Resolution to Comments on Section 7
DS491 Step 7: Deterministic Safety Analysis for NPPs

Reviewer: Country/Organization:		COMMENTS BY REVIEWER Page.... of.... Date: 25/05/16		RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
Japan 18	Section 7	In section 7, it is implied that the Option 4 is used in the Realistic AOO and the Option 2 and 3 are used in the rest of analyses. There should be explicit guidance on which option should be used in each type of analysis.	Clarification				*Realistic approach should be used also for severe accident analysis. In any case paras 2.8 to 2.15 indicate options to perform DSA in a wide range of purposes, not directly and exclusively linked and limited to each plant state. It is understood that "strong recommendations" on which approach should be used for scenarios under examination should not be made in this SG.* *See additional elements in the resolution to Germany-24*

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Germany 24	Section 7, Pages 35 to 42	-	General Comment: The intention regarding the selected structure of Chapter 7 is unclear. For AOOs both conservative and best estimate approaches are discussed. For DBA only the conservative approach is treated. The best estimate approach for DBA is missing. Should be added. The structure of chapter 7 should be made more clear (improvement of the order of the sections)		*A reference to SSR-2/1 (Rev.1) § 5.26 will be added in §7.27:* "7.27. Realistic analysis for DBA is not permitted; one of the conservative methods[8] (Options 1, 2 or 3 from Table 1) should be used. The conservative analysis for AOO and DBA should…". *The footnote will be updated.* *(See resolution to Japan 18 too)*		
Czech 19	7.5	Evaluation of the source term should thus involve determining the behaviour of the radioactive species along this route up to their release to the environment ~~release to the atmosphere~~.	Text clarity. Release can be not only to the atmosphere but to hydrosphere too.	X			
Observer EC/JRC 71	7.7 Line 3	… occurrences and DBAs ~~and design extension conditions~~.	Independently on whether agree or not with integrating dedicated DEC-related systems (e.g. PARs, containment flooding, etc.) in plant limits and		*Initial conditions of reactor power, coolant inventory etc. will be important for DEC analysis.*		

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			conditions, current IAEA NS-G-2.2 does not include them and neither existing collections of plant limits and conditions.		*The para will be clarified as follows:* "7.7. The limits and conditions used in normal operation, such as reactor power and coolant inventory, should cover all important…"		
Canada 19	7.8	7.8. All ~~possible~~ operating modes of normal operation covered by operational limits and conditions should be analysed, with particular attention paid to transient operational regimes such as changes in reactor power, reactor shutdown from power operation, reactor cooling down, handling of irradiated fuel and off-loading of irradiated fuel from the reactor to the spent fuel pool.	"All possible" seems excessive. Many modes are foreseen at the design and construction phase, and limits and conditions are set for them. But this is far short of "all possible" modes. Some unusual modes will be defined if needed and the analysis performed to justify them. They will not be part of the standard set documented in the OLCs.	X			
Observer EC/JRC 72	7.10 Line 4 (addition)	… be avoided in the entire spectrum of transients belonging to the normal operational plant state as defined by the operational limits and conditions and considering the entire plant operating states from full power to shutdown conditions. Transitions from	For clarification's sake.		*Used "operating modes"* "…avoided in all the transients, as defined by the operational limits		"… be avoided ~~in the entire spectrum~~ in all the transients, ~~belonging to the normal operational plant state~~ as defined by the operational

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		one operating state to another as anticipated according to operational guidelines should be also taken into account.			and conditions, and considering all the operating modes. Transitions from one operational state to another, as anticipated according to operational guidelines (??), should be also taken into account		limits and conditions, and considering ~~the entire plant~~ all the operating modes~~from full power to shutdown conditions~~. Transitions from one ~~operating~~ operational state to another, as anticipated according to operational guidelines, should be also taken into account."
Czech 20	7.11 Last sentence	However, demonstration of compliance with the radiological acceptance criteria for normal operation is not covered by this Safety Guide.	Completing the reference of relevant Guide is recommended.	X	"„, However, compliance with the radiological acceptance criteria [3] is not covered by this Safety Guide.		
Observer ENISS-53	7.12	7.12. Systems credited in deterministic analysis of normal operation should be limited to normal operation systems, including plant control systems. No other plant systems should be actuated or be affected (especially the availability of safety-related SSCs) during transient normal operational modes.	For completeness			X	*The clarification seems not necessary*
Madagas 3	7.14	~~I&C~~ shall be replaced	I&C shall be replaced by its ***right meaning***. As it can be	X	"including instrumentation		

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			"Information and Communication", "Installation & Commissioning", "Instrumentation and Communication", …		and control ~~I&C~~ and mechanical…".		
Canada 20	7.17 1st sentence, line 2	7.17. The main objective of the realistic analysis of anticipated operational occurrences is to check that the plant operational systems (in particular control and limitation systems) can prevent most anticipated operational occurrences from evolving into accident conditions and that the plant can return to normal operation following an anticipated operational occurrences.	"Most" should be added as indicated. The control and limitation systems cannot control all AOOs. This is clear in 7.18. See also SSR-2/1 para 2.13 (3) and para 5.75, item (e). Clearly, there is no expectation that control systems must deal with all AOOs.		7.17. The main objective … systems) can prevent a wide range of anticipated operational occurrences …"		
Observer ENISS-54	7.18 Line 2	7.18. For many PIEs the control and limitation systems in combination with inherent plant characteristics and operator actions following normal or abnormal operation procedures will compensate (…)	In addition to system and plant features, operator actions, following normal or abnormal procedures, may be needed.		7.18. For many PIEs the control and limitation … inherent plant characteristics and operator actions will compensate for the…"		
Observer EC/JRC 73	7.18/2,7.20/4	*Read rationale*	In both paras, AOOs are defined as transients beyond normal operation but without leading to reactor trip and safety systems			X	*The text does not cover all the range of AOOs. There are some that must be dealt with by safety*

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			actuation. However, such statement does not belong to AOOs whereas a typical instance of such transients is LOOP where automatic reactor trip is expected to occur. Please update if necessary.				*systems*
Observer ENISS-55	7.19 Line 2	…It is therefore advisable to demonstrate by the analysis that, in case of the operation of the plant control and limitation systems as intended, the safety systems are no unnecessarily initiated and, if their initiation is necessary and unavoidable, the initiation of safety systems will not markedly increase the risk that the anticipated operational occurrence is escalated into an accident.	The reactor trip (scram) function is necessary in some DBC2 events, for example, loss of turbine condenser in BWRs, and cannot be safely avoided in these cases. In addition, 3.41 explicitly considers that in some DBC2 events, a scram is necessary, as it requires the postulations of ATWS cases, and 7.20 also allows reactor trip in cases where unavoidable. Our proposal also agrees with the content of 7.33.		*The sentence was verified rejecting the comment. An editorial correction was identified*: 7.19. In addition, the anticipated operational …that, in case of the operation of ~~the~~ plant control and limitation systems …”	X	*The suggested sentence may be confusing; it seems better not to include it.*

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Belgium 4	7.22	Delete specifications on percentage? (95% probability; 95% confidence; 10-15%). Or include a flexibility statement?	Art. 7.22 seems to us the only article with such precise prescriptions. Article 6.24 also gives %-values, but that article includes some flexibility statement. Make also 7.22 somewhat more flexible?			X	*Sentence states "typically" so the flexibility is already included.*
Japan 19	7.26	This paragraph should provide specific guidance on analysis assumptions and treatment of uncertainties for the realistic AOOs.	Clarification	X	The following text will be added at the end of 7.26: "… determination of the PIEs. Normally, uncertainties are not considered in realistic analysis of AOO. For operational considerations (such as plant reliability), treatment of uncertainties may be applied to the control and limitation systems."		
France 19	7.26 Title	**Analysis assumptions ~~and treatment of uncertainties~~**	No mention is given about treatment of uncertainties		*See resolution to Japan-19*		

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			and this topic should be deleted from the title of the paragraph				
Germany 25	7.27	7.27. Conservative analysis[8] of anticipated operational occurrences and DBAs should demonstrate that the safety systems alone are capable of fulfilling the following safety requirements	The AOOs should only be handled by operational systems. The usage of safety systems should only be allowed for DBA and design extension conditions (see also comment 23). The conservatism regarding AOOs should be considered e. g. by unfavorable initial and boundary conditions.		*(Final wording of 7.27 according to Germany-24 and ENISS-56)*	X	*As an example, most NPPs rely on scram to protect against loss of all main coolant pumps. This event is typically in AOO frequency range.* *Also, see SSR-2/1 para 4.11 (d), 4.13 and para 5.75 (e).*
Observer ENISS-56	7.27	(…) should demonstrate that the safety systems ~~alone~~ and the operator actions following EOPs are capable of fulfilling (…)	Operator actions, in addition to safety systems, are most often required.	X	*To better align with SSR-2/1 §5.24, the §7.27 will be modified as follows:.* "… should demonstrate that the safety systems alone in the short term, and with operator actions in the long term, are capable of achieving a safe state by fulfilling, the following safety		

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					requirements …”		
Observer ENISS-57	7.27	Include here “safe state” from SSR-2/1	SRR2-1 Req. 19 §5.24 that requires a safe state to be reach and maintened for DBA should be added.	X	*(Final wording of 7.27 according to Germany-24 and ENISS-56)*		
Germany 26	7.28	7.28. The safety analysis should demonstrate that the acceptance criteria relevant to the event are met. In particular, it should be demonstrated that some or all of the barriers to the release of radioactive material from the plant will maintain their integrity to the extent required.	The German understanding is that all barriers have to maintain for the AOOs. That is reflected by the set of acceptance criteria used for that level of defense. For DBA in maximum two barriers (fuel matrix and fuel rod cladding) of a limited number of rods are allowed to fail. Modification of the formulation of the sentence?			X	*It may not be possible to maintain all barriers for all AOO. For example, SG tube leakage is a failure of one of the barriers and bypassing another as an initiating event.* *This para is generic. There is a specific provision in 7.30 which requires meeting 7.20 (which deals with integrity of barriers).*
Observer ENISS-58	7.29	7.29. The safety analysis should establish the design capabilities, safety system set points, EOPs to ensure that the fundamental (…)	Operator actions, in addition to safety systems, are most often required. AOOs and DBAs analysis support EOPs definition.	X	*According to the resolution to ENISS-56, it will be modified as follows:* “7.29. The safety analysis should establish the		

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					design capabilities, safety system set points, and operating procedures to ensure that the fundamental …"		
Observer EC/JRC 74	7.31	*Please see rationale*	The scope in para 7.31 should be indicated. Apparently it only refers to DBAs but lacks of indication.			X	*7.31 belong to the subsection* "Conservative Analysis for AOOs and DBAs"; *see heading before 7.27.*
Japan 20	7.32.	7.32. Specific decoupling criteria should be defined in order to prove that the three ~~main~~ safety functions can be ensured	Clarification. According to the IAEA glossary, "main safety functions" means "fundamental safety functions". Consider deleting "main" to avoid confusion.	X	*The term "fundamental" will be used. (Note for convenience: In resolution to Japan-10 (about §3.51) it is indicated:* *A foot note will be added:* (*) According to the IAEA Safety Glossary (2016) the term "main safety functions" is equivalent)		

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Germany 27	7.32	7.32. Specific decoupling criteria should be defined in order to prove that the three main safety functions can be ensured in any condition and that, in an anticipated operational occurrences or DBA, at least one safety barrier remains able to limit the radiological releases to the environment.	For AOOs and DBAs the requirements should be that more than one barrier will be intact. Modification of the wording?	X	"7.32. Specific decoupling criteria should be defined in order … condition and that, in an AOO or DBA, some or all of the barriers are able ~~at least one safety barrier remains~~ to limit the radiological releases …"		
Observer ENISS-59	7.32 Last line	(…) ~~at least one safety barrier remains able to limit the radiological releases to the environment~~ barriers to the release of radioactive material from the plant will maintain their integrity to the extent required to meet Req. 4.10.	Proposal		*See resolution to Germany-27*		
Observer ENISS-60	7.33 1st bullet	(…) ~~and a DBA (in combination with a single failure) should not generate design extension conditions.~~	As single failure is part of the DBA analysis, a DBA PIE + single failure makes the DBA conditions. It can not be a DEC condition.			X	
Finland-3	7.33 3rd bullet Line 3	… Systems used for accident mitigation should be designed to withstand the maximum loads, stresses and environmental conditions for the accidents analysed. This should be assessed by separate analyses covering environmental conditions *and ageing*	Add: Ageing Ageing should be considered with the assessment of the environmental conditions. The equipment/SSCs should be able to perform their	X			

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		(i.e. temperature, humidity or chemical environment) and thermal and mechanical loads on plant structures and components. The margins considered in the design should be commensurate with the probability of the loads to be considered. …	intended function even at the end of their lifetime.				
Observer ENISS-61	7.33 3rd bullet Line 3	(…) i.e. temperature, humidity, irradiation or chemical environment)	Proposal		"…humidity, radiation or chemical environment…"		
Observer ENISS-62	7.33 5th bullet Last line	The number of fuel cladding failures which could occur should be limited for each type of PIE to allow the global radiological criteria to be met and to allow decoupling hypothesis retained to define equipment qualification requirements to be met.	The number of cladding failures should also be consistent with the decoupling hypothesis that may have been retained to define qualification requirements for SSCs.	X	*At the end of 5th bullet it will be added:* "… the global radiological criteria to be met and also to limit the level of radiation used for equipment qualification."		*(See resolution to Germany-28 clarifying that §7.33 applies to DBA)*
Germany 28	7.33 6th bullet, Page 40	— … —In DBAs ~~accidents~~ with fuel uncovering and heatup, a coolable geometry and structural integrity of the fuel rods should be maintained. — …	The relevant group of events for that requirement should be made clearer.	X	*To clarify that §7.30 relates to conservative AOO and §7.33 to DBA, line 1 of §7.33 will be modified:* "7.33. The detailed		

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					acceptance criteria for DBA should typically include …"		
Czech 21	7.33 7th bullet Line 1	No event should cause the temperature~~, pressure~~ or pressure differences between containment compartments to exceed values which have been used as the containment design basis.	Text clarity.			X	*Need both "pressure" and "pressure difference"*
Japan 21	7.33, 8th bullet	— Subcriticality of nuclear fuel in reactor after shutdown, in fresh fuel storage and in the spent fuel pool should be maintained. Temporary recriticality* may be acceptable for certain events and plant operating modes, however without exceeding criteria associated with sufficient cooling of the fuel. Footnote: In case of steamline break for PWR.	Clarification. If the "Temporary recriticality" in 8th bullet is related to steamline break for a PWR plant, such clarification or limitation is needed.	X	"- Temporary recriticality (e.g., steam line break in PWR) may be acceptable for certain …"		
Germany 29	7.33 9th bullet Page 41	—There should be no initiation of a brittle fracture or ductile failure from a postulated defect of the reactor pressure vessel (RPV) during the plant design life for the whole set of transients and postulated DBAs ~~accidents~~. — …	The relevant group of events for that requirement should be made clearer.	X	—There should be no initiation … the plant design life for the whole set of ~~transients and~~ postulated DBAs ~~accidents~~. *Last bullet will be*		

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					modified accordingly: "… dynamic loads during ~~transients and during~~ DBAs so that safe…"		
Observer ENISS-63	7.35	- For DBAs : - Normal operation systems that are in operation at the beginning of the event ant that are not affected by the initiating event and the consequences of the PIE, can be assumed to continue to operate. - Safety systems designed […]	Crediting systems in service should also be applied to DBA in addition to AOO events.	X	See change for Canada 7.35		
Canada 21	7.35	7.35. The conservative considerations regarding the availability of plant systems should typically include the following: — ~~For anticipated operational occurrences,~~ Normal operation systems that are in operation at the beginning of the event and that are not affected by the initiating event and the consequences of the PIE~~,~~ can be assumed to continue to operate. ~~— For DBAs:~~	All these bullets apply to DBA and to conservative AOO analysis for demonstrating the effectiveness of the safety systems. See SSR-2/1 para 5.75 item (e) "*5.75. The deterministic safety analysis shall mainly provide:* *(a)…(d)* *(e) Demonstration that the*	X			

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		- Safety systems […] should be assumed to operate with conservative performances. - Any control or limitation systems should be assumed to start operating only if their functioning would aggravate the effects […]. - A single component failure should be assumed to occur in the operation of the safety groups required for the initiating event, in addition to the initiating failure and any consequential failures (the Single Failure Criterion). If the single failure is applied to the reactor scram system, the insertion of the control rod that has the greatest effect on reactivity should be assumed to fail. - Safety features for DEC should not be credited in the analysis.	*management of anticipated operational occurrences and design basis accidents is possible by safety actions for the automatic actuation of safety systems in combination with prescribed actions by the operator;*" Effectively, an [AOO + failure of the control and limitation function] can be considered to be a DBA. It I can be seen as a multiple failure event in the DBA frequency range. Also clarify that the last bullet is the Single Failure Criterion which is well described elsewhere. Final bullet from earlier draft seems to have been lost and should be restored.				

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Observer WNA 4	7.35	For anticipated operational occurrences, normal operation systems that are in operation at the beginning of the event and that are not affected by the initiating event and the consequences of the PIE, can be assumed to continue to operate steadily	To be specified in order not to contradict the following bullet regarding control & limitation systems. Basically the aim is to keep main coolant pumps operation for instance (steady operation, no control associated) and to consider normal controls "frozen"		*Covered by resolution to Canada-21*		
Germany 30	7.35	- Single failure should be assumed to occur in the operation of the safety systems ~~groups~~ required for the initiating event, in addition to the initiating failure and any consequential failures. Dependent on the selected acceptance criterion the single failure should be put to a system/component leading to the largest challenge for the safety systems. If the single failure is applied to the reactor scram system, the insertion of the control rod that has the greatest effect on reactivity should be assumed to fail.	Single failures are only postulated for safety systems. It should be mentioned where to put a single failure in order to reach the worst initial and boundary condition for the analysis.	X *2nd change*		X *First change*	*First change:* *See SSR-2/1 Req. 25, §5.39 using "safety groups" for single failure criterion*
Japan 22	7.37.	7.37. For conservative safety analysis, credit should not be taken for operator ~~diagnosis of the event and starting the actions, typically earlier than in 30 minutes if performed in the control room, or 60 minutes for the field actions.~~ Action to limit the evolution of a design basis accident within a	Take off specific values and keep the original sentence (SSG-2, 4.10) to be more general expression.	X *First part*	*First part: treated in common with the proposal from Canada-62.* 7.37. For conservative safety … operator diagnosis of the	X *Second part*	"Exceptionally, the design may take credit for earlier operator action …" *According to current practices in the preparation of Safety Satandards it seems*

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		specified time. Exceptionally, the design may take credit for earlier operator action, but in these cases the actuation times should be conservative and should be fully justified. Conservative assumptions should be made with respect to the timing of operator actions. It should be assumed that in most cases post-accident recovery actions would be taken by the operator.			event and starting the actions. The corresponding time claimed should be justified and validated for each specific reactor design; for example earlier than in 30 minutes for operator diagnosis …"		*better not to include this exception*
Canada 62	7.37	Suggest the following changes, 7.37. For conservative safety analysis, credit should not be taken for operator diagnosis of the event and starting the actions, typically earlier than in ~~30~~ 15 minutes if performed in the control room, or ~~60~~ 30 minutes for the field actions. The timing should be justified and validated for specific reactor design.	The proposed credit for operator is more stringent than current practice for PHWR. The ability to complete the operator action should be justified and validated for each reactor design.		*Treated in common with the proposal from Japan-22; see resolution.* *(Note: Figures in Canada for illustration: 30' and 60'for new NPPs (REGDOC-2.5.2). Existing NPPs can use 15' and 30' (REGDOC-2.4.1))*		
Observer WNA 5	7.42	7.42. If a conservative or combined methodology is applied …	According to wording defined in table 2	X			
Canada 22	7.43 First	7.43. In addition to the postulated initiating event itself, a loss of off-site	Loss of offsite power is an over-conservative	X			

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	sentence	power ~~should~~ may be considered as additional conservative assumption. If LOOP ~~should be~~ is considered as an additional failure ~~occurring~~ it may be assumed to occur at a time which has the most negative effect regarding the barrier integrity.~~, then s~~ Some acceptance criteria should be adapted taking into account the probability of this combination.	assumption for shutdown modes. Text should not require LOOP for all DBAs.				
Germany 31	7.43	7.43. In addition to the postulated initiating event itself, for DBAs a loss of off-site power should be considered as additional conservative assumption. LOOP should be considered as an additional failure occurring at a time which has the most negative effect regarding the barrier integrity, then some acceptance criteria should be adapted taking into account the probability of this combination.	Should the superposition of initiating events with the LOOP be limited to DBAs? That seems to be common practices.		*See Canada 22 about this para.*		
Observer ENISS-64	7.43	In addition to the postulated initiating event itself, a loss of off-site power should be considered as additional conservative assumption. ~~LOOP should be considered as an additional failure occurring at a time which has the most negative effect regarding the barrier integrity,.~~ Then some acceptance criteria should be adapted taking into account the probability of	The LOOP superimposition rule should be considered as a conventional rule bringing robustness to the safety demonstration but its origin is still not shared internationally. As such, it is difficult to define at this stage, for example at which time it should be applied.		*See Canada 22 about this para*		

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		this combination.	As such, these conditions of application should rather be debated with national authorities.				
Germany 32	Section 7, Page 42	-	A chapter regarding detailed deterministic analyses for DBA is missing. See also general comment # 24			X	*The level of detail seems compatible with other paragraphs and there is additional information in other sections.*
Japan 23	7.45. 7.55.	7.45. ... adequate margin to avoid cliff-edge effects. 7.55. ... adequate margin to avoid cliff-edge effects.	Editorial.	X			
Canada 23	7.46	7.46. Acceptance criteria for design extension conditions should meet the requirement of SSR-2/1 (Rev. 1) §5.31A [1].The same or similar technical and radiological criteria as those for DBAs ~~should~~ may be considered for these conditions to the extent practicable.	Para 7.46 exceeds the requirements of SSR-2/1. The radiological criteria do not have to be the same for DBA and DEC. SSR-2/1 para 5.25 says DBA should "*have no, or only minor, radiological consequences, on or off the site, and do not necessitate any off-site protective*	X			

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			actions" SSR-2.1 para 5.31A says DEC should need only "*protective actions that are limited in terms of lengths of time and areas of application shall be sufficient for the protection of the public, and sufficient time shall be available to take such measures*"				
Switzerland 7	7.46	The same or similar technical ~~and radiological~~ criteria as those for DBAs should be considered for these conditions to the extent practicable. Radioactive releases shall be minimized as far as reasonably	We request to change it in accordance with the WENRA-RL F4.14 and SSG-2/1. This is in terms of the Graded Approach.	X *Second part*	*Second part; it will be added:* "…to the extent practicable. Radioactive releases should be minimized as far as reasonably practicable."	X *First part*	*It seems to exceed the requirements of SSR-2/1. See resolution to Canada23*

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Japan-24	7.48 Second sentence	Special attention should be paid to the frontline systems (e.g., sump screen blockage) and support systems (electrical, ventilation, cooling,) when assessing the independence of safety systems regarding the postulated failures (e.g., internal-flooding).	Clarification and addition of examples. Sump screen blockage problem is important for long-term cooling during and after SA condition.		"Special attention should be paid to other factors affecting safety systems (e.g., sump screen blockage) and support systems (electrical, ventilation, cooling,) when assessing the independence of safety systems regarding the postulated failures (e.g., internal-flooding)		*Better not to incorporate a new class of systems (frontline).*
Observer ENISS-65	7.49	Please add: If, for some events, normal operation or limitation systems are considered as available, it should be ensured that these are not lost in the PIE, and the PIE group represented by the analysis should be selected accordingly.	Provided that normal operation systems including control and limitation systems are not affected by the PIE and its consequences, and when relevant, the failures that define the DEC condition, they should be considered available to be credited. In some countries, some normal operation systems are allowed to be credited as available, if the PIE does not			X	*For safety demonstration purposes the safety features for DEC are the SSC to be credited*

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			affect them (for example, by crediting normal AC power supply systems in the analysis of loss of seawater, as the likely reason for the loss is an oil spill or similar event that has no effect on that system).				
Belgium 5	7.50 and 7.56	Delete one of these articles	These two articles are saying the same.	X	*7.50 has been removed*		
Observer ENISS-66	7.50	Please remove	Redundant with 7.56	X			
Germany 33	7.50	7.50. The single failure criterion need not be applied in the analysis of design extension conditions without significant fuel degradation. <u>Furthermore, no additional failure of a system/component due to maintenance has to be considered.</u>	For clarification it should be mentioned that also no additional failure of a system/component due to maintenance has to be considered.	X	It is in contradiction to the realistic approach. It will be added: Furthermore, no additional failure of a system <u>or</u> component due to maintenance <u>should</u> be considered. *According to Belgium-5 and ENISS-66, it will be added to 7.56*		

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Japan-26	7.51.	7.51 Non-permanent ~~systems and~~ equipment should not be considered for demonstration of adequacy of the nuclear power plant design…	Editorial. To be consistent with SSR-2/1 (Rev. 1). "Non-permanent systems" is not used in SSR-2/1 (Rev. 1).	X			
Finland-4	7.51	7.51. Non-permanent systems and equipment should not be considered for demonstration of adequacy of the nuclear power plant design. ~~Such equipment is typically considered to operate for long-term sequence and is considered available in the development of emergency operating procedures or accident management guidelines~~.	Unnecessary and ambiguous sentence. There is no need to say here, when non-permanent systems are operating, if they should not be taken into account in DECs without core melt.		*See resolution to Canada-24*		
Canada 24	7.51	7.51. Non-permanent systems and equipment should not be considered for demonstration of adequacy of the nuclear power plant in the short term. Such equipment is typically considered to operate for long-term sequence and is considered available in the ~~development of~~ accordance with emergency operating procedures or accident management guidelines. Non-permanent equipment may be credited after 8 hours for equipment stored on site or 72 hours for equipment stored off site. The time claimed should be	Some modern designs have such long passive cooling capability that non-permanent systems are perfectly acceptable. It would be better to set a time limit after which non-permanent equipment may be credited. This is analogous to the operator action time rules in para 7.37.	X *First and second changes*	*The last two sentences will be modified as follows:* "…management guidelines. The time claimed for availability of non-permanent equipment should be justified; for example, for new nuclear power plants, the safety analysis may		

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		justified.			credit non-permanent equipment after 8 hours for equipment stored on site or 72 hours for equipment stored off site."		
Germany 34	7.51	7.51. Non-permanent systems and equipment should not be considered for demonstration of adequacy of the nuclear power plant design. Such equipment is typically considered to operate for long-term sequence and is considered available in the development of emergency operating procedures or accident management guidelines.	Mobile equipment is also used for preventive measures, like a mobile pump for secondary side feeding of steam generator. Their effectiveness is also shown by deterministic event analyses. Preventive measures by portable equipment should not be excluded here by definition.		*See resolution to Canada-24*		
Switzerland 8	7.51	*Non-permanent systems an equipment should not be considered for demonstration of adequacy of nuclear power plant design. Such equipment is typically considered to operate for long-term sequence and is considered available in the development of emergency operation procedures or accident management guidelines.*	For new plants this can be a clear design requirement but are from our understanding in contradiction with the requirements for DBA's. E. G. SSG-2/1 Ziff. 5.11-5.15 allows already for DBA's the use of mobile equipment *(5.15 Any equipment that is necessary for actions to be taken in manual response and recovery processes shall*		*See resolution to Canada-24*		

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			be placed at the most suitable location to ensure its availability at the time of need and to allow safe access to it under the environmental conditions anticipated.) Also 5.28 and 5.29 are focusing on all other items important to safety or features that are designed for use in, or that are capable of preventing or mitigating…..which not explicitly exclude mobile equipment. We request to cancel this requirement or complete rewrite it. Normally even for new plants (DEC's) AM-Guidelines or mobile equipment (if available) will focus on measure to prevent significant fuel degradation if sufficient time is available. This clearly also meats to cope with DECs for existing plant (see WENRA-RL F4.3).				

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Observer EC/JRC 75	7.51/2	*Please see rationale*	Whole second sentence providing rationale for not accounting for non-permanent systems is unclear. Two arguments are provided: the 'long-term argument' might be better explained, maybe by referring to the time needed to actuate such flexible systems that go beyond to DEC times. The 'EOP and SAMG argument' sounds contradictory: precisely because those systems are accounted for in EOP (just like any other safety system), they should be taken into account in the safety analysis accordingly. Therefore, first argument should be better explained and second argument removed unless clarified.		*See resolution to Canada-24*		
France 16	7.51	Non-permanent systems and equipment should not be considered for demonstration of adequacy of the nuclear power plant design in the short term phase of an accident. Such equipment is typically considered to operate for long-term sequence and is considered available in the	Mobile equipment should be allowed for long term plant stabilization.		*See resolution to Canada-24*		

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		development of emergency operating procedures or accident management guidelines.					
Canada 25	7.52	7.52. Best estimate assumptions can be used for the analysis of design extension conditions. Conservative assumptions as described for DBAs ~~should~~ may be used to the extent practicable. ~~A more realistic approach that considers the information available and the inherent uncertainties in the data might be acceptable but should also consider the additional challenges of design extension conditions.~~	This paragraph exceeds the requirements of SSR-2/1. SSR-2/1 does not use the word "conservative" anywhere under Requirement 20 for DEC. This should be "Best-estimate assumptions" in keeping with the "engineering judgement" and "practicable provisions" wording used in SSR-2/1. Requirement 20. Also 5.27, "best-estimate analysis" and "to the extent practicable". See also SSR-2/1 para 5.75 item (f) "*5.75. The deterministic safety analysis shall mainly provide:* *(a)…(e)* *(f) Demonstration that the management of design extension conditions is possible by the automatic*	X	*Treated with GER-35. Changed to:* 7.52. Best estimate assumptions should be used for the analysis of design extension conditions. Conservative assumptions as described for DBAs ~~should~~ may be used to the extent practicable. ~~A more realistic approach that considers the information available and the inherent uncertainties in the data might be acceptable but should also consider the additional challenges of~~		

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			actuation of safety systems and the use of safety features in combination with expected actions by the operator."		~~design extension conditions.~~		
Germany 35	7.52	7.52. Conservative assumptions as described for DBAs should be used to the extent practicable. A more realistic approach that considers the information available and the inherent uncertainties in the data might be acceptable but should also consider the additional challenges of design extension conditions.	The best-estimate approach should be used for design extension without significant fuel degradation. Those analyses e. g. are performed for showing the effectiveness of preventive EOPs.	X	See resolution to Canada-25		
Canada 26	7.53	7.53. Since the physical phenomena taking place in design extension conditions without significant fuel degradation do not qualitatively differ from those present in DBAs, the requirements on the selection, validation and use of computer codes specified for DBAs should also apply in principle for analysis of design extension conditions without significant fuel degradation, though a lower level of confidence is acceptable.	Again, this exceeds the requirements of SSR-2/1. Best estimate analysis can be used. See comments on 7.46, 7.51 and 7.52.			X	*A lower level of confidence is not defined.*
Observer ENISS-67	7.53	~~Since the (…) the~~ The requirements (…)	It is not because physical phenomena are the same between DBAs and DECs	X			

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			that computer code used for DECs should be validated.				
Canada 27	7.55	7.55. When best estimate analysis is performed, margins to the cliff-edge effect should be ~~proved~~ shown by sensitivity analysis demonstrating to the extent practicable that, when more conservative assumptions are considered for dominant parameters, there are still margins to the loss of integrity of physical barriers.	Again, this exceeds the requirements of SSR-2/1. Requirement 20, paras 5.27 to 5.31A do not mention "margins" or "cliff edge effects".		7.55. When best estimate analysis is performed, margins to avoid the cliff-edge effect should be ~~proved~~ shown, for example by sensitivity analysis demonstrating to the extent practicable that, when more conservative …"		
Observer WNA 6	7.56	To be deleted	Already specified in 7.50			X	*7.50 was deleted instead*
Poland 7	7.56	Proposition to delete this point as this is the repetition of 7.50	Repetition			X	*7.50 was deleted instead*
Germany 36	7.56	~~7.56. For design extension conditions without significant fuel degradation, single failure criterion does not need to be applied.~~	That is a repetition (see also 7.50). Should be deleted here.			X	*7.50 was deleted instead*
Japan-25	7.56	Delete 7.56.	Redundant with 7.50.			X	*7.50 was deleted instead*
Canada 28	7.56	7.56. For design extension conditions without significant fuel degradation, single failure criterion does not need to be applied and unavailability due to	Make it clear that the requirement on safety systems in para 7.36 of the guide does not apply in	(X)	*Covered in Germany-33*		

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		maintenance does not need to be considered.	DEC.				
Canada 29	7.57	7.57. ~~The~~ From the best estimate analysis of severe accidents, ~~should identify the most severe~~ bounding plant parameters ~~resulting from the core melt sequences~~ should be identified, and ~~demonstrate~~ it should be demonstrated that: […]	This exceeds the requirements of SSR-2/1. Requirement 20 for DEC. SSR-2/1 3.27, last sentence states, "*The effectiveness of provisions to ensure the functionality of the containment could be analysed on the basis of the best estimate approach*."		7.57. The analysis of severe accidents should identify the ~~most severe~~ bounding plant parameters resulting from the postulated core melt sequences, and demonstrate that: (…)		
Germany 37	7.57	7.57. The analysis of severe accidents should identify the most severe plant parameters resulting from the core melt sequences, and demonstrate that: - the plant can be brought into a state where the containment functions can be maintained in the long term - the plant structures, systems, and components (e.g., the containment design) are capable of preventing large or early releases, including containment by-pass; SAM measures to minimize the release of radionuclides into the environment are working. - control locations remain habitable to allow performance of required staff actions.	The extension of the list regarding the assessment of severe accident management measures has been done.	X	Change first proposal to: - *the plant structures, systems, and components (e.g., the containment design), and procedures are capable of preventing large or early releases, including containment by-pass;* Accept second addition.		

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		- planned severe accident management measures are effective.					
Observer WNA 7	7.58	7.58. The safety analysis of severe accidents should demonstrate that compliance with the acceptance criteria is achieved by features implemented in the design and not only by implementation of accident management guidelines.	Accident management guidelines are important part of DEC-B management	X	*Covered by Japan 27*		
Japan-27	7.58	The safety analysis of severe accidents should demonstrate that compliance with the acceptance criteria is achieved by features implemented in the design ~~and not by~~ combined with implementation of accident management guidelines.	In case of severe accident, flexible measures which combine design and AMG including using mobile equipment should not be excluded.	X	*Change makes it consistent with SSR-2/1 § 5.75 (f).*		
Observer ENISS-68	7.58	The safety analysis of severe accidents should demonstrate that compliance with the acceptance criteria is achieved by features implemented in the design and not only by implementation of accident management guidelines.	As it is, it may be understood that SA management should be automatic and should not rely on operator actions.	X	*Covered by Japan 27*		
Germany 38	7.58	7.58. The safety analysis of severe accidents should demonstrate that compliance with the acceptance criteria is achieved by features implemented in the design and not by implementation of accident management guidelines.	It is not clear why mitigative severe accident management measures are excluded. One of the main objectives of deterministic severe accident analyses is also to show the effectiveness of SAM measures. Furthermore, for the usage of SAMGs	X	*Covered by Japan 27*		

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			computational aids are necessary which are developed by deterministic event analyses. Another demand is the ALARA principle mentioned e. g. in 2.18 and 4.6. The compliance of the principle has to be shown also for design extension conditions by deterministic event analyses.				
Canada 63	7.58	Suggest the following changes, The safety analysis of severe accidents should demonstrate that compliance with the acceptance criteria is achieved by features implemented in the design and ~~not~~ by operator action credit consistent with the implementation of accident management guidelines	Para 7.65 notes that operator actions should be considered. The implementation of accident management guidelines is consistent with credits for operator action.		*Covered by Japan 27*		
Observer EC/JRC 76	7.58/All	*Please see rationale*	The entire para should be clarified, in particular providing the rationale for not crediting for actions included in the accident management guidelines, at the same time clarifying what is intended to mean by 'design' in apparent opposition to accident		*Covered by Japan 27*		

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			management: fundamental provisions incorporated through backfitting will obviously be reflected in accident management, to an extent that performing actions of mitigating systems used in DEC-B like events will likely be restricted to accident management guidelines, e.g. containment flooding to mitigate MCCI. In addition, take also para 7.65 into consideration for potential updating.				
Germany 39	7.60	7.60. Technical acceptance criteria should ensure that containment integrity is maintained. Examples of acceptance criteria for design extension conditions analysis would include limitation of the containment pressure, temperature and hydrogen concentration and stabilization of molten corium.	That paragraph is incomplete because another upstream safety goal is the prevention of RPV failure. For this, acceptance criteria can also be listed, like retention of core melt inside RPV, external cooling of RPV etc..	X	*Change to:* 7.60. Technical acceptance criteria should ensure … extension conditions analysis ~~would~~ could include limitation of the containment pressure, maintaining in-vessel retention, temperature and hydrogen		

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					concentration …”		
Observer EC/JRC 77	7.60/3	… temperature and ~~hydrogen~~ flammable gases concentration and stabilization of molten corium.	Though highly plant-dependent (in particular basemat chemical composition dependent), long-term combustion process are more governed by carbon monoxide rather than hydrogen generation. Therefore, it is recommended to replace hydrogen by flammable gases throughout the text.	X			
Observer EC/JRC 78	7.62/(Addition)	*Please see rationale*	Application of para 7.33, bullet 3, is much more related to severe accidents than DBAs. Therefore it should be added here as well –even if mentioned within the 'available systems' subsection. For instance, ongoing IAEA-TECDOC-1135 on "ASSESSMENT OF NUCLEAR POWER PLANT EQUIPMENT RELIABILITY PERFORMANCE FOR SEVERE ACCIDENT CONDITIONS" led by A. Duchac from IAEA focuses exactly on this topic and ways to tackle with it. The			X	*Bullet 2 of existing text covers survivability of equipment.*

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			author is invited to look it up.				
Germany 40	7.64	7.64. Single failure criterion need not be considered in severe accident analysis. Furthermore, no additional failure of a system/component due to maintenance has to be considered.	See Comment 33.	X	*Covered by Canada 30*		
Canada 30	7.64	7.64. Single failure criterion need not be considered in severe accident analysis and unavailability due to maintenance does not need to be considered.	Make it clear that the requirement on safety systems in para 7.36 of the guide does not apply in DEC.	X			
Czech 22	7.65.	Operator actions should be considered as for design extension conditions ~~without~~ to mitigate significant fuel degradation.	These are core melting sequences and melting is significant fuel degradation.	X	Change to: "7.65. The same operator actions should be considered as for design extension conditions without significant fuel degradation. See paragraph 7.52."		
France 20	7.65 (new)	Non-permanent systems and equipment should not be considered for demonstration of adequacy of the nuclear power plant design in the short term phase of an accident. Such equipment is typically considered to operate for long-term sequence and is considered available in the	This applies also for severe accident.		*New paragraph:* 7.64A. Non-permanent systems should not be considered for demonstration of adequacy of the		

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		development of emergency operating procedures or accident management guidelines			NPP in the short term. Such equipment is typically considered to operate for long-term sequence and is considered available in accordance with emergency operating procedures or accident management guidelines. The time claimed for availability of non-permanent equipment should be justified; for example, for new NPPs non-permanent equipment may be credited after 8 hours for equipment stored on site or 72 hours for equipment stored off site.		
Czech 23	7.66	Release and transport of fission products, including filtered venting to prevent overpressure in the containment;	Venting thorough sand bed filters or scrubbers, etc. Not direct venting to atmosphere. Scrubbers are one of the primary devices			X	*This is a list of phenomena, not a set of design requirements. The efficiency of filters (if*

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			that control gaseous emissions in case of emergency.				*any) should be modelled.*
Observer EC/JRC 79	7.66/7	In-vessel melt retention by RCS injection at different degrees of core damage, and by ex-vessel cooling	Clarification's sake: it is not very clear what 'in-vessel retention' is meant to be.			X	*In-vessel retention can be quite different in different designs, e.g. PHWR. Current text is sufficiently general to cover this.*
Observer EC/JRC 80	7.66/8 (addition)	Direct Containment Heating	Even if the list is not exhaustive, DCH is comparable to steam explosions and combustion processes so it should be included for clarification's sake.	X	Add new bullet.		
Japan-28	7.68	According to ~~Requirements to be met include~~ Req. 20 from SSR-2/1 (Rev. 1), § 5.31 [1], "The design shall be such that the possibility of conditions arising that could lead to an early radioactive release or a large radioactive release is 'practically eliminated'."	Clarification for "practically eliminated".			X	*Not to include quoted text from requirements*

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Observer EC/JRC 81	7.69/1	According to ~~2.8~~ 2.1,…	Typo	X			
Observer ENISS-69	7.70	Ask for clarification.	Consistency between 2nd and 3rd bullets should be improved. 2nd bullet requires a high confidence demonstration. Then, 3rd bullet requires sensitivity studies. Shouldn't these sensitivity studies be part of the high confidence demonstration?		*See proposal from France*		*Text of bullets 2 and 3 combined and clarified.*
Canada 31	7.70	7.70. Demonstration of practical elimination of certain conditions (unless such conditions are judged as physically impossible) should include, where appropriate, the following steps: […]	Deterministic safety analysis is not always needed (last two bullets). For example, catastrophic pressure vessel failure is not analysed.	X			
Observer EC/JRC 82	7.70/7	Sensitivity studies ~~to provide assurance that sufficient margins exist to address uncertainties and~~ to avoid cliff-edge effects	It is the opinion of this reviewer to make a clear distinction between uncertainty and sensitivity as they constitute very different		See changes to ENISS comment on 7.70.		

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			statistical tools even if sharing some of their tasks. Uncertainty margins cannot be assessed through sensitivity analysis as para 7.70 is suggesting. Moreover, such complex, interrelated uncertainties, as those characterizing the field of severe accidents, would need to be integrally taken while sensitivity analysis is usually performed on one-at-a-time basis. Instead, cliff-edge effects can be deterministically imposed by forcing the code to simulate the worst conditions and afterwards then check whether outcomes go beyond design limits.				
Observer WNA 8	7.70 bullet 2	Assessment of the ability of the design and operational provisions with high confidence to eliminate or to address the challenges, <u>by providing an appropriate combination of safety classified features</u>	Practical elimination cannot be based on non classified features	X	*Covered by changed proposal from ENISS.*		

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France 8 France-21?	7.70	Demonstration of practical elimination of certain conditions (~~unless such conditions are judged as physically impossible~~) should include the following steps: • Identification of undesired conditions (challenges) potentially endangering the containment integrity or by-passing the containment, resulting in early or large releases, • Challenges should be addressed. In case this is not possible, design and operational provisions should be implemented in order to practically eliminate them ~~Assessment of the ability of the design and operational provisions with high confidence to eliminate or to address the challenges~~ • Sensitivity studies to provide assurance that sufficient margins exist to address uncertainties and to avoid cliff-edge effects • Final confirmation of the adequacy of the provisions by deterministic safety analysis, complemented by probabilistic safety assessment and engineering judgment.	This § is not clear : - Physical impossibility could be a way for practical elimination, - What does "eliminate with high confidence" means - second bullet is understood according to the proposal - For step 3: during the identification phase, the "threshold values" which should not be exceeded to avoid cliff-edge effects are identified (e.g. the value of the reactivity insertion which can lead to prompt criticality). Once these values are determined, the reactor is designed such to guarantee those margins. Here the object of the sensitivity studies is not clear. **Clarification is necessary (proposed modification is a minimum) or consider full deletion**	X			
Observer ENISS-70	7.71	Although probabilistic targets can be set, demonstration of practical	The practical elimination is relevant for early and large	X	*Changed to:* 7.71 Although		

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		elimination of early and large releases should not be based solely on low probability numbers. The achievement of any probabilistic value cannot be considered as justification for not implementing ~~reasonable design or operational measures~~ reasonably practicable safety improvements.	releases and should be named like this. Second addition needed to be in line with SSR 2-1 (especially para 1.3).		probabilistic targets can be set, demonstration of practical elimination of event sequences that would lead to an early radioactive release or a large radioactive release should not be based solely on low probability numbers. The achievement of any probabilistic value cannot be considered as justification for not providing ~~reasonable design or operational measures~~ reasonably practicable safety features.		
Belgium 6	7.72	"Where a claim is made that ~~is~~ the conditions potentially resulting in early or large releases are 'physically impossible', …"	Typographical correction (delete "is")	X			

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Observer EC/JRC 83	7.72/2	… it is necessary ~~to examine the inherent safety characteristics of the system~~ to demonstrate that the conditions cannot~~, by the laws of nature,~~ take place whether because of laws of nature (physically impossible to occur) or because of relying on systems whose inherent fully –or almost fully– passive nature leads to highly confident levels of performance.	The 'practically eliminated' condition is defined in the overarching Safety Requirements document, SSR-2/1, Rev. 1, where it is mentioned that "physical impossibility of the phenomenon with a high level of confidence to be extremely unlikely to arise". Para 7.71, and even more 7.72 when talking about "inherent safety characteristics… by the laws of nature", seems to go too far because of not attending the definiens clause on 'extremely unlikely' hence accounting for risk hence for probability to occur; and because of not considering that in most cases the pursued elimination is achieved through mitigating systems, and even if these systems are passive, they can fail. In fact, passive safety systems belonging to 3rd generation have an associated probability of failure (huge literature is found on that). For instance, if overpressurization as the cause for containment failure is said to be avoided by means of FCV, even if this system were fully passive, it would always			X	*Comment is not clear.*

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Observer EC/JRC 84	7.72/10	… elimination by **physical** impossibility of the conditions).	Please see rationale of previous comment 83	X			
Observer EC/JRC 85	7.72	An example dealing with high-level performance could be the Passive Autocatalytic Recombiners to avoid reaching DDT conditions jeopardizing containment integrity. Due to their passive nature, failing to succeed in accomplishing with their committed safety function turns to be extremely unlikely.	Please see rationale of previous comment 83			X	PARS can be impaired due to surface contamination or may have insufficient surface area to deal with the threat.