DRAFT IAEA SAFETY GUIDE DS482 “Design of Reactor Containment Structure and Systems for Nuclear Power Plants” Step 8a

ENISS Comments

COMMENTS BY REVIEWER Reviewer: ENISS RSG Page 1 of 8 Country/Organization: ENISS Date: 2017-01-13				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	General comment		It was observed that many of ENISS comments that were raised in the previous review step (step 7) have been rejected in the latest revision of the report (step 8a). In the following, we have decided to re-iterate a few comments that we find particularly important. ENISS re-iterates the opinion that the guide needs to be adjusted to suit PS-containment designs in order for the guide to be of use for such designs. It appears to us that a deeper involvement in the work by BWR experts is necessary. In its present state, the report is only applicable to PWR containments. We would like to remind that our remarks are not limited to these comments but they serve to illustrate a need for a general review with regards to BWR containment issues. We suggest that the report distinguishes between “large-dry containments” and “small pressure-suppression containments” in applicable subject areas. At present these designs are supported by common guiding statements while it is necessary to treat them separately. The report contains descriptions and guiding principles that appear unfamiliar to a BWR expert community and sometimes even provide recommendations that are contradictory to the working principles of PS-containment designs. We believe this requires a deeper involvement by BWR experts. The second alternative is to issue the report as a guide aimed solely at large-dry (PWR) containments.	X			**Reason for rejection in previous step (step 7):** MS representatives with BWR reactor technologies have also reviewed this guide. **IAEA TO:** An extra CS meeting was organized end of February 2017 with the participation of a NRA representative (Japanese Regulatory Body) to evaluate the needs to provide separate section for a large dry containment and for PS containment (in particular for the para. “energy management” which is the more affected para.) as suggested by your remarks.. Conclusion was to keep a structure stressing that different design options exist to remove energy from the containment and that various combinations of them can be implemented (see new **clause 4.60**). Then it becomes possible to provide a list of the options widely implemented illustrated by a short description. As the applicable recommendations for the design depend on the plant state category for which the system is required to operate, only very specific recommendations are provided (the more important are driven by section 3).

							By this way the number of modifications is limited but your concern is captured. See clauses 4.63 and 4.70 either
2	3.68	Independence between safety systems and safety features necessary to mitigate the consequences of a core melt accident should be implemented *as far as is reasonably practicable.*	In some cases independence and separation cannot be fully achieved. According to Req. 7 (SSR-2/1) "The design of a nuclear power plant shall incorporate defence in depth. The levels of defence in depth shall be independent as far as is practicable." Para. 4.13A (SSR-2/1) "The levels of defence in depth shall be independent as far as practicable to avoid the failure of one level reducing the effectiveness of other levels. In particular, safety features for design extension conditions (especially features for mitigating the consequences of accidents involving the melting of fuel) shall as far as is practicable be independent of safety systems." Examples where full independence cannot be achieved: The containment is a structure that is used on different levels of defence to fulfil the confinement function. It is not reasonably practicable to require a fully independent containment structure for different levels of defence. Additional examples include, e.g. reactor pressure vessel, emergency power supplies used for DEC, certain I&C aspects. For further examples, please refer to p. 16-17, WENRA Report on "Safety of new NPP designs", March 2013.		X		**Reason for rejection in previous step (step 7):** Not disputed by any other reviewers Step 8a: Clause 3.68 has been deleted because quite similar to 2nd bullet of clause 3.71 (ex 3.72) dedicated to DiD. By adding "dedicated" your concern should be captured. For a requirement "as far as is practicable" is a usual and correct terminology. For a safety guide the recommendations should be less general
3	Para. 4.3 10th bullet	*In PWRs* ensuring an adequate single free volume in the upper part of the containment to improve the efficiency of the containment spray (if any);	Please note that in a BWR, pressure control during a LOCA is achieved primarily by steam condensation in the suppression pool not by the containment spray. The containment spray is designed primarily to provide temperature control, i.e., to cool-down the conditions in the drywell and make sure that the temperature stays within prescribed limits (temperature vs. time-curve). This is important for component environmental qualification purposes. While the containment spray also helps to reduce the pressure and		X See clauses 4.63 and 4.70		**Reason for rejection in previous step (step 7):** Advanced BWR are now designed with large free volume and are very comparable to PWR free volumes. **ENISS response:** This is not true. One of the main features of

			wash out radioactive particles in a severe accident these functions are not main drivers for the spray design. Thus, the drywell free volume in a BWR is not a significant design parameter in order for the containment spray to perform its intended function. The containment spray doesn't require a large free volume to perform its intended function. Reducing the temperature in the containment atmosphere does not require the spray to enter a large volume. This may seem like small detail, however, the paragraph gives the wrong design motives behind the containment spray. See further comment on para. 4.58.				a BWR is that it has a small containment. IAEA:s statement is an illustrative example that the guide is written for PWRs and little BWR expertise has been involved in the authoring of the guide. Comparison PWR/BWR: The drywell free volume of GE's 1400 MWe ABWR design is 7350 m3. The containment free volume of AREVA's 1650 MWe EPR design is 80000 m3. Thus, the free volume of the BWR is smaller by a factor of 10!
4	4.18	~~The design pressure should not be lower than the value of the peak pressure that would be generated by the design basis accident with the most severe release of mass of material and energy and increased by 10 %.~~ ENISS have different proposals to revise this paragraph: At the early stage of the design , The design pressure should be defined as not be lower than the value of the peak pressure that would be generated by the design basis accident with the most severe release of mass of material and energy and increased by 10 %. The design pressure should not be lower than the value of the peak pressure that would be generated by the design basis accident with the most severe release of mass of material and	ENISS re-iterates this comment in the way it was raised in the previous review round. We propose to adapt the design pressure notion due account of DBC and DEC accidents. The containment is designed with several loads combinations and some parts of the containment are sized by different load combinations, there is not a unique design case. Furthermore criteria depend on the codes. In France RCC CW code provides that design basis accident (P,T) is balanced only by the pre-stressed force with a criteria of no traction within the containment wall, thus it provides margin to deal with design extension conditions which are verified with different criteria. The reliability of the design depends on the design criteria as much as the design pressure. There is not a single (P;T) that sized the containment structure. The margin of 10% on the initial DBA pressure has to be taken at an early stage of the project to include potential uncertainties. Ok to define a margin of 10 % but not linked with a design pressure which defined the tests pressure. At the early stage of the project a margin of 10% should be taken to cover those uncertainties. At the end of the project it has to be verified that all the accident pressure are below the initial values. P DBC final > 1,1 P DBC initial and P DEC final > 1,1 P DEC initial (the margin could be less than 10 % at the end of the project between the initial pressure, and the actual maximum pressure		X		**Reason for rejection in previous step (step 7):** Correct but there is a clear consensus to keep a definition for the design pressure. Clause 4.14 is of greater importance for design. Should be raised by the ENISS representative at the meeting.

		energy and increased by for example 10 %. The design pressure should not be lower than the value of the peak pressure that would be generated by the design basis accident with the most severe release of mass of material and energy and increased by a coefficient defined by the project.	(calculated at the end of the design phase). The test pressure should be defined with the actual maximum pressure due to the most penalizing pressure between design basis condition and design extension condition including eventually some uncertainties or phenomenon not properly represented during the test (liner thermal thrust). In France, the test pressure is defined relative to the most penalizing pressure Max {Pdbc; PDecwo core melt} multiplied by 10%, we need to modified AIEA NSG in order not to have a cumulative coefficient 1,1(margin) x 1,1(non represented phenomenon) x DBA pressure, it would be too stringent.				
5	Table 2. p. 31	SL-2 plus DBA – Criteria for leaktightness = ~~Level II~~ N/A	The previous version of AIEA NSG 1.10 considered the leak tightness requirement as not applicable (N/A) for containment. The design of the containment take into account more severe situations (higher seismic level, DEC combinations, resistance to air plane crash) which provide margins. As it is mentioned in our comments this combination is a solution to provide margins, those margins shall be evaluated according to the section on "Ultimate capability and failure mode". If those margins are not sufficient, the designer shall strengthen its design in the most limiting parts. From our experience feedback in containment design, we know that this combination generates stresses in the lower and vertical direction of the containment. If this part is not the limiting part of the containment, it is not relevant to strengthen it. We re-iterate our proposition to return to the previous proposal of AIEA NSG 1.10 and to considered leak tightness requirement as not applicable (N/A) for this combination. The present proposal will cause difficulties in the construction of future containments. Furthermore we agree that it is not relevant with the engineering criteria for liner in table 2; i.e., not applicable for SL2+DBA (previously the level III was given).	X			**Reason for rejection in previous step (step 7):** For the time being will be kept as it is. IAEA TO: SL-2 plus DBA : N?A for leak tightness (modification implemented in Table 2)
6	4.58	Separate the chapter on "ENERGY MANGEMENT" into two parts: 1) Dry containments (PWR) 2) Pressure-suppression	This paragraph is not true for pressure suppression containment designs. A large drywell free volume may lead to higher containment pressures during LOCA. Basic design features of a PS-containment that are necessary to		X See clause 4.70		**Reason for rejection in previous step (step 7):** Text in red not understood. A large free volume is always a good design

		containments (BWR) Develop a completely new Chapter dealing with guidelines applicable to “Pressure-suppression containments (BWR)”.	limit the peak pressure during a LOCA are: 1) Sufficient water volume in the pool. The suppression pool must contain a sufficient amount of water to be able to condense all steam that is released from the reactor in during a LOCA. 2) Seal-tight barrier separating the drywell from the wetwell air space. If steam can escape from the drywell to the wetwell without condensing in the pool then the PS-function is by-passed in which case high-pressures will be generated during a LOCA. 3) Sufficient vent area. The vent flow area between the drywell and the suppression pool must be properly sized to limit the maximum pressure during blowdown. When the above basic requirements are fulfilled the primary physical parameter that govern the peak pressure is: 4) the ratio of the drywell free volume to the wetwell free volume. A large drywell free volume in relation to wetwell free volume will result in higher containment pressure following a pipe rupture event. The reason is that a larger drywell volume contain a larger volume of non-condensable gas that will transfer to the wetwell during a LOCA. During normal operation the drywell and wetwell free volumes are filled with non-condensable gas (either nitrogen or air). During a LOCA, this gas will accumulate in the wetwell air space. The pressure in the drywell balances at a pressure slightly above the wetwell pressure (steam is always present at sufficient amounts to pressurize the drywell). When all nitrogen gas has been transferred to the wetwell the drywell/wetwell pressure practically reaches its maximum. Vacuum breakers equalizes the pressure between the wetwell/drywell if the pressure in the drywell decreases due to steam condensation. Thus, the free volume of a PS-containment is not a “primary physical parameter determining peak pressures after a postulated pipe rupture event”. The required volume of a PS-containment is determined by other needs than for the purpose of limiting the pressure during a LOCA. One of the main features of a BWR is its small containment. IAEA:s statement is an illustrative example that the guide is written for				and such recommendation also applies to BWR. **ENISS response:** It is not true that a large free volume is always good for a PS-containment. Comment re-iterated.

			PWR containments and little BWR expertise has been involved in the authoring of the guide. Comparison PWR/BWR containment size: The drywell free volume of GE's 1400 MWe ABWR design is 7350 m3. The containment free volume of AREVA's 1650 MWe EPR design is 80000 m3.				
7	4.60	For a dry containment, the energy management function of the spray system is to remove energy from the containment atmosphere in order to limit both the maximum values and the time durations of the high pressure inside the containment in accident conditions. Add a new chapter dealing with "Pressure-suppression containments (BWR)" For a pressure-suppression containment, the function of the spray system is to control temperatures in the containment atmosphere. The spray system is also used to reduce pressures and wash out radioactivity.	For a PS-containment, the primary function of the containment spray system is to control temperatures in the containment atmosphere. The spray system also helps to reduce pressures and wash out radioactivity. Energy management, on the other hand, is handled by the suppression pool cooling systems and by heat transfer to containment structures.				**Reason for rejection in previous step (step 7):** Containment spray where installed has that function

Form for Comments

Design of Reactor Containment Structure and Systems for Nuclear Power

(DS482)

COMMENTS BY REVIEWER Reviewer: M-L Järvinen Country/Organization: Finland/STUK			Page.... of.... Date:12.12.2016	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	3.45	A set of the most likely representative conditions in case of an accident with core melting should be considered to provide inputs to the design of the containment and of the safety features necessary to mitigate the consequences of an accident with core melting. Conditions with core melting, retained as boundary conditions for the design of the containment structures and for the associated systems, should be justified on the basis of PSA level 2 analyses supplemented by engineering ~~experience~~ judgement with the aim at selecting the more likely and representative ones.	Terminology Replace experience by judgement Consistency with the other IAEA documents.	X			
2.	3.87	Environmental qualification should be carried out by means of testing, analysis and ~~the use of expertise~~ engineering judgement, or by a combination of these.	Terminology Replace the use of expertise by engineering judgement Consistency with the other IAEA documents.	X (ietm 3.86)			
3.	4.31	Engineering criteria for leak-	Please check the	X			Clause 4.31 refers

		tightness and integrity of the containment and appurtenances (penetrations, isolation systems, doors and hatches), as proposed in 4.31 and 4.32 should be established on the basis of stress and deformation limits for different load combinations. Meeting the criteria given by codes and standards internationally recognized provides reasonable assurance that structures and components are capable of performing their intended functions.	referenced paragraphs. At the moment 4.31 is making a reference to 4.31.				to 4.34 and 4.36
4.	4.47/1	In this strategy, the heat from the molten core is removed through the wall of the reactor pressure vessel.	Clarity; change “vessel” to “reactor pressure vessel”.	X			
5.	4.49/3	…outside of the reactor pressure vessel.	Clarity; change “vessel” to “reactor pressure vessel”.	X			
6.	Reference [6]	INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety IAEA Safety Standards Series No. GSR Part 2 Published Thursday, 30 June, 2016.	Replace the reference [6] to updated GSR Part 2.	X ([13])			

TITLE: *DS 482 Design of reactor containment structure and systems for NPPs*

COMMENTS BY REVIEWER Country/Organization: FRANCE Date: pages				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.2	For nuclear power plants, ~~confinement of radioactive material in accident conditions primarily relies on the integrity and leak tightness of~~ a strong structure surrounding the reactor termed "containment" in this publication is designed for the confinement of radioactive material, notably in accident conditions.	Confinement function is far more complex than the containment structure	X			
2	2.4	~~an increase of up to 1 mSv over the dose received in a year from exposure due to naturally occurring radiation sources is recommended by ICRP~~	ICRP does not recommend an increase of doses			X	" an increase of up to about 1 mSv" Ref GSR Part 3 item 1.25
3	2.4	For design basis accidents and design extension conditions without significant fuel degradation, the releases are minimized such that off-site protective actions (e.g. evacuation, sheltering, iodine thyroid blocking~~, food restrictions~~) are not necessary (see Requirement 19 item 5.25)	Requirement 19 does not mention anything about food restrictions. A full avoidance of food restriction after accident – even without core melt – may be not achievable.	X			

TITLE: *DS 482 Design of reactor containment structure and systems for NPPs*

4	2.4	~~Sequences which might lead to an early radioactive release or a large radioactive release are "practically eliminated" by appropriate design provisions (see item 2.13/4)~~ Create a 2.4a 2.4a Moreover, the possibility of conditions arising that could lead to an early radioactive release or a large radioactive release is 'practically eliminated by appropriate design provisions (see item 2.12/4).	This sentence could not be: • A bullet of 2.4 because 2.4 is related to the design of containment and associated system to minimize releases: for practically eliminated situation, the design does not aim at minimizing releases but at avoiding these situations • A sub-bullet of "releases are to be dealt.." for the same reason. The proposed 2.4a is from requirement 20/5.31 that enhance the specificities of these situations		X		Level of the bullet has been upgraded
5	2.6	Leak tightness is generally characterized by specified maximum leak rates	Precision	X			
6	3.7	The PIEs relevant for the assessment of the containment structures and systems should include	Precision			X	PIEs are relevant for both design and assessment. So keeping more general is also correct
7	3.18	Design methodologies should contain measures to ~~confirm~~ ensure that adequate margins exist to avoid cliff edge effects		X			
8	3.20	management of combustible gases inside the ~~Primary~~ containment during accident conditions	Primary containment is not defined	X			
9	3.21	The following recommendations provide guidance to prevent an early radioactive release or a large radioactive release in the event of levels of natural hazards exceeding those considered for design, derived from the hazard evaluation for the site (Requirement 5.21A [3]).	To be consistent with the requirement (copy/paste from the requirement		X The list is kept as examples		

TITLE: ***DS 482 Design of reactor containment structure and systems for NPPs***

10		Structures, systems and components (SSCs) ultimately necessary to prevent an early radioactive release or a large radioactive release in the event of levels of natural hazards exceeding those considered for design, derived from the hazard evaluation for the site refer in particular to some of the SSCs necessary to mitigate the consequences of accidents with core melting and to some of the SSCs necessary to practically eliminate those conditions. ~~A detailed list of these SSCs is design dependent, however, in general and for the scope of this Safety Guide it should include at least:~~ • ~~…~~	To be consistent with the requirements 5.21A and 5.31 Consider deletion of the list which could not be exhaustive and may be tricky, at least controversial				
11	3.38	Design extension conditions should be identified and used to establish the design bases of containment structure and of systems necessary to meet the ~~radiation protection~~ objectives established for that category of accidents	Objectives in general should be achieved	X			
12	3.49	For containment ~~with a small free volume~~ for which venting the containment would be necessary to preserve the integrity of the containment	This article is applicable whatever the volume is	X			
13	3.63	~~Additional safety features should have an adequate reliability to contribute to the practical elimination of conditions that could lead to an early radioactive release or to a large radioactive release~~	The general sub title is " Safety features for design extension conditions without significant fuel degradation". Such conditions could not lead to large or early radioactive releases			X	In DS 482 The additional safety features for DECs are not those implemented to reinforce the prevention of accident with core melting but to preserve the containment integrity in the event of multiple failures in systems designed to control the pressure build up: containment venting, extra spray system, Containment Heat removal system, etc. As long as the integrity of the containment is maintained we do not expect a large release

TITLE: ***DS 482 Design of reactor containment structure and systems for NPPs***

14	3.68	Safety systems and specific safety features necessary to mitigate the consequences of an accident with core melting should be independent to the extent practicable, of those used in more frequent accidents	To be consistent with requirement 20. Moreover "to be independent" without mentioning "of something" does not mean anything.		X Clause deleted		Repetition with 2nd bullet of 3.56 (Defense in depth)
15	3.98	~~As a complement to a number of investigations related to fabrication, testing, inspection, evaluation of the operating experience, PSA should be used together with deterministic calculations in demonstrating a very low probability of an early radioactive release or a large radioactive release for postulated design extension conditions with core melting. This should include inter alia the analysis of the reliability of containment systems, e.g. containment cooling system, containment filtered venting, etc. and other aspects that have traditionally been considered in level 2 PSA~~	This article does not provide any further guidance compared to 3.97 and may be misunderstood, notably with regards to the position of practical elimination: DEC conditions are postulated, practically eliminated conditions are obviously not, since they are practically eliminated		X		, PSA should be used to confirm the very low probability of the failure of the means implemented for an appropriate mitigation of the design extension conditions with core melting.
16	4.105	Appropriate design provisions should be taken to demonstrate that conditions involving a containment bypass and leading to a large early radioactive release ~~or a large radioactive release~~ have been practically eliminated	The general sentence from requirement does not provide any guidance here: it should be more accurate since the chapter deals with the conditions with containment by pass		X		."…early radioactive release or a large radioactive release" Is kept. (see SSr2/1 rev 1.)
17	4.129	…gases or by a ~~fast~~ deflagration or detonation of a combustible gas	"fast" is not necessary		See new paragraph on threats due to combustible gases		
18	A.12	~~Although~~ the use of permanent equipment for the practical elimination of large early releases should be preferred ~~(~~as for new plants~~) a more relaxed approach on the use of non-permanent equipment may be acceptable provided the plant is provided with adequate connection features.~~	The recommendation for the use of permanent equipment is fully relevant only for practical elimination of early release since time is an important parameter (consistently with A11). Practical elimination is not applicable to operating reactor.		X		This clause applies to <u>large</u> release only. Although the use of permanent equipment for avoiding large releases should be preferred ….

Draft Safety Guide DS482 "Design of Reactor Containment Structure and Systems for Nuclear Power Plants"
(Version dated 2016-08-31)
Status: STEP 8 – Submission to the Member States for comments

Note: Underlined are those to be added in the text. ~~Crossed out~~ are those to be deleted in the text.

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS and RSK) Page 1 of 20 Country/Organization: **Germany** Date: 2016-12-23				RESOLUTION			
Relevance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
3	1	1.4	The objective of this Safety Guide is to make recommendations on the implementation and fulfillment of <u>SSR-2/1</u> Revision 1 requirements relevant for the containment structures and <u>containment</u> systems <u>[3].</u>	- Typing error SSR-2/1 - Harmonize text with regard to chapter termed „containment structures and containment systems" in SSR-2/1and add missing reference.	X			
2	2	1.6	This Safety Guide addresses the functional aspects of the <u>containment and</u> major systems associated to the containment for the management of energy, radionuclides and combustible gases. Consideration is given to the definition of the design basis for the containment and associated systems, in particular to aspects affecting the structural design, the reliability and the independence of systems that do not belong to the same level of defence. <u>Consideration is given also to the definition of design extension conditions (accidents without and with core melting) and the additional and specific safety features to be implemented to mitigate the consequences of such accidents.</u>	The SG does not only address major systems of the containment, it addresses both - the containment and associated systems. It should be made clear that the OBJECTIVE for new NPPs now is to include requirements for DBA and DEC.		X See new item 1.6		
2	3	1.9	Section 3 provides recommendations to the de-	Clarification			X	Captured in item 1.6

Relevance: 1 – Essentials 2 – Clarification 3 – Wording/Editorial

			sign basis of the containment and associated systems including considerations for design extension conditions. Section 4 provides specific recommendations for the design of the containment structures and associated systems including considerations for design extension conditions.					
2	4	2.4, second bullet	"- For design basis accidents and design extension conditions without significant fuel degradation, … - For design extension conditions with significant fuel degradation ~~accident with core melting~~, the …"	The term "design extension conditions without significant fuel degradation" covers all aspects (severe accidents not related to the core or to fuel melt), this term should consistently used throughout the text (already in the next bullet).			X	"With core melting" is the terminology used in SSR-2/1
3	5	2.13	The containment is designed to protect structures, systems and components (SSCs) housed …	Clarification; abbreviations should be explained.	X			
3	6	3.1	… to meet the requirements 1 to 3 of SSR-2/1 Rev.1 [3] and GSR Part 2 requirements [6].	Typing error SSR-2/1 and missing reference	X			
3	7	3.	**3. DESIGN BASIS OF CONTAINMENT STRUCTURES, SYSTEMS AND COMPONENTS**	To make it clear, that the containment is meant and not other SSCs.	X			
3	8	3.20	The autonomy of systems designed for the energy management, the control of radionuclides and the management of combustible gases inside the ~~Primary~~ containment during accident conditions should be longer than the time necessary prior to crediting off-site support services.	It seems not necessary to limit this requirement only to systems within the "primary" containment. If reasons exist, the term "primary containment" needs to be defined beforehand.	X			
2	9	3.21	The following recommendations provide guidance to practically eliminate ~~prevent~~ an early radioactive release or a large radioactive release	To make it clear, that releases from the containment are meant.	X			

			from the containment in case of an accident (Requirement 5.21A [3]).					
2	10	3.22	Structures, systems and components (SSCs) ultimately necessary to prevent an early radioactive release or a large radioactive release from the containment refer in particular …	To make it clear, that releases from the containment are meant.	X			
2	11	3.21 & 3.22	-	The paras 3.21 & 3.22 are located under the subchapter “EXTERNAL EVENTS, but contain general information related to SSC and the prevention of radioactive releases from the containment. They should be moved up to the subchapter GENERAL.			X	SSR-2/1 Req. 5.21A is relevant for External Hazards
2	12	3.23	SSCs ultimately necessary to practical eliminate an early radioactive release or a large radioactive release from the containment should be protected against ~~For~~ external flooding. This would mean that either all the structures hosting ~~the above mentioned~~ such systems are located at an elevation higher than the one derived from the site hazard evaluation, or adequate engineered safety features (such as water tight doors etc.) should be in place to protect these structures and ensure that mitigating actions can be maintained.~~:~~	In case paras 3.21 & 3.22 are moved up to subchapter GENERAL the para 3.23. should be changed as follows			X	See above
2	13	3.30 - 3.33	-	The paras 3.30 & 3.33 are located under the wrong headline ACCIDENT CONDITONS.			X	Accident conditions should be assessed/calculated by running codes in

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				They should be moved further down to the sub-chapter CODES AND STANDARDS where similar requirements are already defined.				order to design performances of the safety systems and safety features for DECs. So it also makes sense to keep those recommendations under this sub chapter.
2	14	3.31	To the extent practicable, 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 qualified and trained with respect to the operation and limits of the code and with respect to the assumptions made in the design. [21]	References to the relevant paras of DS491 should be made. This is also true for para 3.40, 3.41, 3.43, 3.45				See 3.39
2	15	3.35	For the performances of the containment structures and systems, design basis accident conditions should be defined ~~calculated~~ taking into account	Clarification	X		X	This Safety guide provides guidance for the design of components. Conditions should be calculated
2	16	3.36	-	3.36 should be moved up to subchapter GENERAL, as it is a general requirement.			X	This information is also important to understand how DBAs should be managed
2	17	3.39	Calculation performed to assess conditions imposed by DECs may be less conservative than those imposed by design basis accidents provided that margins be still sufficient to cover uncertainties. Performing sensitivity analyses could also be useful to identify the key parameters. [21]	References to the relevant paras of DS491 should be made. This is also true for para 3.40, 3.41, 3.43, 3.45.			X	Do not confuse design and safety assessment. Methodology used for design may be different provided requirements and margins

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								are met and ensured
3	18	3.43	- Loss of wet well / heat sink (BWR);	Typing error	X			
2	19	3.49	„~~For containment with a small free volume for which~~ In case venting the containment would be necessary to preserve the integrity of the containment, its use should not lead to an early or a large radioactive release (see Requirement 6.28A).“	This should not only be recommended for containment with a small free volume.	X			
2	20	3.49, new bullet	• The venting system should not fail due to combustible gas effects.	Clarification.			X	Included in the 2nd bullet
2	21	3.53	Furthermore, design limits should be specified for each containment structure and associated system ~~system as well as for each structure and component within each system.~~ Limits should be applied …	Sentence was not clear. Design limits are to be applied for each containment structure and associated system, right?	X			
2	22	3.56	Energy management (for pressure and temperature control, and for containment heat removal) and control of radionuclides in the event of design basis accidents	Explanation what energy management means would be helpful.			X	Clear with the paragraph dedicated to energy management
2	23	3.63.	Additional safety features should have an adequate reliability to contribute to the practical elimination of conditions that could lead to an early radioactive release or to a large radioactive release.	Should be moved down to the subchapter for “Safety features implemented to mitigate the consequences of an accident with core melting“ as such releases are to be expected not in case of no significant core degradation.			X	This clause targets systems designed to preserve the containment integrity in the event of DBAs combined with multiple failures in the systems designed to limit the containment pressure
2	24	3.67	~~Components~~ Additional safety systems and specific safety features necessary to mitigate the consequences of an accident with core melting should be capable of being supplied by any of the available power sources.	Use same wording as in 3.68 respectively in 3.62 and 3.63. Not only components are required for DEC.			X	Applicable to any component credited in the demonstration submitted for accidents with core melting.

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3	25	3.68	Additional safety systems and specific safety features necessary	Use same wording as in 3.62 and 3.63				3.68 has been removed (repetition of 3.71 2nd bullet
2	26	3.69	Recommendations related to the reliability of the system with regard to the effects of internal or external hazards and environmental conditions are addressed in paragraphs 3.3, 3.4 and ~~3.11~~ 3.25 respectively.	3.25 seem to be more appropriate than 3.11 for systems used in accidents with core melt.		Explicit reference to the right clauses		
1	27	3.73 & 3.76	~~Conditions~~ Plant states arising in case of postulated core melt accidents under DEC that could lead to an early radioactive release or a large radioactive release are required to be practically eliminated by design (see Requirement 20/5.31). Under consideration of the estimate of the probability that such conditions will occur, additional design provisions to practically eliminate such conditions are to be taken. ~~3.76. Core melting accidents should be postulated as Design Extension Conditions despite of design provisions taken to prevent such conditions and of the estimate of their probability to occur.~~	So far requirement 3.76 and 3.97 are contrary. Proposal to modify and combine 3.73 and 3.76 and have in mind what is said in 3.97: "PSA can be used to demonstrate the practical elimination of conditions that could lead to an early radioactive release or …"			X	Clauses 3.72 (new numbering) and 3.75 are correct and not have been commented by other MS
3	28	4.7, 4.8		There should be a link (footnote?) to the definition of "secondary" containment as given in 4.97.		X Not necessary to say "Primary" or "Secondary" here.		
2	29	4.20	• The potential input from the secondary system (PWR) to cover for effects e.g. due to subsequent steam generator tube ruptures in case of LOCA	German requirements ask for taking into account (for PWRs) the secondary coolant mass and energy content of one steam generator, when calculating the pressure and temperature load in the containment volume. The			X	Not the practice of other MS

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				potential input from the secondary system (PWR) should be mentioned, at least to cover for effects e. g. due to subsequent steam generator tube ruptures in case of LOCA.				
2	30	4.47	In this strategy, the heat from the molten core is removed through the wall of the reactor pressure vessel. This requires e.g. the reactor cavity to be flooded sufficiently to remove the heat produced. ~~at least to a level above the location of the molten core.~~ Mechanical and thermal loads in the walls of the cavity should be considered. Features should be included to remove the heat from the cavity and to avoid ~~its~~ the pressurization of the cavity and the containment.	Is it always the case that flooding the cavity to a level above the location of melt is sufficient? A more general recommendation would be better. Pressurization of the cavity is one item, but in general the containment is meant.		… to be sufficiently flooded to enable external cooling of the reactor pressure vessel		
2	31	4.48	The structures of the cavity should be considered as items ultimately necessary to enable external cooling of the RPV and to avoid RPV failure, melt release into the containment and possibly large radionuclide releases in case of containment failure; ~~and~~ consequently they should be such that design margins are adequate to deal with seismic loads exceeding SL-2.	It is not clear, why in case of in-vessel retention the cavity structure avoids large releases. Clarification could be provided by some additional explanations as proposed.		Considering 4,47, the structures …		
2	32	4.49	In this strategy, the containment should be equipped with an ex-vessel retention structure (core catcher ~~or wet cavity for BWR~~) or another measure dedicated to contain and cool the molten core outside of the vessel.	As far as it is known, research results do not always confirm that a wet cavity might be sufficient to cool the melt coming out of the RPV in a BWR. Example should be deleted and formulated in another way.		Parenthesis deleted		

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2	33	4.53	The core catcher or any other measure should be considered as items ultimately necessary to enable melt retention and cooling in the containment and thereby avoiding large releases in case of containment failure; ~~and~~ consequently it should be such that design margins are adequate to deal with seismic loads exceeding SL-2.	Modification recommended in case comment to 4.49 is taken further. It is not clear, why in case of in-vessel retention the cavity structure avoids large releases. Clarification could be provided by some additional explanations as proposed.		The ex-vessel retention structure …		
2	34	Page 34	STRUCTURAL DESIGN OF ASSOCIATED SYSTEMS	To make it clear, that associated systems to the containment are meant.			X	DS 482 deals with the containment structure and systems
2	35	4.54	For the structural design of systems associated to the containment ~~systems~~, a set of representative loads and load combinations, as well as a set of adequate engineering criteria, should be established by a similar procedure as for the containment structures, with account taken of all the relevant accident conditions.	To make it clear, what is meant.			X	Clear
3	36	4.56	During normal plant operation, a ventilation system should be operated to maintain the pressure and temperature in the containment within the limits specified for normal operation. ~~More detailed recommendations are given in [10].~~	[10] makes reference to NS-G-1.5 which covers "External Events Excluding Earthquakes in the Design of NPP". The reference does not contain any relevant information with regard to "control of pressure and temperature". Should be deleted.			X	Reference to the SG dealing with the design of Auxiliary systems (new draft in progress)
2	37	4.66, 4.67	Complex hydraulic and pressure transients occur when steam and gases are vented into the suppression pool water, either from the dry well or				X	4.71 and 4.72 (new numbering) has been kept separated.

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			through steam discharge from RPV. *The hydraulic response of and loads imposed to the pressure suppression pool in the different plant states should be determined and considered for design.* The design of the dry and wet wells and connection features should be such that the hydraulic responses and the dynamic loads can be reliably determined by analysis and tests.					
2	38	4.80	For containment with a steel shell, heat released in the containment under accident conditions can be removed passively through the steel shell. A secondary and outside envelope is needed and is designed to remove heat by providing a natural circulation path for air (the chimney effect). Additional systems may be designed to enhance the heat removal by adding water to the outer side of the containment. ~~Containment spray is implemented by spraying of the outside of the steel shell.~~	The requirement is very design specific but does not cover main designs as AP1000 or CAP1400. Such designs use passive water flow from an elevated storage down along the outside of the containment; an external spray is not used. Text should be adopted as proposed.			X	Recommendations for reliability, performances or autonomy should not be design dependent and should be those given in Chapter 3
2	39	4.82	Where passive containment cooling is adopted, the following aspects should be considered: ~~• The entire system should be qualified and validated by means of tests and analyses.~~	Why it is only for passive systems requested that the entire system should be validated by means of tests and analyses? This is an overall requirement and does not necessarily be mentioned here.	X			
3	40	4.83	Containment structure and systems should be designed to meet the objectives for preventing and limiting the radiological release specified for the different plant states as indicated in ~~2.1~~ 2.4.	Wrong reference to para 2.1; 2.4. provides basic requirements with regard to radionuclides.	X			
3	41	Page 40	**Secondary ~~containment~~ confinement**	The head line should be made conform to the wording used in the text	X			

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				thereafter. Secondary confinement is used in the text.				
2	42	4.97	Secondary confinement is in some designs an arrangement, in which the primary containment is completely or partially enclosed within a secondary envelope. The purpose of the secondary envelope in such designs is not to take over the functions of the primary containment should it fail but to allow for the potential collection of leaks from the primary containment and for a filtered release via the vent stack. In addition, it can provide increased protection against external hazards. When such a design option is implemented, the secondary ~~containment~~ confinement structure is also often designed as the shielding structure of the containment.	Not in all new NPPs the secondary confinement has the functions as defined in 4.97 - 4.103. E.g. in AP1000, CAP1400 the secondary confinement is used for passive containment cooling. Wording should be adopted. Use same wording everywhere.	X			
2	43	4.112	In general, a single system is not sufficient for reducing the concentrations of radionuclides, and multiple systems should be employed. Examples of methods used for the reduction of airborne radionuclides in water cooled reactors of extant and new designs are: • Deposition on surfaces; • Spray systems; • Pressure suppression pools; • Ventilation and venting systems.	These are only examples of measures to reduce airborne radionuclides. Other exists as the enhanced convection of the gas flows in the containment as adopted by the EPR. Therefore “Examples of …” should be added. For consistency between headline and text, venting systems should be mentioned here as well.	X			Venting system
2	44	4.122	Where containment venting systems are installed, the system should be designed to minimize the release of radionuclides to the environment [4]. The system design could include a filtering system such as sand, multi-venturi scrubber systems, HEPA or charcoal filters, or a	It is not only air what is released.	X			

			combination of these. HEPA, sand or charcoal filters may not be necessary if the ~~air~~ released gas flow is scrubbed in a water pool.					
2	45	4.124	Hydrogen and oxygen are generated during normal operation of a plant as a result of the radiolysis of water in the core. In accident conditions (e.g. during a LOCA, or to a larger extent during an accident with core melting), combustible gases (hydrogen and carbon monoxide) might be released into the containment atmosphere.		X			See new text
2	46	4.125	• Metal–water reactions ~~in the~~ of core components and RPV internals;	The metal water reaction does not take place only in the core; it is extended even further after melt relocation. If core components are mentioned, absorber materials are included as well. Modified wording would take this into account.	X			See new text
3	47	4.125	~~•~~ All these contributions should be evaluated.	Remove the dot; this is a separate sentence.	X			See new text
2	48	4.126	The amount of combustible gases generated and typical release rates into the containment should be calculated for normal operation, LOCA and design extension conditions. The uncertainties in the various possible mechanisms for generation should be taken into account by the use of adequate margins. ~~If the amount of hydrogen expected to be generated by metal–water reactions is estimated on the basis of the assumption of total oxidation, uncertainty evaluation may be not necessary.~~	For the management of combustible gases not only the total amount of gases is important, as well the release rate into the containment. The last sentence should be deleted, as it is not precise enough - what does “total oxidation” mean - of what?	X			See new text
2	49	4.128	~~Additional hydrogen production due to molten core concrete interaction should be estimated.~~	This can be deleted, as it is included already in	X			See new text

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				4.125 and 4.126.				
2	50	4.129	Threats to the containment structures are reactor technology and design dependent but usually refer to a risk of over pressurization caused by a large production of non-condensable gases or by different combustion phenomena, e.g. a fast deflagration or detonation of a combustible gas.	Global combustion may as well happen, not just fast deflagrations or detonations. Wording could be adopted as proposed.	X			See new text
2	51	4.129	… However, in case measures to inert the containment are applied ~~for~~ ~~inert containment~~ (e.g. as applied for some BWR) the risk of hydrogen combustion ~~explosion~~ is ~~low~~ practically excluded due to the presence of inert gas and the absence of oxygen in normal power operation and accident situations.	The containment of a BWR is not inert by itself, active measures are implemented to inert the containment. This needs to be corrected.			X	The term “Risk” was not appropriate; but “probability” is low.
2	52	4.129	… For non-inert containment (PWR, PHWR, BWR) generally characterized by a large free inner volume, the primary threat in the short term is the risk of strong hydrogen combustion challenging the containment integrity ~~explosion~~ due to potential high local hydrogen concentration.	It must not be necessarily an explosion, global combustions or other events may challenge the containment integrity as well.				See new text
2	53	4.130	To identify a need for the installation of special features to control combustible gases, an assessment of the threats to the containment should be made. The assessment should cover Generation phenomena (see 4.125), release rates, transport and mixing of combustible gases in the containment, combustion phenomena (diffusion flames, deflagrations and detonations) and the consequent thermal and mechanical loads.	A link to 4.125 should be made. Release rates are as well important.				See new text
2	54	4.131	The contribution of non-combustible gases should be taken into account for combustion calculations ~~ignition~~ and containment over pressurization.	The sentence does not make sense. Probably non-condensable gases are meant and “combustion calculations” not		The contribution of all -combustible gases		See new text

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				"combustion ignition".				
2	55	4.132	Leaks and releases of combustible gases from the containment should also be taken into account when evaluating the threats both to environment and connected or surrounding buildings (e.g. secondary confinement, penetration buildings or auxiliary buildings hosting safety equipment). To identify a need for the installation of special features to control combustible gases in connected or surrounding buildings, an assessment of the threats to such buildings should be made (see 4.130).	Here the secondary confinement should especially be mentioned, in which hydrogen would be "stored" if leaking from the containment. What may happen was shown in Fukushima. Therefore the need for analyses for the installation of special features to control combustible gases there should be required.		X		Last sentence is not needed (if the threat is high, provisions should be implemented)
2	56	4.135 and 1. sentence of 4.136	Systems for the prevention of hydrogen combustions challenging the containment integrity should be provided. The efficiency of the systems should be such that global and local hydrogen concentrations are low enough to preclude combustions challenging the containment integrity.~~, e.g. hydrogen removal, deliberate ignition, homogenization or inerting should be provided~~.	Not the systems should be mentioned, the goal of the implementation of such measures need to mentioned here first. The first sentence of 4.136 should be added for clarification. Examples are to be deleted here as they follow in 4.136.				See new text
2	57	4.136	~~Design~~ Provisions to be implemented ~~in the design~~ for achieving this goal under DBA and accident conditions are, for example, an enhanced natural mixing capability of the containment atmosphere coupled with a sufficiently large free volume, passive autocatalytic recombiners and/or igniters suitably distributed in the containment, or an inert containment.	Efficiency or efficacy? Efficacy was used at another place (3.49). "Design provisions" could be misunderstood, as accident conditions must be included.				See new text
2	58	4.137	~~*Removal*~~	It is not clear what the				See new text

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			~~4.137. Passive means such as passive autocatalytic recombiners and/or active means such as igniters should be provided for burning/removing hydrogen.~~	intention is - should in all new plants such devices being implemented or are other measures possible instead of? What are the requirements for an implementation? Proposal - to be deleted, as no new information is provided ; example is given already under 4.136.				
2	59	4.138	~~*Homogenization*~~ ~~4.138. The containment design either should incorporate active means (such as sprays and mixing fans qualified for operation in a combustible gas mixture) or should facilitate the action of mechanisms (such as large volume dispersion or natural circulation) to enhance the uniform mixing of the containment atmosphere within and between compartments. This is to ensure that local hydrogen concentrations do not reach detonation limits following an accident.~~	As for 4.137 - it is not clear what the intention is - should in all new plants such devices being implemented or are other measures possible instead of? What are the requirements for an implementation? To be deleted, as the option of HOMOGENIZATION is just one option to be implemented. The text reads as it is requested for all NPPs; example is given already under 4.136.				See new text
2	60	4.139	~~*Inerting*~~ ~~4.139. One possible way to avoid combustion is to inert the containment atmosphere during reactor operation (usually with nitrogen). This is mainly applicable to a small containment.~~	To be deleted, as no new information is provided; example is given already under 4.136.				See new text
2	61	4.176	Ageing effects should be evaluated in the selection and design of types of concrete [16]. An appropriate ageing management program should	Should also be added for the other materials listed on the following pages.	X			

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			be developed."					
2	62	4.191	To support the implementation of the defence in depth concept, ~~and~~ to enhance the reliability of the containment systems, and to obtain essential information on the plant that is necessary for its safe and reliable operation, for determining the status of the plant in accident conditions and for making decisions for the purposes of accident management, instrumentation should be provided for the purposes of: • Monitoring of the stability of the containment structure; ~~• Detection of deviations from normal operation;~~ • Periodic testing; • Monitoring of the availability of the containment systems; • Initiation of automatic operation of systems; • Detection of deviations from normal operation; • Accident and Post-accident monitoring (monitoring of essential parameters of the containment for normal operation and accident conditions)	Requirement 59 of [3] *"Instrumentation shall be provided for determining the values of all the main variables that can affect … the containment at the nuclear power plant,* ***for obtaining essential information on the plant that is necessary for its safe and reliable operation, for determining the status of the plant in accident conditions and for making decisions for the purposes of accident management."*** is more pronounced as it is currently described in 4.191 and following paras. It should be mentioned that instrumentation for monitoring of essential parameters of the containment for normal operation and accident conditions is required. Information available under "Post-accident monitoring" should be extended to include "Accident situations"		4.1. For a safe operation of the containment structure and systems in operating states and accident conditions, instrumentation should be provided for the purposes of:		In order not to repeat Req. 59
3	63	4.197	Appropriate instrumentation for measurements relating to earthquakes should be installed at suitable places (e.g. on and/or the basemat of the	Sentence is incomplete or "and/or" should be deleted.	X			

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			containment at suitable floors).					
2	64	4.198	Appropriate instrumentation should be incorporated inside the containment for an early detection of deviations from normal operation: • Abnormal pressure, temperature and gas concentration including combustible gases • Leaks of radioactive material (as airborne activity, activity in the sumps); • Abnormal radiation levels; • High energy leaks; • Leaks; • Fire; • Failure of components.	Why is there no need to implement instrumentation to measure pressure, temperature and gas concentrations incl. combustible gases? This is common practice in operating NPPs.		X		List of conditions causing deviation from normal operation, not a list of parameters to be monitored.
2	65	4.199	Instrumentation sensitivity and ranges necessary to detect a developing deviation from normal operation and to detect the plant status in accidents should be estimated by appropriate analytical methods.	Not only the sensitivity is important, as well the measurement range.		X		
2	66	4.200	For an adequate detection of the different abnormal conditions, information provided by the instrumentation can be used alone or in combination with others. ~~Parameters typically monitored are dealt with in the following:~~	Most of the parameters mentioned thereafter are obligatory to be measured; many of them are needed for plant status detection in case of accidents. Therefore the last sentence should be deleted.			X	Last sentence can be kept to provide examples but not an exhaustive list
1	67	4.xxx	*Containment atmosphere gas composition* Monitoring of containment atmosphere gas composition is necessary to check whether challenging conditions exist where combustion processes are to be expected and where active safety features are to be initiated.	This system is already installed in many plants. Accident condition monitoring and plant state determination requires such instrumentation. I is surprising that nothing is added in the SSG. Compare 4.220 where				

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				such a measurement is requested for accident conditions.				
2	68	4.220	**Accident and Post-accident monitoring** For the determination of the plant status in case of accidents and for management of accidents, appropriate instrumentation displays and records should be available in the MCR and the Emergency Control Center to allow personnel to make a diagnosis and to decide and to take the manual protection actions specified in the Emergency Operating Procedures or in the Severe Accident Management Guideline. Such instrumentation should provide information about: • Conditions inside the containment (containment pressure and temperatures, radiation levels, airborne activity, gas composition (e.g. steam, oxygen or hydrogen concentration if relevant);	As recommended for extension of 4.191, Accident monitoring should be included in the headline, as the paras within the chapter already include such requirements.	X			
2	69	Page 59	~~Sampling~~	Delete the headline sampling, as the instrumentation described belongs to the previous chapter	X			
2	70	5.4	A pressure test should be conducted to demonstrate the structural integrity of the containment ~~envelope~~ (including extensions and penetrations) and of the pressure retaining boundary of systems.	It was mentioned already in the comments received that envelope will be deleted, but it was not done.	X			
2	71	5.6	**Integrated leak tests (of the containment ~~envelope~~)** A leak test should be conducted to demonstrate that the leak rate of the containment ~~envelope~~ does not exceed the specified maximum leak rate. The test should be conducted with the components of the containment in a state representa-	It was mentioned already in the comments received that envelope will be deleted, but it was not done.	X			

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			tive of the conditions that would prevail following an accident, to demonstrate that the specified leak rate would not be exceeded under such conditions.					
2	72	5.12	For double wall containments, one way to determine the direct leak rate from the primary containment to the environment (i.e. if the leaked water or gas does not collect in the secondary containment or annular space between both ~~the inner and the outer containment walls~~) is by calculation. This calculation should determine the difference between (a) the total leak rate from the primary ~~inner~~ containment as determined by the leak test for the primary ~~inner~~ containment (this consists of both flow from the primary ~~inner~~ containment into the secondary confinement / annulus and flow from the primary ~~inner~~ containment to the atmosphere) and (b) the leak rate from the primary ~~inner~~ containment wall to the annulus, obtained after ventilation of the annulus has been stopped (this is typically calculated by subtracting the normal flow out of the annulus vent from the flow out of the annulus vent during the leak test).	The wording primary and secondary containment was used		X		
2	73	A.5	The assessment should consider a set of design extension conditions whose consequences should be analyzed with the purpose of further improving the safety of the nuclear power plant by:	Sentence incomplete		X		
2	74	A.14	Energy management:•Conditions leading to a direct containment heating should be prevented by different means; •Possibilities for steam explosion arising should be identified and their effects evaluated; •~~Different and d~~Diverse means should be implemented to control the pressure build up inside the containment in the different plant states; •Different and diverse means should be imple-	"Diverse" should include "different"	X			

			mented to remove heat from the containment in the different plant states; •If a containment venting system is needed for certain beyond original design basis events, it should be reliable, robust to withstand loads from hazards (e.g. earthquake), accident conditions, and to withstand the dynamic and static pressure loads existing when the containment venting line is operated; •Specific safety features and systems should be implemented to ensure the cooling and stabilization of the molten core. ~~Direct contact of core debris and containment structural concrete should be reliably prevented.~~	The last requirement which is to be implemented for existing NPPs seems to be unrealistic. It should be deleted.				
2	75	A.15, last bullet	Integrate the requirement 4.122 into A.15: 4.122. Where containment venting systems are installed, the system should be designed to minimize the release of radionuclides to the environment [4]. The system design could include a filtering system such as sand, multi-venturi scrubber systems, HEPA or charcoal filters, or a combination of these. HEPA, sand or charcoal filters may not be necessary if the air is scrubbed in a water pool.	The accident at Fukushima has caused large contaminated areas with severe consequences for the inhabitants. These consequences could have been largely avoided, if the releases had been filtered. By adequate filtering no significant Cesium- and Strontium-contamination had occurred. In several countries filtered vents were backfitted already in the 80ies or 90ies. This demonstrates that backfitting of filtered vents is possible for existing plants. Hence the requirements for filtered vents should			X	This concern is captured in the last bullet of A15.

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				be the same for existing plants (appendix) as for newly designed NPP. IAEA should demand this also in the interest of neighbouring countries, which should be protected from unfiltered releases from NPPs in the adjacent countries.				
2	76	A.16	Management of combustible gases: •Risks for hydrogen deflagration and detonation should be evaluated and adequate provisions should be implemented, if necessary, to prevent <u>hydrogen combustions challenging the containment integrity</u> ~~detonation~~ and to control the concentration of combustible gases inside the containment.	Compare 4.136 for use of text: "to prevent hydrogen combustions challenging the containment integrity" instead of "prevent detonations"		X		
2	77	A.16 New para	<u>The venting system should not fail due to combustible gas effects.</u>	Clarification.			X	
2	78	A.17	Instrumentation: •Operability, reliability and adequacy of instrumentation should be evaluated (e.g. measurement ranges, environmental qualification, power supply) to ensure operators obtain essential and reliable information about the containment status in the different plant states; •The containment shall be equipped with measuring and monitoring instrumentation that provides sufficient information on the progress of core melt accidents and threats to containment integrity and by which the operator can do the necessary SAMG actions. That instrumentation should be to the extent possible independent from the instrumentation used for the mitigation of DBAs;	Use wording as in main document with regard to "severe accidents"	X			

			•The new instrumentation should be qualified for ~~severe~~ accident~~s~~ conditions with core melt.					
1	79	New para	"The design of the inner structures of the containment should ensure that in case of a LOCA or a water loss event from the spent fuel pool (in case the pool is inside the containment) the water collects within the containment in such a way that it can be used for fuel cooling by recirculation."	The proposal should be added at an appropriate location within this Guide.			X	In DS 487 (Design of fuel storage and systems

DS482 "Design of Reactor Containment Structure and Systems for Nuclear Power Plants"

COMMENTS BY REVIEWER Reviewer: Imre PÁSZTOR Page.1 of. 4. Country/Organization:Hungary/MVM Paks II. Nuclear Power Plant Development Plc. Date: 11/01/2017				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	2.4.	...in accident conditions to ensure ~~a good~~ the required level of protection of the people and the environment (see Requirement 55	Strange wording.		..to achieve ~~a good~~ the required level of…		
2.	3.22.	Containment venting system (if exists);	Mistyping.	X			
3.	3.75.	Spent fuel melting (in-containment SFP);	It would be advisable to include among the conditions to be practically eliminated, because of the severity of the consequences.			X	Not relevant for DS 482, but it is addressed in DS 487 (design of fuel storage and systems)
4.	3.78.	According to ~~Member States practices, generally the effect of the failure of a SSC should be considered both on the accomplishment of the function, and on the level of the radioactive release. For items to which both effects are relevant, the safety class and the associated quality requirements needed to achieve the expected reliability are defined with due account taken of those two effects. For items which do not contain radioactive material the safety class and the quality requirements are directly derived from the consequences assuming the function is not accomplished.~~ SSG-30 [11] when defining safety significance of an items important to safety following factors shall be taken into account:	It would be preferable not to outline member state practices here but newly published SSG-30.		X Consequences of the failure of a SSC should be considered both…		Requirement 22 of SSR-2/1 rev1, and recommendations from SSG 30 are already given as references. Here the text provides a recommendation on how the consequences of a failure should be considered.

		(a) The safety function(s) to be performed by the item; (b) The consequences of failure to perform a safety function; (c) The frequency with which the item will be called upon to perform a safety function; (d) The time following a postulated initiating event at which, or the period for which, the item will be called upon to perform a safety function. Based on the defined safety significance the item is safety classified accordingly. Differentiated by safety classes engineering design rules are applied to achieve expected reliability.					
5.	3.79.	Engineering requirements applicable to a whole system (e.g. single failure criterion, ~~independence,~~physical and electrical separation, emergency power suppl~~ied~~y, periodic tests etc.) should be derived from ~~the consequences assuming the function is not accomplished.~~its safety significance.	To be in line with SSG-30.		X (e.g. single failure criterion, ~~independence,~~physical and electrical separation, emergency power suppl~~ied~~y, periodic tests etc.) should be derived from the safety class assigned to the system, primarily assuming the function would not be accomplished		Safety significance includes more but here those engineering requirements could be derived from the consequences when the function is not accomplished
6.	3.80.	The classification should be established in a consistent manner such that all systems and its auxiliary systems necessary for the accomplishment of a single function are assigned ~~in~~ to the same safety class.	Clarification.		X (front line system and the associated service		
		All design provisions applied in the reactor containment structure and systems (e.g.					

		containment itself, biological shieldings, stairs, platforms etc.) are identified and classified according to the severity of consequences of their failures.			support systems)		
7.	New in the safety classification part		Identification of the design provisions form essential part of the safety classification process and their classification methodology differs from the one applied to safety systems.			X	You are right but that is already clear in SSG-30. Moreover DS 482 cannot be as detailed as SSG-30
8.	3.82.	Safety class 1 and 2 p~~P~~ressure retaining equipment should be designed and manufactured according to requirements established by proven nuclear design and construction codes and standards widely used by the nuclear industry. For each individual component, the requirements to be applied should be selected with due account taken to its safety significance ~~of the two effects resulting from its failure (function not accomplished and radioactive release)~~.	For safety class 3 SSCs application of nuclear design and construction codes are not required.		X Safety classified …		According to SSG-30 some systems might be assigned in SSG-30 safety class 3 and could be designed and manufactured according to requirements provided by nuclear codes (e.g. ASME or RCC-M level 3 for systems necessary for the mitigation of accident with core melting).
9.		Following the above recommendations: • In the event of a design basis accident, systems necessary for the containment isolation, for the control of the pressure build up inside the containment (e.g. containment spray system), or to remove heat from the containment and transport heat from the containment to the ultimate heat sink should be ~~assigned~~ classified as ~~in SSG-30~~ safety class 1; • Systems implemented as a back-up of the safety class 1 safety systems for design extension conditions should be ~~assigned~~ classified as ~~at least in SSG-30~~ safety class 2; Systems implemented as a back-up of the	SCs are classified as safety class, functions are assigned to different categories. According to SSG-30 the classification of SSCs providing a back-up of an SSC depends on the safety class of the original SSC. It would be necessary to give a guidance of the classification of the containment structure itself.		X Containment structure designed as the last physical barrier against releases should be		As the numbering of safety class is classification system dependent it is needed here to precise SSG-30 safety class.

		safety class 2 safety systems for design extension conditions should be classified as safety class 3; • Systems necessary to preserve the containment integrity in the event of an accident with core melting should be ~~assigned~~ classified as ~~at least in SSG-30~~ safety class 3 (e.g. ex-vessel core cooling/corium cooling system, RCS depressurization system, containment spray system, venting and filtering system, systems to prevent hydrogen detonation, heat transport chain)~~.~~; • Containment structure serving as a last physical barrier against releases should be classified as safety class 1.			classified as safety class 1.		
10.	4.64.	When the spray system is designed to operate in a recirculation mode, the spray nozzles should be designed against clogging by the largest postulated pieces of debris that can reach them through the intake screens. In the same way, the spray pumps should be protected from cavitation or failure due to accumulation of debris. The minimum net pump suction necessary for the operation of the pumps should be calculated taking into account the ~~an~~ accumulation of debris on the surface of the filters (if any).	Clarification.				New number clause 4.79
11.	4.156.	4.156. The following recommendations provide guidance to fulfill the requirement 6.21 of [3].	Mistyping.	X			
12.	4.197.	Appropriate instrumentation for measurements relating to earthquakes and aircraft crashes should be installed at suitable places (e.g. on and/or the basemat of the containment at suitable floors).	It is suggested to expand this requirement, because characteristics of these impacts could be different.				

				X		X	Rejected for the time being. It makes sense for an earthquake to register the intensity of the shocks and that corresponds to the MS practice. For air plane crash, not.

DS482 "Design of Reactor Containment Structure and Systems for Nuclear Power Plants"

COMMENTS BY REVIEWER Reviewer: Dr. Tamás ABOU-ABDO, Petra,BALLA, Emese GÁL Page.1 of.3 Country/Organization: Hungary /Hungarian Atomic Energy Authority Date: 09/01/2017				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	4.15.	The containment may be subject to several ageing phenomena such as the corrosion of metallic components, the creep of tendons and the reduction of pre-stressing (in pre-stressed containment), the reduction of resilience in elastomeric seals, the shrinkage and cracking of concrete, and carbonization of concrete, or other concrete corrosion.	The concrete degradation could be more in depth discussed. More detailed guidance is provided in [16].	X	In Ref.[7}		
2.	4.20.	Including hydrogen explosion	Text shall be clear that hydrogen explosion shall be included or excluded in the load combination and its calculations. The text "including chemical energy from metal–water reactions" can be explained as a hydrogen explosion.				Table 2: DEC with core melting pressure and see 4.135 AICC pressure
3.	TABLE 2.	Internal explosions	If internal explosion is not included than it shall be clarified. Coherence with 4.131. point shall be clear.			X	Explosion other than hydrogen explosion should be avoided inside he containment (see NS-G 1.7)
4.	4.137.	Passive means such as autocatalytic recombiners shall be supported by architectural tools such as openings, room shapes, etc.	Flow of hydrogen in the containment is determined by the layout of the cavities, corridors, room shapes, etc. This shall be taken into account.		See new recommendations for Hydrogen management 9see 4.143)		

5.	4.138.	Homogenization shall be supported by architectural tools such as openings, room shapes, etc.	Flow of hydrogen in the containment is determined by the layout of the cavities, corridors, room shapes, etc. This shall be taken into account.		See new recommendations for Hydrogen management		
6.	Air locks, doors and hatches	Adequate space and equipment shall be planned for traffic of personnel and equipment at doors for decontamination in case of severe accidents.	This recommendation might be considered as additional requirement. The service of air locks and doors of the containment shall be further in depth discussed in case of accidents. Generally, the serviceability of all routes and doors of the containment shall be further discussed in case of accidents.			X	Escape routes, doors and hatches are designed for normal operation including maintenance activities
7.	4.170.	"For example: a concrete containment with stressed cables usually ensures both strength and leak tightness, whereas a reinforced concrete containment structure usually ensures only strength while its steel liner ensures leak tightness. „ Suggested text instead: Concrete containment with stressed cables shall strengthen leak tightness of containment structure in newly built containments while its steel liner ensures an additional barrier of leak tightness.	With the current concrete technology airtight structures can be built. In the requirements of new containments, the advancement of the novel concrete technology shall be implemented and containment structures with better airtightness requested.				Changes have been proposed by the British Regulator comment 22 See new clause 5.3 for your concern dealing with the construction of the containment building
8.	4.175.	Additionally, considerable: Construction processes and construction capacity with adequate back up must be planned in accordance with the design and construction phases of the containment.	The safety and the air tightness of the containment starts with the right planning and construction. The text could be improved with in depth requirements based on the analysis of the construction process and its safety related steps.		X		See new clause 5.3

			The whole text includes the “construction process” phrase just in this point. More details of requirements of the construction process could be beneficial.				
9.	4.195.	Additionally, considerable: Measurements of deformations shall be recorded from the beginning of pre-tensioning of the containment throughout the lifetime of the containment. The containment shape should be recorded to show trends.	For the proper construction quality and functionality, these measures are necessary as the effect of tensioning steps on the containment can be checked by the measurements and later any unexpected deformations can be early detected.		X		See clause 4.208 (new numbering) supplemented by clause 4.210
10.	4.13	For example, connections to refill containment water storage tanks.	Grammatical accuracy.	X	…design of the NPP (e.g. connections to refill containment water storage tanks).		

Reactor containment Structure and Systems for NPPs' (DS-482)							
COMMENTS BY REVIEWER **Reviewer :** AERB **Country/Organization : AERB** **Date:** January 13, 2017				**RESOLUTION**			
Comment No.	**Page/ Para/Line No.**	**Proposed new text**	**Reason**	**Accepted**	**Accepted, but modified as follows**	**Rejected**	**Reason for modification / Rejection**
1.	Page 5, Section 2.4, Bullet 2, sub-bullet 1	For design basis accidents ~~and design extension conditions without significant fuel degradation~~, the releases are minimized such that off-site protective actions (e.g. evacuation, sheltering, iodine thyroid blocking, food restrictions) are not necessary (see Requirement 19 item 5.25).	Clause 5.25 of Requirement 19 of SS-R-2/1 (Rev.1) w.r.t. no-necessity of off-site protective actions is applicable to DBA only (and not to DECs).			X	Although Req. 5.25 is for DBAs, any accident without significant fuel damage should comply with the same general objective that implementing protective measures for the public would not be necessary (food restrictions has been removed from the parenthesis). It does not mean to meet exactly the same dose limit
2.	Page 5, Section 2.4, Bullet 2, sub-bullet 2	For **design extension conditions** ~~accident with core melting~~, the releases are minimized such that only off-site protective actions limited in terms of areas and times are necessary **and sufficient time shall be available to take such measures** (see Requirement 20 item 5.31A)	Clause 5.31A of SS-R-2/1 (Rev.1) talks about the DECs in general (and not specifically refer to the DECs involving core-melt). Further, it emphasizes on the need of sufficiency of time available to implement the off-site measures.		X 2nd modification is considered		If 2.4 is not modified, no need to modify this one.

3.	Page 5, Section 2.5	The sentence may be modified as: 'Moreover the containment and its associated systems are designed so that releases are ~~below the prescribed limits and as low as reasonably achievable~~ **below the authorized limits on discharges in operational states and below the acceptable limits in accident conditions** and as low as reasonably achievable (see Requirement 55)	In line with SSR-2/1	**X**			
4.	Page 5, Section 2.8, 3rd Line	Clarification required: Meaning of "Multiple means" may be elaborated. Can two systems (defence in depth philosophy) working on same principles be considered as multiple means?					Here multiple means are only required but an adequate independence between the means is expected (embedded in the DiD concept)
5.	Page 6 Section 2.11	Additionally to measures implemented to mitigate the consequences of the postulated conditions, the use of non-permanent equipment is considered, and adequate connection points and interfaces with the plant are installed with the objective to avoid large release and unacceptable off-site contamination in case of accidents exceeding those considered in the design **(Design Extension conditions)** (see Requirement 58).	Better clarity			**X**	Non-permanent equipment is for accidents not considered in the design.

6.	Page 6, 2.15, add new para after 2.15	*CONTROL OF PLANT ENVIRONMENT* **2.16 The containment envelope provides housing for reactor safety systems so that the environment necessary during different plant states for safe operation of these systems is controlled and maintained. The containment layout and system configurations should be such that the pressure, temperature, humidity and radiation levels are controlled and/or maintained for safe operational states and accident conditions. The layout should also facilitate long term operation and maintenance of these systems (Requirements 27, 29, 32, 40 and 58 of [3]).**	One of the important functions of containment and corresponding design considerations.			**X**	Section 2 aims at reminding the main principles which drive the general design of the containment, and more detailed recommendations are provided in sections 3 and 4. Safety systems and safety features for DECs should be housed in buildings not exposed to harsh environmental conditions to the extent possible. Equipment inside the containment and required to operate in accident conditions should be designed to accommodate with the accident conditions
7.	Page 7, Section 3.3, 3rd line	**Combinations of conditions (viz. pressure, temperature, humidity, flooding etc.) including** load combinations created by internal and external hazards should also be included in the design basis of the structures, systems and components.	To account for the environmental conditions created by internal and external hazards in the design basis besides accounting for the load combinations.			**X**	Qualification is addressed in a specific paragraph. Protection against floods is 3.11

8.	Page 8, Section 3.11, 1st bullet, 2nd line	The containment structure and the systems should be protected against impacts of high energy (internal missiles, pipe whipping**, jet impingement,** heavy loads), or designed to withstand their loads and the loads caused by explosions as well;	'Jet impingement' is one of the effects of internal hazards.	**X**			
9.	Page 9, Section 3.11, fourth bullet	Clarification required: A single hazard should not have the potential for a common cause failure between safety systems designed to control design basis accidents and safety features required for design extension conditions with core melting. What about design extension conditions without core melt?					No consensus on this point. For a safety point of view you should consider the two recommendations bullet 2 and 4
10.	Page 9, 3.15, 1st line	A list of typical external hazards, and their ~~contribution~~ **combination** as appropriate, usually considered is given for guidance in [9] but should be adapted or supplemented as needed to include the site specific hazards.	Editorial	**X**			

11.	Page 9, 3.15, 2nd line	A list of typical external hazards, and their contribution as appropriate, usually considered is given for guidance in [9**, 10**] but should be adapted or supplemented as needed to include the site specific hazards.	Existing [9] does not address external hazards. Hence [9] should be 'NS-G-1.6', which deals with seismic design and qualification. Further, [10] deals with external hazards other than earthquakes.	**X**			
12.	Page 9 , Section 3.17	Clarification required: The concept of CCF is provided in 3.11 (second bullet) which deals with internal hazard. Similar consideration may also be required for external hazard.				**X**	In general you are right, and for external hazards the layout of the buildings at the site is of prime importance. DS 482 deals with the containment structures and he associated systems. So for the systems that are installed inside buildings I do not think that the recommendation for internal hazards and the design of the buildings are adequate Protection against the effects of external hazards is achieved by the design of buildings or directly by the design of equipment when the protection by building is not effective (e.g. for earthquake0

13.	Page 10 / section 3.22	The list may include following point: • **Equipment or structure which are required for radioactivity management which is released in containment (e.g. filters, spray water)**	As it is important for confinement of radioactivity				Radioactive materials released inside the containment should not be discharged to the atmosphere except leaks. But leaks cannot be considered as early or large release. If venting the containment is necessary to prevent its collapse the release should be also filtered. Containment venting is in the list.
14.	Page 10, Section 3.26	More detailed recommendations are provided in [**9,**10].	Editorial	**X**			
15.	Page 14, 3.46, last bullet	• Add 'SFP' in the list of abbreviations.	Editorial	**X**			

16.	Page 19, Item 3.83	Clarification required: The safety categorization provided in SSG 30 is different than the earlier standard of IAEA. As per the new categorization containment spray has been kept as Category I. In case of DBA like LOCA the failure of containment system may not result in "high severity" owing to actuation of dedicated ECCS system. Therefore the categorization would be design specific (different for PHWR, PWR or BWR type NPPs). If this is the case then only reference to IAEA SSG 30 should be provided rather than giving examples of systems.				**X**	SC1 is assigned to the spray system if the spray system is required to operate to limit the pressure build up in DBA. For some design, spray is not required to operate in DBA but in DEC and therefore the spray system is not SC1.
17.	Page 21, Section 4.2	Clarification required: Regardless of permanent design provisions for DBAs and for DECs, features enabling the safe use of non-permanent equipment for restoring the capability to remove heat from the containment should be installed (see Requirement 6.28B). Examples may please be provided for non-permanent equipment					Safety guide should provide guidance to understand the requirement. Here we state that a backup of the Containment heat removal by the use of non-permanent equipment should be possible.

18.	Page 21, Section 4.2, last line, within bracket	Regardless of permanent design provisions for DBAs and for DECs, features enabling the safe use of non-permanent equipment for restoring the capability to remove heat from the containment should be installed (see Requirement 6.28B **of [3]**).	Editorial	**X**			
19.	Page 22, Section 4.4, 1st and 2nd line	The following recommendations provide guidance to fulfill the relevant requirements **6, 32, 81 and 5.15 of [3]** ~~of Requirements 6, 32, 81 and the requirement 5.15 of [3]. Recommendations [7]~~ to prevent non authorized persons from accessing the containment and the buildings that housed the systems important to safety should also be implemented in an integrated manner with the recommendation for safety.	Editorial	**X**			
20.	Page 23, Section 4.6 4th line	Maintenance related factors considered in the containment design should include the provision of adequate working space, shielding, lighting, air for breathing, and working and access platforms; the provision and control of environmental conditions; the identification of equipment; the provision of hazard signs; the provision of visual and ~~acoustic alarms~~ **audio alarms**; and the provision of communication systems.	Editorial	**X**			

21.	Page 25, Section 4.20, 2nd bullet	Replace '~~structural tolerances'~~ with '**structural gaps and coatings'**	'Structural tolerances' is commonly used for allowable deviations in geometric dimensions of the structural components. The more appropriate word in the context of 4.20 would be 'Structural gaps and coatings'.			**X**	"Structural tolerances was the word used in the former revision
22.	Page 25, Section 4.24, 2nd line, 2nd sentence	In steel containments the load bearing and leak tightness functions are fulfilled by the steel structure. The metallic structure should be protected against **fires and** missiles generated inside and outside the containment as a result of internal and external hazards that affect the plant.	The metallic structures are vulnerable to fires also besides missiles generated as a result of internal and external hazards.	**X**			.
23.	Page 26, Table 1, Remarks column, 1st line against 'Dead Load'	Loads associated with the masses of structures or components **including effects of shrinkage and creep of concrete (for concrete structures)**	Effects of shrinkage and creep are considered in 'Dead load' category for design of concrete structures. These effects are not included anywhere in Table 1.	**X**			

24.	Page 26, Table 1, Remarks column, second line against 'Live load'.	Loads associated for example with component restraints **and during short periods like maintenance.**	To account for tools, equipment and components required during maintenance periods. These are temporary, short duration loads and hence form part of 'Live load'.			**X**	Table 1 gives a list of typical loads but does not aim at being a comprehensive list. Specific loads are not listed
25.	Page 27, Table 1, Remarks column, 3rd sentence against 'External pressure'.	Loads resulting from pressure variations both inside and outside the primary containment **including earth pressure, if applicable.**	To account for earth pressure if the containment wall is exposed to earth.			**X**	Table 1 gives a list of typical loads but does not aim at being a comprehensive list. Specific loads are not listed

26.	Page 30, Table 2, 4th row, last column against pre-stressing (if applicable)	Put **‘x’** for ‘DEC w core melting’.	‘Pre-stressing (if applicable)’ is always present as a load under all plant states and hence applicable under ‘DEC with core melting’ state also.	**X**			
27.	Page 31, Table 2, last row, 9th column	Replace ~~\NA~~ with **Level II** for Engineering criteria for a liner on pre-stressed concrete wall	Engineering criteria II related to leak rate is applicable for liner also under ‘SL-2 plus DBA’ loading.			**X**	Only requested by India. For Pre stresses containment “leaktightness level II” has been changed to N/A as indicated in the previous Safety Guide NS-G 1.10
28.	Page 31, Table 2 Load Combination:	Clarification required: As per the table in DBA condition the structural integrity is mentioned at Level-II. This suggests that small permanent deformation is allowed in case of DBA. On the contrary, no permanent deformation (plastic range) is allowed for DBA condition while designing containment.			In DBA Structural integrity: I Leaktightness I Liner : I		Mistake corrected

29.	Page 32, Section 4.38, 2nd line	Localized stress, including those at welding regions and regions with changing geometry, **as well as near localized support points of concentrated loads** and their effects on the mechanical performance of structures, including leak rates, should be evaluated.	Concentrated point loads may also cause localized 'stress concentration' unless distributed over wide area through suitable structural arrangement.		**X** …near supports and ..		
30.	Page 33, Section 4.46, 3rd line	Acceptance criteria for leak-tightness and integrity given by Table 2 should be met in the event of accident conditions with significant core degradation, and conditions for a basemat melt **through** ~~trough~~ should be practically eliminated for both of the design options retained for the core molten retention (In Vessel Retention or Ex Vessel Retention)	Editorial	**X**			
31.	Page 34, Section 4.56, 3rd line	Clarification required: Check reference [10]. It seems inappropriate w.r.t. 4.56.	Ref. [10] deals with external hazards while 4.56 addresses pressure and temperature during plant operation.	**X**	Reference to DS 440		

32.	Page 37, Section 4.76 8th line, within bracket	To avoid the clogging of sump screens or strainer filters, special care should be taken in the design of piping, component insulation and the intake sump screens or strainer filters themselves, and consideration should be given to the chemical effects as determined by the sump and suppression pool water chemistry and temperature, and to corrosion and/or erosion of some metallic components and their interaction with the debris. In addition the material used inside the containment (thermal insulation material, paints, etc.) should be carefully considered. The design should also avoid certain combination of these materials which may worsen the issue of clogging at sump screens or strainer filters. (See ~~paragraph 4.9.4~~ **paragraphs 4.182 to 4.153** "Covering, **cushioning** thermal insulation and coating materials").	Editorial and also for completeness.	**X**			

33.	Page 37, Section 4.78, 2nd line, within bracket	Piping crossing the containment walls should be equipped with containment isolation devices (see ~~paragraph 4.8.1~~ **paragraphs 4.142 to 4.153** "Provisions for containment isolation **of piping and ducting system**"), and devices necessary to isolate leaks in the external recirculation loops and to maintain a sufficient water inventory for cooling. Non-isolable leakage (e.g. between the containment penetration and the isolation valve) should be prevented by design (e.g. by means of the provision of a guard pipe).	Editorial and also for completeness.	**X**			
34.	Page 38, Section 4.83, 2nd and 3rd line	Containment structure and systems should be designed to meet the objectives for preventing and limiting the radiological release specified for the different plant states ~~as indicated in 2.1~~.	Incorrect reference to 2.1.	**X**			
35.	Page 39, Containment Source term	Clarification required: 4.88 is provided only for DBA conditions. Similar clarity is not provided for DEC conditions.					This clause states that a conservative methodology should apply to the calculation of the source term released in DBAs only. For DEC conservative approach is not required

36.	Page 39, Section 4.93, 1st and 2nd sentence	To limit the number of leak paths, the number of penetrations should be optimized ~~as indicated by the recommendation 4.3~~.	Incorrect reference to 4.3.				4.4 bullet 8 is correct
37.	Page 39 / Leak tightness of containment	The following may be considered for inclusion: **For improving the leak tightness of containment structure, the number of blank embedded plates, if any, shall be minimized.**				**X**	What do you mean by blank plates? Free embedded plates are necessary for additional needs during the lifetime of the plant
38.	Page 40, Section 4.95, 2nd line	A reliable design of and actuation for containment isolation system should be incorporated, ~~as described in paragraph 4.8.1 "Provisions for containment isolation",~~ to ensure the leak tightness of the containment in the event of an accident.	Such frequent references to other sections should be kept only where it is essential. Otherwise any revision may make such references inappropriate as it has happened in this revision.	**X**			

39.	Page 41, after Section 4.103	Add a new para after 4.103 as follows: **If credit of secondary containment is taken to preclude certain loading conditions on the primary containment due to external events (e.g. extreme winds, airplane crash, air shock wave, fluctuation of atmospheric temperature, etc.), these events should be considered in the design of the secondary containment structure.**	Secondary containment precludes certain loading conditions for primary containment, which should be accounted if no secondary containment is provided. This should be flagged here.			**X**	Stated in the last sentence of 4.102 : "shielding structure"

40.	Page 42 Section 4.114	The containment structure and its internals provide the first mechanisms for the removal of airborne radioactive material, since they present a large surface area for deposition **of radionuclides on exposed surfaces and leak paths**. The plate-out and desorption factors ascribed to the containment structure should be conservatively based on the best available knowledge of deposition of radionuclides on surfaces. **The effect of condensation of steam and deposition of airborne particles in the leak path shall be conservatively estimated.** The surfaces of the containment and its internal structures should be decontaminable to the extent possible.	To include radioactivity deposition in other paths			**X**	1st addition is not needed, it is clear that this recommendation deals with deposition of radionuclides **shall be conservatively estimated.** The effect should be minimized in order to maximize the leaks of radioactive materials

41.	Page 43, Section 4.121, 4th line	Ventilation systems are often used to collect, filter and discharge air from a secondary confinement, which may become contaminated with airborne radionuclides in accident conditions as a result of leakage from the primary containment. For such cases the recommendations in paragraph ~~4.8.1 "Provisions for containment isolation" apply.~~	All cross references should be corrected as per final numbering of paragraphs.	**X**			
42.	Page 43, Section 4.122, 2nd line, bracket [4]	Clarification Required: Check appropriateness of Ref. [4]. It appears to be a facility management document and not energy/radionuclide management.	Correctness of cited reference.	**X**			Reference is deleted
43.	Page 44, Section 4.124	Hydrogen and oxygen are generated during normal operation of a plant as a result of the radiolysis of water in the core. In accident conditions (e.g. during a LOCA, or to a larger extent during an accident with core melting**, radiolysis, metal water reaction, molten fuel assemblies from Spent Fuel Pool located inside containment**), combustible gases might be released into the containment atmosphere.	Based on Fukushima lessons learnt			**X**	Melting irradiated fuel stored in SFP should be prevented by design. See SSR 2/1 Rev 1**.** See the bullet list.

44.	Page 45, Section 4.134	Clarification required: Is there any reason as to why same clause (4.134) is not made applicable in case of system with auto actuation.	Containment Spray System may be in Auto /manual.				For some design, not exceeding the design pressure in DBA relies on the operation of the spray system. For such a design the operation of the spray system is necessary in the short term and is therefore automatically actuated. In LOCA conditions the production of H2 is not abundant. In the event of an accident with core melting SAM should also consider the risk of hydrogen deflagration. See modification 4.137
45.	Page 48, Section 4.156	Write '**4.156**' instead of ~~4.56~~	Editorial	**X**			
46.	Page 49, Air locks, doors and hatches	Following may be included **"Back-up air/nitrogen cylinders for maintaining air lock seal pressure should be provided in case of depletion of normal compressed air supply following an accident"**	Post Fukushima experience			**X**	This applies to any air operated valves safety classified

47.	Page 50, Section 4.170, 5th line	For example: a concrete containment with **pre** stressed cables usually ensures bothX strength and leak tightness, whereas a reinforced concrete containment structure usually ensures only strength while its steel liner ensures leak tightness.	The right word is 'prestressed'.	**X**			
48.	Page 52 Section 4.186	The following text may be added: **The organic liner shall be selected so as to provide good adhesion and low air/gas permeability. Other desirable properties are good crack spanning ability and resistance to blistering after thermal ageing.**	Desired properties of organic liner	**X**			
49.	Page 53 Instrum entation	Clarification required: The guidance on ensuring the availability of Instrumentation provided for DEC or Severe accident management during normal operation is not given in the draft standard.	Instruments for Severe Accident Management are recommended to be separate from those for Normal Operation and for DBAs. Availability of such instruments like PG for containment pressure, sump level, H_2 detectors etc needs to be ensured during operation.			**X**	Reliability and availability of any instrumentation is addressed in SSG- 39 and cannot be detailed in this Safety Guide

50.	Page 54, existing Section 4.197, within bracket	Appropriate instrumentation for measurements relating to earthquakes should be installed at suitable places (e.g. on ~~and/or~~ the basemat of the containment **and** at suitable floors).	Editorial	**X**			
51.	Page 54, Section 4.201, 2nd bullet	Monitoring of containment atmosphere temperatures is necessary to check whether temperatures are within the ranges specified for the normal operation. • A sufficient number of temperature sensors should be installed to measure the containment atmosphere temperatures; • In/out containment air coolers may be used to ~~complete~~ **limit containment inside temperature within the specified range** and confirm **it** ~~temperatures inside the containment.~~	Editorial and also for clarity.		" to complete and confirm temperatures" is replaced by "to estimate ".		Instrumentation by itself cannot limit the temperature. To estimate was the wording used in the former revision
52.	Page 56, Section 4.212, 2nd line	Smoke and flame detectors should be installed as additional means of an early ~~departure~~ **detection** of a fire in each compartment where there may be a risk of fire.	Use of correct word.	**X**			

53.	Page 56, Section 4.215, 2nd line	Appropriate instrumentation should be used to monitor the availability of the containment systems used for energy management, management of combustible gases ~~or~~ **and** for the control of radionuclides.	All these functions (energy management, management of combustible gases and control of radionuclides) are essential. These are not alternatives to each other.	**X**			
54.	Page 60 Section 5.3, 2-4 lines	Commissioning tests for the containment should be carried out prior to the first criticality of the reactor to demonstrate the containment's structural integrity, to determine the leak rate of the containment envelope and ~~to confirm the performances of systems and equipment~~ **to confirm the performances of systems and equipment (Related to containment and associated systems.**				**X**	Clear , everything in DS 482 is related to the containment design
55.	Page 60 Section 5.6,	The para should be replaced as: 'The test should be conducted with the components of the containment in a state representative **(to the extent practicable)** of the conditions that would prevail following an accident, to demonstrate that the specified leak rate would not be exceeded under such conditions	It may not be possible to create all conditions similar to accident.	**X**			

56.	Page 61 Section 5.10, last two lines	Clarification Required: ……. Means should be provided to ensure that the temperature and humidity of the containment atmosphere are uniform. Does this mean that forced mixing to achieve uniform temperature and humidity inside containment during testing is acceptable?					For details refer to the industry code
57.	Page 63 Section 5.26	Clarification Required: The testing method of the containment integrated leak test should be qualified. Please elaborate the means of qualifying the testing method.			The testing method of the containment integrated leak test should be conducted according to proven standards.		

58.	Page 63 Section 5.27	Clarification Required: Where it is technically feasible, the design should provide for a complete visual inspection of containment structures (including the tendons for pre-stressed concrete containments), penetrations and isolation devices.	It may be noted that visual inspection of prestressing tendons will require complete de-stressing and removal of strands from the duct. Again the strands are required to be rethreaded after inspection. This may not be practically possible to implement during operating stage. Also in bonded system, one has to create provision for separate unbonded cable/tendons (greased filled) for the purpose of inspection. The elaboration about the visual inspection of tendons should be provided in view of the above.				See new text
59.	Page 64, A.4, 5th line	Most of the containment systems of the existing plants were designed for DBAs (Large LOCA), without account taken of the possibility for severe accidents to occur. However, safety assessments showed that the conservative deterministic approach followed for the design gave the capability to withstand situations more severe than those originally included in the design basis, ~~either~~ **even** for existing plants.	Editorial	**X**			

60.	Page 64, A.5, 1st line	The assessment should **select/postulate** a set of design extension conditions whose consequences should be analyzed with the purpose of further improving the safety of the nuclear power plant by:	For completeness and clarity of action.		be conducted on the basis of		
61.	Page 66, A.15, 1st bullet	All piping penetrating the containment should be isolated ~~but~~ **except for** systems necessary for the mitigation of the accident conditions;	For clarity.				English ?
62.	Page 67, A.17, 3rd bullet	The new instrumentation **meant for monitoring severe accident progression and containment integrity** should be qualified for severe accident conditions.	To remove ambiguity about new instrumentation.	**X**			
63.	Page 68, [9]	[9] INTERNATIONAL ATOMIC ENERGY AGENCY, ~~Design of Instrumentation and Control Systems~~ **Seismic Design and Qualification** for Nuclear Power	Correct reference.	**X**			

Note: the proposed additions are made in Red Color in Bold font with yellow highlight. The proposed deletion is kept in Red Color with ~~Red strikethrough~~

Japan Comments on DS482, "Design of Reactor Containment Structure and System for NPPs"

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page 1 of 5 Country/Organization Japan／NRA Date: 20 DEC. 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	2.4./ 2nd bullet/ Item 1	- For design basis accidents ~~and design extension conditions without significant fuel degradation~~, the releases are minimized such that off-site protective actions (e.g. evacuation, sheltering, iodine thyroid blocking, food restrictions) are not necessary (see Requirement 19 and para. ~~item~~ 5.25);	To keep a consistency with SSR-2/1 (Rev. 1) requirement 19 and para. 5.25.			X	Although Req. 5.25 is for DBAs, any accident without significant fuel damage should comply with the objective that protective measures for the public would not be necessary (food restrictions has been removed from the parenthesis). It does not mean to meet exactly the same dose limit
2.	2.4./ 2nd bullet/ Item 2	For design extension conditions ~~accident with core melting~~, the releases are minimized such that only off-site protective actions limited in terms of areas and times are necessary (see Requirement 20 and para. ~~item~~ 5.31A);	To keep a consistency with SSR-2/1 (Rev. 1) requirement 20 and para. 5.31A.				If 2.4 is not modified, no need to modify this one.

3.	4.2./ L3	Regardless of permanent design provisions for DBAs and for DECs, features enabling the safe use of non-permanent equipment for restoring the capability to remove heat from the containment should be ~~installed~~ included (see ~~Requirement~~ para. 6.28B).	To keep consistency with SSR-2/1 (Rev. 1) para. 6.28B.	X			
COMMENTS BY REVIEWER Reviewer: Japan NUSSC member — Page 2 of 5 Country/Organization Japan／NRA — Date: 20 DEC. 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
4.	4.37. /L1	To provide margins, loads resulting from earthquake level SL2 and design basis accidents should be combined using adequate ~~SSR~~ method*1 (e.g.: Square Root of the Sum of the Squares), unless the probability of the coincidence of the events is extremely low,*2 although one cannot realistically be a consequence of the other since the pressure boundary is designed to withstand seismic loads caused by earthquake level SL2 [15].	*1: SRSS method is one of the evaluation methods. There are several methodologies for combining load effects. *2: Design basis accident can be divided into two parts, the initial part (short period) when a fluctuation of accident load is intense and the later part (long period) when it is not so intense. Considering the extremely low probability of simultaneous occurrence of earthquake level SL2 and the initial part of design basis accident, there is a		X adequate statistical combination of the loads		Second modification is not necessary because already reflected by the second part of the sentence.

			case that it is not necessary to combine these loads.				
5.	4.49.	In this strategy, the containment should be equipped with an ex-vessel retention structure (core catcher or wet cavity ~~for BWR~~) dedicated to contain and cool the molten core outside of the vessel.	The wet cavity strategy is not limited to BWRs and there are some practices in PWRs.	X			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page 3 of 5 Country/Organization Japan／NRA Date: 20 DEC. 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
6.	4.58./ L1	Define “containment envelope” in a footnote, as stated in NS-G-1.10 para. 2.3., as follows; “The containment envelope should include all those components of the reactor coolant pressure boundary, and those connected to the reactor coolant pressure boundary, that cannot be isolated from the reactor core in the event of an accident.”	Clarification for “containment envelope”.	X	”.		
7.	4.131.A	Add after para. 4.131. as followings; “Preventive measures for hydrogen deflagration and explosion in the secondary containment including reactor building for BWR should be taken into	Considering the lessons learnt from the Tepco Fukushima Daiichi NPPs accidents, preventive measures for hydrogen deflagration and	X			See new clause 4.137

		account.”	explosion should be described here for BWR reactor building clearly.				

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page 4 of 5 Country/Organization Japan／NRA Date: 20 DEC. 2016				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification /rejection
8.	5.5./l 3	The value of the test temperature should not be ~~close to the ductile brittle transition temperature for the metallic material~~ higher than the minimum operating temperature provided by the applicable codes.	Clarification. To avoid reader's misunderstanding that current description allows the lower temperature than ductile brittle transition temperature.			X	OK for metallic containment
9.	5.10.	Add the description on method of leak rate test for BWR after the text of this paragraph. Another way of determining leak rate is the reference vessel method, which is often used for the containment, in which the temperature of each location is different. The reference vessel, which is small volume of a cylindrical pressurized structure, should be deployed at several locations whose temperature may change during the test period. Leaktightness of the reference vessels should be ensured prior to the leak rate test. This method can determine leak rate from the differential pressure between the containment atmosphere and the reference vessel atmosphere without the effect on owing to temperature change.	The reference vessel method is one of BWR's standard leak rate test based upon the USNRC practice in Japan.	X			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Country/Organization Japan／NRA		Page 5 of 5 Date: 20 DEC. 2016		RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification /rejection
10.	APPENDIX A.13. 3rd bullet	~~beyond original design basis conditions~~ design extension conditions	These wordings look confusing. Should be used "design extension conditions" to keep a consistency with SSR-2/1 (Rev. 1).			X	Appendix deals with NPPs in operation designed according to some standards which might not include DECs. This is why the wording " beyond original design basis events" is appropriate
11.	A.14. 5th bullet	~~beyond design basis plant states~~ design extension conditions	Ditto.			X	
12.	A.18. 1st bullet	~~beyond design events~~ design extension conditions	Ditto.			X	

13.	APPENDIX A.14.	Add new bullet as follows; · Venting line should neither be shared nor interconnected with other units at a multiple unit plant site. · It should be made easier to open manually rupture disks for immediate vent operation, where practicable.	Should be added the lessons learnt from the Tepco Fukushima Dai-ichi NPPs accidents.			X	The Appendix does not aim at providing detailed design solutions

Form for Comments
Design of Reactor Containment Structure and Systems for Nuclear Power
(DS482)

COMMENTS BY REVIEWER Reviewer: Johanna Spåls, Joakim Ehrinton Country/Organization: Sweden/Ringhals AB			Page 1 of 2 Date: 2016-12-15	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	Table 1	Include a description of SL2 (seismic level 2) in the table	In Table 2 SL2 is introduced. It would be clearer and more easy to follow if a description of SL2 is introduced before Table 2	X	SL-2 : Level of ground motion associated to the maximum earthquake to be considered for design often denoted as the safe shutdown earthquake		
2.	4.171	… and environmental conditions (of heat and moisture)	Is there any guide of how radiation can be considered when the design capacity of concrete is calculated? I know that there are ongoing researches of how radiation affects the properties of concrete but is there any method to consider this in design?				I questioned people about your concern but apparently loss of efficacy of concrete over time as a sheltering material does not seem a crucial safety issue.
3.	4.186	Organic liners	Is it possible to give example of organic liners in a footnote? We are not aware of this term.				Organic liner exists for PHWR/CANDU reactor; e.g. rigid epoxy liner or epoxy + polyurethane painting

4.	4.196		Is it possible to verify the concrete compression and rigidity parameters with NDT (acoustic measurements)? There is ongoing research within this field but are there really methods that in an efficient way can do those tests? Since it "should" be done it is important that it is possible to do it.				

Member State Comments on draft Safety Standards on

DS482 Design of Reactor Containment Structure and Systems for Nuclear Power Plants

COMMENTS BY REVIEWER					RESOLUTION		
Reviewer: Les Smith, Tim Allmark, Lidia Haddock Country Organisation: UK/Office for Nuclear Regulation & NuGeneration Ltd			Date: 25 Nov 16				
Comment Nr	Para Nr. & Line	Proposed new text	Reason	Accepted	Accepted modified as follows	Rejected	Reason if modified/rejected
1	2.4, Line 9	"an increase of up to 1 mSv over the dose received in a year from exposure due to naturally occurring radiation sources is the maximum recommended by ICRP"X			" an increase of up to about 1 mSv" Ref GSR Part 3 item 1.25		
2	2.9, Line 2	"operating, design extension and accident conditions"	Structural integrity also required under DECs			X	Accident conditions include DBA and DECs according to SSR-2/1 Rev1
3	2.9, Line 4	"(see requirements 20 and 42)"	Re previous comment			X	
4	2.10, Line 2	Replace "core melting" with "core damage"	Represents wording of Requirement 20 more accurately				Already in 2.10
5	Subtitle for 2.13	Protection against internal and external hazards		X			
6	3.5, Line 1	"The performance of structures and systems necessary for …"	Strength is not the only requirement for structures – e.g. leaktightness	X			
7	3.17, Line 1	"Systems required for energy management"	Grammatical, style	X			
8	3.20, Line 1	"Systems designed for energy management"	Grammatical, style	X			
9	3.35, Line 1	"For the performance of the containment"	Grammatical/meaning	X			
10	3.35, Line 3	"equipment performance"	Grammatical/meaning	X			

COMMENTS BY REVIEWER					RESOLUTION		
Reviewer: Les Smith, Tim Allmark, Lidia Haddock Country Organisation: UK/Office for Nuclear Regulation & NuGeneration Ltd			Date: 25 Nov 16				
Comment Nr	Para Nr. & Line	Proposed new text	Reason	Accepted	Accepted modified as follows	Rejected	Reason if modified/rejected
11	3.35, Bullet 2	The adoption of excessively conservative assumptions could lead to unrepresentative analysis and consideration of unrealistic stresses on components and structures.”	Clarity	X			
12	3.45, Line 6	“analyses supplemented by the careful application of engineering experience in order to allow the selection of appropriate conditions that are more probable and representative.	Clarity		analyses supplemented by engineering judgement in order to allow the selection of appropriate conditions that are more probable and representative.		To consider Swedish comment either
13	Numerous locations in document e.g. 3.49, Line 3	Generally, replace “Requirement Y.YY” with “Requirement XX Paragraph Y.YY of [3]”	YY is a paragraph in Reference [3}, not a Requirement. The Requirement is XX.	X			
14	3.49, Bullet 1	“ Venting lines”	Either “ The venting line” or “Venting lines”		“The containment venting system”		Like in 2nd bullet
15	3.49, Bullet 2	“The containment venting system”	Grammatical	X			
16	3.55, Line 1	“to achieve adequate structural reliability and the reliability of systems”	Structural SSCs must be included			X	“reliability” cannot be achieved if the structural integrity is lost. “reliability” has a broad sense
17	4.9, Line 1	“should be provided that has the ability to be used while maintaining the integrity of the containment.“	Escape routes should not compromise containment integrity.	X			
18	4.15, Line 4	“mechanisms”	Typo	X			

COMMENTS BY REVIEWER					RESOLUTION		
Reviewer: Les Smith, Tim Allmark, Lidia Haddock Country Organisation: UK/Office for Nuclear Regulation & NuGeneration Ltd			Date: 25 Nov 16				
Comment Nr	Para Nr. & Line	Proposed new text	Reason	Accepted	Accepted modified as follows	Rejected	Reason if modified/rejected
19	4.15, Line 7	"age-related degradation. This should be incorporated into an ageing management programme and permanently installed instrumentation may be used to monitor ageing effects, structural response of the containment and protection of the structure under pressure testing conditions. Guidance is available in [X]" Additionally, add a reference[X} to IAEA Nuclear Energy Series NP-TP-3.5	Ageing effects should be managed in an integrated manner.		Ageing mechanisms should be identified, taken into account in the design and incorporated into an ageing management programme.		
20	Table 1	Additional loads and effects include creep effects on the containment, PS tendon removal loads in ungrouted prestressed containments, equipment replacement loads and superimposed crane loads.	Additional factors		See adding in Table 1		
21	4.46, Line 3	"through"	Typo	X			

COMMENTS BY REVIEWER					RESOLUTION		
Reviewer: Les Smith, Tim Allmark, Lidia Haddock Country Organisation: UK/Office for Nuclear Regulation & NuGeneration Ltd			Date: 25 Nov 16				
Comment Nr	Para Nr. & Line	Proposed new text	Reason	Accepted	Accepted modified as follows	Rejected	Reason if modified/rejected
22	4.170, Line 4 & 5	"For example: an unlined pre-stressed concrete containment can provide both structural support and leaktightness, whereas a reinforced concrete containment structure can provide structural support but relies on a steel liner for leak-tightness. In some containment designs, prestressed concrete containments are provided with a steel liner to provide leak-tightness.	Clarity and more generic statement	X			
23	4.171, Line 4	Add at end, "Concrete specifications should also ensure that measures are taken to avoid material vulnerabilities that may lead to ageing effects, for example, those caused by chloride attack, alkali-aggregate reaction, delayed ettringite formation amongst others.	Important considerations.	X			
24	4.172, Line 1	Replace "rigidity" with "stiffness"	More commonly used term	X			
25	4.195	Add at end, "Appropriate measures should be provided to allow settlement and differential settlement to be monitored."	Important parameter		4.195: …(e.g. monitoring of settlement and differential settlement of the buildings)		
26	4.196, Line 2	Replace "rigidity" with "stiffness"	More commonly used term	X			

COMMENTS BY REVIEWER					RESOLUTION		
Reviewer: Les Smith, Tim Allmark, Lidia Haddock Country Organisation: UK/Office for Nuclear Regulation & NuGeneration Ltd			Date: 25 Nov 16				
Comment Nr	Para Nr. & Line	Proposed new text	Reason	Accepted	Accepted modified as follows	Rejected	Reason if modified/rejected
27	4.196, Line 4	Meaning of "singularities" not understood – should this be "locations"	Clarification		Singular locations		
28	4.196, Line 5	"proof pressure tests"	More commonly used term	X			
29	4.196, Line 5	Add at end, "Appropriate instrumentation should be installed to allow the measurement of temperature, creep and strain effects within the containment structure. Further guidance on structural monitoring is available in [X]" Additionally, add a reference[X} to IAEA Nuclear Energy Series NP-TP-3.5	Important parameters		Already in clause 4.15		
30	4.208	Add at end, "Any water discharges from the containment should be made via delay tanks to allow monitoring and interception to take place."	Important safety consideration regarding releases			X	Activity measurements are in tanks or sumps. See parenthesis
31	5.20, Line 6	"structure. Instrumentation for structural monitoring should be used to ensure that vulnerable areas of the containment structure are not overstressed during testing. A leak test…"	Prevention of damage to the containment			X	The goal to prevent the test from causing excessive stresses is clear indicated in this clause. All measurements and instrumentation needed for the monitoring of parameters during the test are much better detailed in the code.

COMMENTS BY REVIEWER					RESOLUTION		
Reviewer: Les Smith, Tim Allmark, Lidia Haddock Country Organisation: UK/Office for Nuclear Regulation & NuGeneration Ltd			Date: 25 Nov 16				
Comment Nr	Para Nr. & Line	Proposed new text	Reason	Accepted	Accepted modified as follows	Rejected	Reason if modified/rejected
32	5.28, Line 4	"cracks and may augment the results from structural monitor-ing and instrumentation."	Cross link to other activities	X			

Member State Comments on IAEA Draft Safety Guide,
"Design of Reactor Containment Structure and Systems for Nuclear Power Plants (NS-G-1.10)" (DS482)

COMMENTS BY REVIEWER Reviewer: Kathryn Brock Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	2.2	"The containment and its associated systems are designed to perform together with other design provisions the following safety functions (see Requirements 4 and 54):"	Consider providing a reference to the document where these requirements are provided, SSR-2/1 [3].	X			
2	2.8	"…functionally separated and independent as far as practicable from other systems."	"As far as practicable" is vague and difficult to conform with. If a plant can achieve the intent without complete separation, such as diverse components within a single piping system, that should not be excluded. Instead, trying to meet some sort of safety target may be more appropriate than defining the method for meeting an unspecified target.			X	"As far as practicable" is from SSR 2/1 Rev1,. Item 4.13 A. Separation/independence and diversity are implemented for different purposes even if both contribute to reliability (diversity does not help much where the systems are not functionally separated
3	2.9	"Stresses in the civil structures due to loads or combinations of loads caused by operating conditions and accident conditions are such that the structural integrity of the	The recommendation should also include consideration of normal and accident conditions combined with the natural phenomena, to be consistent with Section 3.3 of the	X			

COMMENTS BY REVIEWER Reviewer: Kathryn Brock Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		containment and of the systems required for the mitigation of the accident conditions is maintained with appropriate margins. (see Requirement 42)."	guidance.				
4	2.13	"The containment (and/or in conjunction with appropriate structure, separate from the containment) is designed to protect SSCs housed inside the containment against the effects of natural and human-induced external hazards identified by the site hazard evaluation, and against the effects of hazards originated by equipment installed at the site. "	Some designs elect to provide a separate "shield" structure to protect the containment (and SSCs contained within) from some external hazards without a diminishment of either function. This potential is appropriately captured in subsequent sections, but should be clarified here as well. Alternatively: "The containment (or shield structure) is designed…"	X			
5	2.14	"The containment (and/or in conjunction with appropriate separate structure) is also designed to provide protection against the effects of possible malicious acts directed against the facility…"	Some designs elect to provide a separate "shield" structure to protect the containment (and SSCs contained within) from some external hazards without a diminishment of either function. This potential is appropriately captured in subsequent sections, but should be clarified here as well.	X			Comment 4 and 5 are the same
6	3.5,	"To accommodate the loads	Variation of outside	X			

COMMENTS BY REVIEWER Reviewer: Kathryn Brock Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
	Bullet 8	occurring during operational transients, including variation of outside environmental temperature (e.g.,…) "	environmental temperature (which could result a thermal gradient in the containment structure) should be accommodated in the design for the operational states.				
7	3.38	Design ~~extension~~ basis conditions should be ~~identified and~~ used to establish the design ~~bases~~ extension conditions of containment structure and of systems necessary to meet the radiation protection objectives established for that category of accidents.	In order to determine design extension conditions (a term that is not used in the US, but could be equated with beyond design basis conditions) it would seem logical to first establish the design basis.		X For clarity, clause 3.35 has been slightly modified, not Clause 3.38		A design basis should be defined for every SSC taking into account the conditions for which the SSC is required to operate
8	3.41, Bullet 1	Request clarification	The first bullet is very unclear on what should be considered. What degree of unlikeliness is appropriate for "very unlikely events"? Is the requirement to appropriately conclude that the containment safety systems possess margin under best-estimate conditions? Is this indicating that design extension conditions without core melt should consider events with deterministic early containment failure? Perhaps supported by PRA/PSA evaluations would be	X			Bullet 1: Equipment failure(s) leading to a release of mass and energy higher than the one postulated design basis accidents (e.g. by a LOCA, main steam line break, etc.);.

COMMENTS BY REVIEWER

Reviewer: Kathryn Brock

Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017

RESOLUTION

Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			of a benefit?				
9	3.43 Bullet 3	Loss of the heat transfer chain to the ultimate heat sink removing heat from the containment in the event of a design basis or beyond design basis accident;	This item appears to be focused on active plants, and is demonstrated to be a beyond design basis event for some passive plants; therefore, this item should be adjusted to be more inclusive of more plant designs.			X	Anyway one system should be designed to remove decay heat in DBA (this system might be designed with active components or be a passive system). The possibility to lose this capability in DBA should be considered and retained as a DEC if relevant
10	3.46	Consider adding: - Status of DC power sources; - Status of instrument air systems	Completeness	X			
11	3.47	D~~edicated d~~esign provisions should be implemented to prevent a containment failure in case of DEC.	"The emergency Power source (EDGs) Dedicated" implies separate, independent, etc., but safety may be achieved without this strong wording.	X			
12	3.57	"The ~~on-site AC power source (~~emergency power source~~)~~ should have adequate capability to supply power to	Recommend removing the term "on-site AC power source", as this will not necessarily be the emergency power source for		X 3.57. The emergency power source (EDGs))		

COMMENTS BY REVIEWER Reviewer: Kathryn Brock Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		electrical equipment necessary for the energy management and control of radionuclides in the event of design basis accidents."	new designs.				
13	3.72, Bullet 2	…In particular, safety features designed to mitigate the consequences of accidents with core melting should be sufficiently (by independence~~t~~ from equipment or through other means) designed to mitigate the conditions inside the containment caused by design basis accidents;	Suggesting separate systems only to deal with severe accidents is an extreme view and likely cost-prohibitive. Due to the unpredictable nature of severe accidents resulting in core damage, a more pragmatic approach is to have multiple capabilities to cope with a given event, and usage of existing systems to mitigate design basis events should be acceptable, as failure of ALL systems is extremely unlikely.			X	Achieving independence of those features can be a good recommendation in this safety guide to meet SSR 2/1 Rev 1, item 4.13A
14	4.2	…remove heat from the containment and depressurize	Completeness	X			
15	4.18	The design pressure should be maximized to exceed ~~not be lower than~~ the value of the peak pressure that would be generated by the design basis accident with the most severe release of mass of material and energy and increased by ~~10%~~ as much as practical.	This is a lofty goal, but could require substantial efforts to be met for many plants (both operating as well as under construction/ proposed). Additionally, this clause appears to ignore the inherent margin in the design code to determine the design pressure		X The design pressure should be higher than the peak pressure (DBA peak pressure + margin).		

COMMENTS BY REVIEWER Reviewer: Kathryn Brock Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			allowable in the first place. It would be better to suggest wording without a specific number.				
16	4.28		Additional pressure load on the concrete containment due to instantaneous temperature rise of the liner during an accident condition should be considered.	X			
17	Table 1, pg. 27	Among Loads due to extreme external events, add: Flooding load – Loads resulting from flood effects, e.g., flow induced load, flood debris impact, or hydrostatic pressure	Flooding Load is not included as a potential loading during extreme external events (e.g., hurricane, tsunami, etc.)			X	Margins provided by design should be adequate to cope with the loads due to extreme natural hazards
18	4.30 (Table 1, 4th section load due to accident, line 3)	Design pressure = DBA pressure + ~~10%~~ "appropriate margin*" *For example see [12a] Table CC-3230-1 "Load Combination and Load Factors."	Completeness and clarity: Important to highlight that margin varies with load combination. Suggest adding a technical reference, e.g., ASME Boiler and Pressure Vessel Code, Section III, Division 2, Rules for Construction of Concrete Containment.	X	Design pressure=DBA pressure + margins		
19	4.36	*Add the proposed new text below at the end of 4.36:* Use applicable codes and standards for Load Combinations and Load Factors. For example, see	Scope and Completeness: TABLE 2 does not present load combination. Load combinations and load factors are provided in applicable			X	Loads and load combinations should be defined from a safety point of view independently of

COMMENTS BY REVIEWER Reviewer: Kathryn Brock Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		[12a] Table CC-3230-1 "Load Combination and Load Factors". Load Factors change with design method (i.e. working stress design, or ultimate strength design method).	design codes and standards. For example: ASME Boiler and Pressure Vessel Code, Section III, Division 2. Added as reference [12a].				the codes.
20	4.37	To provide margins, loads resulting from earthquake level SL2 and design basis accidents should be combined, ~~using SSR method (Square Root of the Sum of the Squares)~~ although one cannot realistically be a consequence of the other since the pressure boundary is designed to withstand seismic loads caused by earthquake level SL2 [15].	Quality and clarity: The loads are <u>not</u> combined using square root of the sum of the squares. See [12a] Table CC-3230-1 "Load Combination and Load Factors"		X should be combined using an adequate statistical combination of the loads although …		JPN comment
21	4.42	Failure modes such as liner tearing, penetration failures, <u>concrete failure, rebar failure,</u> and tendon failures should be analyzed. To the extent possible, a failure should not be catastrophic and should not cause additional damage to systems and components for retaining radioactive material.	Completeness and clarity: Concrete and rebar failures should be added	X			
22	4.138	Add at end of the paragraph:	Completeness			X	Necessity to

COMMENTS BY REVIEWER Reviewer: Kathryn Brock Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		"Consideration should be given to alternate power for hydrogen igniters."					emergency power supply any component should be derived from section 3
23	4.179 4.180 4.184	N/A	Comment – in the selection of all materials which may come into contact with primary system water in the event of a design basis accident, consideration should also be given to minimizing or eliminating the generation of chemical precipitates which may interact with debris to further clog sump screens. It is not clear whether the DSG as written specifically addresses this point.			X	4.82 should capture your concern
24	4.195	One way of monitoring the containment structure is by incorporating permanent instruments. Appropriate instrumentation ~~should~~ may be incorporated inside the containment in order to monitor closely any deformation (radial, vertical or circumferential) or movement of the containment structures or the containment walls. For other internationally	Completeness: Not all containments are monitored by instrumentation. An additional technical reference may be provided.	X			See 4.209

COMMENTS BY REVIEWER Reviewer: Kathryn Brock Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		acceptable methods see [12b].					
25	5.5	The pressure test should be conducted at a specified pressure for which account is taken of the applicable codes for the material used, and which is at least the design pressure. [12a] CC-6110 recommends the test pressure at least 1.15 times the containment design pressure to demonstrate the quality of construction and to verify new design features). The value of the test temperature should not be close to the ductile brittle transition temperature for the metallic material.	Scope and completeness:			X	I agree with this test pressure which corresponds to MS practice, but I think that it is preferable not to put a number in the guide. The phrasing is the same as it was in the previous revision.
26	5.28	Add this sentence at end of paragraph: A visual inspection technique that is specifically qualified for detecting the type and size of cracks/ defects which are determined to be important for leakage and structural integrity should be employed.	Comment - the use of visual inspection techniques for the detection of cracks/defects can be problematic depending on (1) the nature of the cracking mechanism, (2) the size of the cracks/defects which must be reliably detected, (3) the precision of the visual inspection technique employed, etc. The DSG may wish to	X			New number 5.31

COMMENTS BY REVIEWER Reviewer: Kathryn Brock Country/Organization: USA / US Nuclear Regulatory Commission Date: 11 January 2017				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			elaborate on the importance of choosing a visual inspection technology which is specifically qualified for detecting the type and size of cracks/defects which are determined to be important for leakage and structural integrity.				
27	REFERENCE	Insert additional references: [12a] AMERICAN SOCIETY OF MECHANICAL ENGINEERS, ASME Boiler and Pressure Vessel Code, Section III, Division 2, Rules for Construction of Concrete Containment, ASME, New York, NY (2015). [12b] AMERICAN SOCIETY OF MECHANICAL ENGINEERS, ASME Boiler and Pressure Vessel Code, Section XI, Rules for In service Inspection of Nuclear Power Plant Components, Subsection IWL, Requirements for Class CC Concrete Components of Light-Water-Cooled Plants, ASME, New York, NY (2015).	Applicable References for completeness. Adding [12a] and [12b] provides completeness		X not the reference to In service inspection		
28	General	The document lacks a Sub-section or a detailed text	Completeness to address Radioactive waste			X	See IAEA GSR-Part 6 and the

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		addressing safety requirements for waste management. This document is developed to provide guidance on implementation of SSR-2/1. In this regard, SSR-2/1 Safety Requirement #12 stated: In particular, the design shall take due account of: (a) The choice of materials, so that amounts of radioactive waste will be minimized to the extent practicable and decontamination will be facilitated; (b) The access (e.g.; to waste) capabilities and the means of handling that might be necessary; (c) The facilities necessary for the management (i.e. segregation, characterization, classification, pretreatment, treatment and conditioning) and storage of radioactive waste generated in operation, and …" Therefore, we recommend the document to allocate a sub-section on "Design Consideration to Minimize and Manage Radioactive Waste."	management in more detail consistent with SSR-2/1 Requirement #12.				associated safety guides
29	General	Added emphasis on the usage of PRA/PSA to influence focus				X	Addressed in 3.40, 3.96 to 3.98 (former

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		of evaluations for more likely events would be beneficial for all parties.					numberring)
		ADDITIONAL EDITORIAL COMMENTS					
30	Table of Contents	The Table of Contents is inconsistent with the text particularly in numbering subtitles and paragraphs. In addition, the Table of contents is truncated after Para 5.2; for example it did not include Subtitle “Local Leak tests of isolation devices, air locks, and penetration till the end of Chapter 5. Further, the Table of contents needs to include Appendix and Reference List.	Correctness and omissions as well as consistency between the Table of Contents and the text.	X			
31	General: Chapter 5	The document contains repetition of subtitles with different underlying text. For example, Subtitle “Structural Integrity Test” has been repeated on pages 60 (before Para 5.4) and on page 62 (before Para 5.20). Authors	Repetitions & Redundancies and Editorial			X	Done on purpose to separate tests during the commissioning from test throughout the lifetime.

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		need to reconcile and place similar topics/text under the same subtitle.					
32	General	The text provided reference to SSR-2/1 requirements. We recommend that after each quoted requirement or mention of requirement number to add Reference #3.	Clarity to refer to SSR-2/1 (e.g.; Reference #3) when a requirement is indicated in the text.	X			
33	2.13, line 3	… For both of them, ~~causation~~ cause and likelihood of hazard combination is considered (see Requirement 17).	Editorial			X	Word used in Requirement 17
34	4.46, line 3	"…melt ~~trough~~ through should be practically eliminated…"	Editorial	X			
35	A.4 Line 4	… included in the design basis~~, either~~ for existing plants.	Editorial	X			
36	Page 64	Refer to Appendix as indicated below: **APPENDIX A: PLANTS DESIGNED WITH EARLIER STANDARDS**	Need to designate the Appendix and title in an appropriate fashion.	X			
37	Page 69 Ref. [18]	Add after reference [18]: (November 11, 2016, Step #13)	Provide date/update for the reference.			X	DS 452 is not published yet