDS1) in the reactivity control safety potion.		X Text added above para. 7.83 "The shut-down system relying on the drop of solid absorbers and the reactor regulating system (reactivity control system) are addressed in the Safety Guide [18]."		
3	§7.76	Diverse ~~ttechnologies~~technologies should be used for pressure and inventory control, and the overpressure protection devices to reduce the likelihood of common cause failure.	Typo	X			
4	LIST OF ABBREVIATIONS	To add "DT" in §5.53 in the List of Abbreviations.			X "DT" is replaced by "Delta T" in the text		
6	ANNEX I	CVCS : Chemical and Volume Control System	Add missing words	X			
6	ANNEX I	CCWS : Component Cooling Water System	Correct name of the CCWS	X			
7	ANNEX II	ADS : ~~Component Cooling System~~Automatic Depressurization System	Correct name of the ADS	X			
8	ANNEX II	H~~P~~HIP : High Head Injection Pump	Correct the HHIP	X			

COMMENTS BY REVIEWER	RESOLUTION
Reviewer: Mikhail Lankin **Country/Organization:** **Russian Federation** **Date:** 23 October 2016	

Comment No.	Page / Section / Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/ rejection
1.	2.1	Add new bullet "maintain necessary chemical characteristics and provide necessary coolant purification"	Para 3.3 has a reference to requirement 50 of SSR-2/1, which realized through usage of chemical and coolant purification systems.			X	Coolant purification and control of the coolant chemistry are not addressed in DS 481 and will be in DS
2	2.2	(pressure, temperature, coolant inventory, coolant inventory and **coolant chemical characteristics**)	Chemical characteristics are important conditions for adequate operation of heat exchanging surfaces (fuel cladding, steam generator tubes).			X	See above
3	Chapter title before para 2.5	Replace wording "in operational states" by wording "in shutdown states"	The existed text is not accurate since power operation mode is one of operational states		X Shutdown modes		
4	Chapter title before para 2.6	Replace wording :in operational states" by wording "in shutdown states"	The existed text is not accurate since power operation mode is one of operational states		X Shutdown modes		
5	2.6	Replace wording " operational conditions" to "operational states"	To unify terminology in p.2.6 and in preceding heading.	X			

COMMENTS BY REVIEWER Reviewer: NUSSC Page.... of.... Country/Organization: REPUBLIC OF SOUTH AFRICA Date:				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	3.12	Systems relied upon for a safe shutdown of the reactor and for the mitigation of the accident	Clarity				See modifications made following other comments

		conditions should be protected against the effects of internal hazards. That protection should also consider the consequences of the failures of non-protected components.					
2	3.28	Codes and engineering rules that are used for design should be documented, validated and, in the case of new codes, developed according to up to date knowledge and recognized standards for quality assurance. Users of the codes should be trained and qualified with respect to the limits and application of the code and the assumptions used in the design.	Clarity and proper sequencing of events		X Users of the codes should be qualified and trained with respect to the domain of validation and application, and to the assumptions made in the models of the codes		
3	3.42; Bullet 7	• Use of equipment designed to fail-in a safe mode.	Clarity	X			
4	3.46	Adequate physical separation should be implemented between the redundant trains of the safety systems to prevent common cause failure attributed to the hazards taken into consideration in the design.	Clarity		X Redundant trains : OK		
5	3.49; Line 7	they should be unlikely to fail simultaneously or at once.	Clarity			X	Same cause is better: the objective is to remove dependencies. Independent simultaneous failures can always iccur.
6	3.52; Line 3	in the different plant states should be implemented.	Editorial: Extra space before full stop	X			
7	3.52	… or to accomplish residual heat removal and heat transfer	The words "or to limit the level of radioactive release"			X	RCSAS are designed to shut down the reactor or

		to the ultimate heat sink in the different plant states or to limit the level of radioactive release…	are added here in order to be consistent with the first sentence of Par 3.56.				to remove and transfer residual heat.
8	3.56; Line 4	expected reliability are defined to take into account those two effects.	Clarity				Depending on the individual safety significance of components different levels of reliability are expected.
9	3.60; Bullet 1; Line 7	Systems designed to keep the key reactor parameters (e.g. pressure, temperature,	Editorial: Missing comma	X			
10	3.66; Line 2	temperature, wind, pressure, humidity, radiation levels, and local accumulation of radioactive	Addition		See modification	X	Should be restricted to environmental qualification and not to the broader scope of equipment qualification
11	3.66; Line 3	Aerosol, dust, vibration, water spray, steam impingement, flooding and contact with chemicals.	Addition		See modification.	X	Same as above
12	3.68/1	For components subject to the effects of ageing degradation by various mechanisms, design life time	Clarity	X			
13	3.74; Line 1	Loads should be identified and analysed to take into consideration the following aspects:	Clarity			X	
14	3.76; Line 2	to each load combination taking into account the load combination category.	Clarity			X	
15	3.79; Line 1	Emergency and faulted conditions should be defined with conservatism: e.g. by taking	Space added	X			
16	3.91; Line 1	The design should establish a	Clarity	X			

		technical basis for SSCs that require in-service inspection,					
17	3.96; Bullet 8	Controls of the manufacturing process: Reference and traceability for the	Clarity	X			
18	3.99; Bullet 4	Provisions for controlled venting and draining the reactor coolant;	Clarity			X	Not needed
19	3.100; Line 2	repair and replacement of components, with consideration taken of the need for the radiological	Clarity		X		According to other comment
20	3.108; Line 1	Provisions should also be made for collecting coolant leakages during normal operation.	Consistency and clarity		Modified		According to other comment
21	3.109; Line 3	…prevent the situation where failure of a system or component could cause the loss of the safety….	Clarity	X			
22	3.115; Line 1	Consequences of sharing of sensors for different purposes should be assessed in	Clarity	X			
23	3.115; Line 3	The following recommendations should be implemented to the extent possible:	Clarity	X			
24	3.116; Line 1	Instrument lines[5] should be designed such that the detected parameters (e.g.	Clarity	X			
25	3.119; Line 5	For design and construction the latest edition of the applicable codes/standards should be	Clarity	X			
26	3.120	international	Removed the hyphen in “inter- national”.	X			
27	4; Line 7	includes screens/strainers, spray nozzles, de-icing features, mechanical fans,	Clarity	X			See new text

		which ensure continuous…					
28	4; Line 2	In the selection of the type of ultimate heat sink, consideration should be taken of the specific site characteristics in which the plant will operate and of its impact on the environment.	Clarity				See new text
29	4.6; Line 3	effects of every external site hazard.	Editorial				See new text
30	4.8; Line 1	The effectiveness of the ultimate heat sink should not be over sensitive to short term variations.	Editorial	X			
31	4.11; Line 5	consideration should be taken of factors that could delay the replenishment process. Such	Editorial consistency				See new text
32	4.22; Line 5	bleed steam generators should not be dependent on the heat transfer chain.	Clarity	X			
33	4.23	To ensure effectiveness of the defence in depth strategy, the different means provided should be independent to the extent practicable, in particular a different and independent heat transfer chain should be implemented for accidents with potential core melting [15].	Clarity	X			
34	4.31; Line 1	Heat transfer capacity for the spent fuel pool should be designed assuming it is at its maximum storage	Clarity	X			
35	4.32; Line 2	operational states for a temperature of the ultimate heat sink within the range defined for	Spelling error	X			

36	4.34; Line 1	An activity monitoring system should be designed to detect radioactivity in the intermediate	Clarity	X			
37	4.35	The intermediate cooling system should be protected against over pressure caused by leaks occurring in the heat exchangers with coolant systems interfaces operated at higher pressure. In such circumstances, the intermediate cooling system should be designed to prevent primary coolant leaks outside of the containment	Clarity	X			
38	4.37; Bullet 3	The minimum level of coolant supplies	Clarity			X	"Supplies" is more general
39	4.38; Line 1	The design of the plant should include additional systems for redundancy to transfer residual heat to the	Clarity			X	Additional is correct, not redundancy
40	4.42; Line 4	be applied should be selected with due consideration taken of the two effects resulting from its	Clarity			X	Account is also correct
41	5.6; Line 2	be significantly lower. Where such materials are used for the manufacturing of component used, the	Clarity			X	Manufacturing is correct
42	5.22; Line 1	The RCPB and the SSPB	Clarity-consistency	X			
43	5.47; Line 1	The integrity of the RCPB should be maintained in the event	Clarity-consistency	X			
44	5.48; Line 1	…RCPB	Clarity-consistency	X			
45	5.52; Line 2	ageing effects, acoustic excitation, thermal fatigue and	Comma	X			

		the accumulation of radioactive					
46	5.53; Bullet 3	Delta T max between hot leg and pressurizer;	Clarity	X			
47	5.55; Line 2	classified with due consideration taken of the two effects resulting from its failure (function not	Clarity			X	Account is also correct
48	5.72; Line 1	Steam generators tubes belong to the RCPB and hence	Clarity-consistency	X			
49	5.105; Line 2	lead to the depressurization of more than one steam generator despite a single failure in the	Clarity	X			
50	5.113; Line 3	after a design basis accident conditions (see paragraph “Residual heat removal after design basis	Clarity			X	Design basis accident is here correct
51	5.114; Line 3	specified in normal operating conditions for the fuel and the reactor coolant pressure boundary.	Clarity	X			
52	5.118; Line 9	not accident conditions with significant core degradation. Recommendations for the design of residual heat transfer chain and ultimate heat sink in accident conditions are addressed in section 4.	Clarity	X			
53	5.124; Line 3	For design, the same engineering criteria as those recommended for DBAs can be	Clarity		X ..applied..		
54	5.128; Line 2	break should be considered during the design phase of assessing the performances of the cooling system.	Clarity			X	Should be considered for design if necessary and not just in the assessment
55	5.134; Line 4	selected with due consideration taken of the two effects resulting from its failure	Clarity			X	Account is also correct

		(function not					
56	5.135; Line 2	to decrease the reliability of ECCS those isolation devices should be designed to	Editorial: Extra word (be)	X			
57	5.140; Line 1	The ECCS pumps should be qualified to operate with active	Clarity	X			
58	5.141; Line 2	pumps should be ensured at any time during DBAs with consideration taken of accumulation	Clarity			X	Account is also correct
59	5.143; Line 3	fuel, the RCPB and structures important to safety defined for	Consistency	X			
60	5.150; Line 1	Isolation of EFW and of steam dump valves from the affected SG should be performed	Word misplacement	X			
61	Footer 12; Line 2	…..with ASME…..	Remove unnecessary full stop.	X			
62	5.152; Line 8	Such a system train includes several redundant trains, each of which includes a pump and a heat	Clarity	X			
63	5.152; Line 10	into RCS after being cooled by the heat exchanger. This system should be considered as the first	Clarity	X			
64	5.155; Line 4	selected with due consideration taken of the two effects resulting from its failure (function not	Clarity	X		X	Account is also correct
65	5.160; Line 2	designed for the RCS over pressure protection.	Clarity	X			
66	5.164; Line 7	of water with high boric acid concentration. Recommendations for the shut-down system relying on	Clarity	X			
67	5.165; Line 2	That system, designed as a second and diverse mean to	Clarity	X			

		shut down the reactor, should be					
68	5.169; Line 1	The boric acid concentration should be sufficient to compensate for the moderator effect at	Clarity		X Moderator effect variation ~~at any time~~ during the cooling		
69	5.171; Line 2	due to high concentration in the tanks and pipes. Extreme cold conditions derived from site	Addition			X	Cols conditions is preferred taking into account that a peak of of short time is generally not considered in that case
70	6.14; Line 1	Provisions to maintain adequate cooling conditions of the fuel should be classified as items	Missing word			X	Correct
71	6.21; Line 2	coolant to the RPV in the event that the high pressure ECCS are unable to keep RPV water level high enough.	Consistency	X			
72	6.35; Line 4	pressure designed piping should be eliminated to the extent practical. This event is	Extra word	X			
73	6.50; Line 2	induced vibration, ageing effects, acoustic excitation, thermal fatigue and the	Add comma	X			
74	6.55; Line 6	does not exceed the pressure that is allowed by accepted codes (typically 110%).	Missing word	X			
75	6.59; Line 2	classified with due consideration taken of the two effects resulting from its failure (function not	Clarity				Account is also correct..
76	7.76; Line 1	Diverse technologies should be used for pressure and inventory control, and the	Spelling	X			
77	7.133; Line 2	should be equipped with	Clarity			X	Same

		containment isolation devices, in accordance with Requirement 56					
78	7.181; Line 2	and following a site design basis earthquake.	Clarity	X			
79	List of Abbreviations	SSPB: Secondary Side Pressure Boundary	To be included	X			
80	Annex I/3	CVCS: Chemical and Volume Control System	Incomplete	X			

COMMENTS BY REVIEWER Reviewer: U.S. Nuclear Regulatory Commission Country/Organization: **USA** Date: October 28, 2016				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	2.1/ add to end of bullet list	• Provide a barrier for the protection of plant workers and the public from radioactive material.	The RCS is traditionally considered to function as one of the key barriers for protection of the public from radioactive material	X			
2	3.5	A number of RCSASs are design dependent and may be different in their design principles (e.g. use of active or passive systems for emergency core cooling or for removing residual heat etc.). Nevertheless, systems having to accomplish the same safety function in different technologies should be designed in compliance with similar general design requirements.	Design requirements for systems with different technologies performing the same function would necessarily be high-level or general requirements. For example an active and a passive emergency core cooling would have the same fundamental design requirement (i.e., maintain core cooling during and following and accident) but would have very different	X			

COMMENTS BY REVIEWER Reviewer: U.S. Nuclear Regulatory Commission Country/Organization: USA Date: October 28, 2016				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			specific design requirements.				
3	3.12/ line 2	Items necessary for a safe shutdown of the reactor and for the mitigation of the accident conditions should be protected against the effects of internal hazards. That protection should also consider the ~~consequences of the failures of items non-protected~~ effects of the failures of items non-protected on items necessary for a safe shutdown.	Proposed editorial change to make the point clear		X …the effects of the failures of items non-protected on protected items.		
4	3.18	"The design of the components of the reactor coolant system should be such that the effects of the external hazards derived from the site evaluation cannot be the cause of an accident for the reactor."	This requirement is not clear. What is meant by an "accident for the reactor?" It would be difficult to demonstrate that the RCS design alone can prevent accidents or transients from occurring due to external hazards.		X … cannot be the initiator of an accident		I agree that an accident can be initiated by a broader range of different PIES (and all are not RCS failures or malfunctioning). But this recommendation means that an RCS equipment failure should not external initiated by the effects of an external hazard which is correct.
5	3.23	"Margins provided by the design of the associated systems ultimately necessary to avoid an early or a large radiological release (if any) should be large enough so that it can be	As written, this seems to require that boundless margin be provided. Designers need to be given a reasonable bound on the				What is the comment?

COMMENTS BY REVIEWER Reviewer: U.S. Nuclear Regulatory Commission Country/Organization: **USA** Date: October 28, 2016				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		demonstrated that the integrity and operability of those systems would be preserved in case of natural hazards causing loads exceeding those resulting from the site hazard evaluation.”	amount of margin that must be provided.				
6	3.24	Revise the reference to [2].	Requirement 5.17 of [2] (SSR-2/1 Rev 1) does not appear to address “permanent systems.”		X …by systems available at the site		
7	3.27/ last bullet	• Uncontrolled positive reactivity insertion with or without loss of coolant	A postulated control rod ejection could be caused by the failure of a control rod housing. The subsequent LOCA with a power surge is normally bounded for large LWRs. For a small modular reactor, the combination of high power and the loss of coolant event may become challenging.			X	Not needed Recommendations for SMRs will probably need some adjustments (see para. 1.5)
8	3.33	Mitigation of design extension conditions (DECs) should be accomplished by permanent systems. For returning the plant to a safe state or for mitigating the consequences of an accident, consideration could be given to the full design capabilities of the plant and to the temporary use of	Addition is from foot note 15 of parent document SSR-2/1 (Rev. 1)		X ***…should be accomplished by permanent systems to the extent possible. Short term actions should be implemented X***		

COMMENTS BY REVIEWER Reviewer: U.S. Nuclear Regulatory Commission Country/Organization: USA Date: October 28, 2016				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		additional systems.			***by permanent equipment.***		
9	3.42 / para. 1	The following factors should be considered to achieve the adequate reliability of the systems necessary to control reactivity of the core, to maintain sufficient inventory in the reactor coolant system, to remove residual heat from fuel and to transfer residual heat to the ultimate heat sink:	Inventory control is a key safety function and should be included.	X			
10	3.42/ add a bullet to list	• Root cause evaluation of system or component failures	Root cause evaluation of failures is an important activity in any reliability assurance program.			X	You are right but DS 481 provides design recommendations
11	3.52	Alternative means belonging to different levels of defence, necessary to shut down the reactor, to maintain subcriticality, and to accomplish residual heat removal and heat transfer to the ultimate heat sink in the different plant states should be implemented.	The initial shut down margin may not be sufficient to accommodate beyond design basis scenarios. It is necessary to maintain subcriticality as long as possible.	X			
12	3.113	3.113 For system piping ~~crossing~~ that penetrates the containment wall(s) containment extensions should satisfy the design recommendations [15].	It is not clear what "crossing" means and what is considered a "containment extension" If "crossing" is the same as "penetrates," then use		*X* *Piping* that penetrates the primary containment wall(s) should be provided with adequate isolation devices and the		

COMMENTS BY REVIEWER Reviewer: U.S. Nuclear Regulatory Commission Country/Organization: **USA** Date: October 28, 2016				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			"penetrates" (i.e., use language consistent with the requirement). The meaning of the expression "containment extensions" is unclear. This term should be defined or a reference to its definition provided.		piping run between isolation valves should be designed according to [15].		
13	4., para. 1, line 6	"This includes screens/strainers, spray nozzles, de-icing features, mechanical fans, with includes an ensure air flow path."	This requirement is not clear. What is meant by "with includes an ensure air flow path"?		X "with includes an ensure air flow path" has been deleted.		