TITLE

COMMENTS BY REVIEWER Reviewer: Fokken, Loy Country/Organization: Switzerland, ENSI			Page. 1 of 2 Date:05.10.2017	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	4.21 (a) New paras in chapter “fire mitigation”	<u>Proposal 1:</u> delete the last two sentences ~~In this case, the performances of those systems should be designed taking into account the single failure criterion. The application of the single failure criterion is described in paras 5.39-5.40 of Ref. [1].~~ <u>Proposal 2:</u> A single failure should not compromise the entirety of mitigating fire protection measures in place.	According to paras 5.39 of Ref. (1) the single failure criterion shall be applied to a safety group or safety system. In our point of view fire detection and fire fighting systems are explicitly not denoted as part of the safety system. Instead, it should be pointed out in general that a single failure should not compromise the entirety of mitigating fire protection measures in place (including manual as well as automatically initiated fire detection and fire extinguishing).		In this case, the performances of those systems should be designed taking into account the application of single failure criterion to the safety function they protect. The application of the single failure criterion is described in paras 5.39-5.40 of Ref. [1].		Similar text as in NS-G-1.7.
2	1.3	1.3 The objective of this Safety	It should be pointed out		X		

		Guide is…against internal hazards *primarily in new* power plants.	somewhere, that the recommendations apply primarily to new power plants. For existing power plants it is not possible to meet all requirements even when the system is backfitted. According to SSR 2/1, where it is explicitly stated on pp 16 “Application of the IAEA Safety Standards” *The requirements established in the IAEA safety standards might not be fully met at some existing facilities that were built to earlier standards.*		1.3. The objective of this Safety Guide is to provide recommendations and guidance to regulatory bodies, nuclear power plant designers and licensees on hazard combination, hazard assessment and design concepts for protection against internal hazards in new nuclear power plants. This Safety Guide provides interpretation of the relevant Safety Requirements on Safety of Nuclear Power Plants: Design [1] and recommendations on how to fulfil them. For plants designed with earlier standards, comprehensive safety assessments are to be carried out considering these recommendations		The resolution considers also comment from ENISS on assessment in the objective.

					in order to identify safety improvements that are oriented to prevent accidents with radiological consequences and mitigate such consequences should they occur. Reasonably practicable or achievable safety improvements are to be implemented in a timely manner.		

TITLE
"Protection against Internal Hazards in the Design of Nuclear Power Plants" (DS 494)

COMMENTS BY REVIEWER Reviewer: Ing. Jolana Rýdlolvá Page.1 of 3. Country/Organization Czechia/SÚJB Date: 13.10.2017				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	2.4, third bullet	- the remaining systems important to safety used in normal operation and anticipated operational occurrences (AOO) and which are termed safety related systems , and their supporting systems	Supporting system is a prerequisite for the safety function of the SSC to be carried out.		X		Solved by referring to the IAEA Safety Glossary and adding "According to that definition, the safety features for DEC, defined in [1] are part of the systems important to safety." The comment is not anymore relevant.
2	4.109 (a)	For high energy pipes (except for those qualified for break preclusion) circumferential rupture ~~or~~ and longitudinal through-wall crack.	Paragraph 109 seems to intend the <u>types</u> of failure. Conjunction "or" could have various validation in the result (1 – 0, 0 -1, 1 -1 – all three results are valid). In high energy pipes both breaks and cracks should be postulated.		X 4.109. Depending on the characteristics of the pipes under consideration (internal parameters, diameter, stress values, fatigue factors), the following types of failure should be considered:		This resolution considers also comments from UK and from ENISS.

					(a) For high energy pipes (except for those qualified for leak-before-break, break preclusion or for low probability of failure) circumferential rupture or longitudinal through-wall crack, or both. The high energy of the contained fluid means that dynamic effects, such as pipe whip, or jets is more important.		

3	4.109 (b)	For low energy pipes, through wall cracks (circumferential or longitudinal)	Meaning of the item is not clear. Paragraph 4.109 deals with types of failure		X (b) Low energy pipes could also suffer through wall cracks, either longitudinal or circumferential, but cracks would in some cases be more stable, given the energy of the fluid, and dynamic effects would be less significant. By exception, for low energy pipes, it could be possible to justify limiting the break size to that of a leak with limited area.		See resolution of comment No.2.
4	4.110	It is acceptable to postulate only a limited leak (and not a break) if it can be demonstrated that the piping system considered is operated under 'high energy' parameters for a short period of time (e.g., less than 2% of the total operating time) ~~or if its nominal stress is reasonably low (e.g., a pressure of less than 50 MPa~~).	If we would like to utilize "reasonably low nominal stress", we should define the limits/criteria for "reasonably low …" , and specify loading conditions which should be included in an analysis. The possibility of rejection of breaks in		X 4.110. It may be acceptable to postulate only a limited leak (and not a break) if it can be demonstrated that the piping system		This resolution takes also into account UK comment.

			SC (with week defined assumptions) could lead to the omission of hazards in some cases.		considered is operated under ‘high energy’ parameters for a short period of time (e.g., less than 2% of the total operating time) or if its nominal stress is reasonably low (e.g., a pressure of less than 50 MPa). Alternatively, assessment of the consequences assuming a full pipe rupture can be viewed as a good practice to demonstrate the hazard robustness of the design. [1] This approach is only applicable in some Member States, in particular those where leak-before-break has		

					been accepted.		
5	4.111	If an computational analysis has been performed, rupture should be postulated at the following locations: - worst locations on the stress and fatigue criteria basis - at terminal ends. Otherwise, all welds to the pipe fittings (e.g. tee, valve…) should be considered within the process of specification od locations of postulated failure.	The para is not clear. Failure could be break/rupture and/or crack. At terminal end, usually only breaks are postulated. Moreover, all results (locations) should be dependent on the fact whether the computational analysis has been performed, or not.			x	The critical locations of the rupture are first identified on the basis of engineering judgement and if necessary, calculations are performed.
6	4.112	For high energy small diameter piping systems, breaks should be postulated at all fittings (e.g. elbow, valve…) and terminal ends because they are sensitive to vibration-induced failure.	As written above, breaks for low energy piping are not required to be postulated. Specification of "all locations" on piping seems to be very (and excessively) demanding for small diameter piping.			X	Both high energy and low energy pipes (for which the worst location is assumed) are considered in this paragraph.

7	Footnote 4, page 36	A low energy pipe is defined as a pipe with an internal operating pressure of less than 2.0 MPa ~~or~~ and an operating temperature of less than 100°C in the case of water.	Exceeding of one of those limits (p, T) satisfy already the definition of high energy piping. Therefore, both conditions (p, T) shall be met simultaneously	X			
8	Footnote 8, page 37	One example of this approach is ANSI/ANS-58-2-1988. Attention should be paid to the possible non-conservatism, as it is written in SRP 3.6.2, Rev. 3 from December 2016.	If an example is given here, then it is necessary to give the information in accordance to the current level of knowledge	x			The footnote is removed to also accommodate a similar UK comment (comment No. 22)
9	4.136	Instead of break postulation, an approach intended to break prevention could be used. (e.g. LBB as described in NUREG 0800, SRP 3.6.3)	The meaning of the first sentence is not clear. Reading remaining sentences in this para, one can think that leak before break (or similar) approach is intended by the author of this para. Moreover, nowhere in the chapter for pipe breaks, LBB is mentioned.		X For locations where leak before break criteria are met, a leak (rather than a complete rupture) may be assumed * ________ *This is applicable in Member States where leak-before-break has been accepted		Add a footnote to reflect that this is applicable in Member States where leak-before-break has been accepted

TITLE DS494 - Protection against Internal Hazards in the Design of Nuclear Power Plants

COMMENTS BY REVIEWER Reviewer: Diego Lisbona, Anastasios Alexiou and Gareth Hopkin (Internal Hazards and Structural Integrity Inspectors) Page....1 of....13 Country/Organization: UK/ Office for Nuclear Regulation (ONR) Date:13/10/2017				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	3.4	Certain postulated hazards might be of such magnitude that providing design features to mitigate them is not practicable ~~(e.g., excessive load drop).~~ In this case, the focus is on prevention and an evaluation should be performed to ensure that the likelihood of such events is acceptably low. Even if they cannot be completely mitigated, design measures should be implemented to minimize the consequences of these events to the extent practicable.	The example suggests that the design of slabs to prevent unacceptable consequences from dropped loads may not be practicable; ONR's assessment of new reactor designs has showed that it is reasonably practicable for new designs to be improved to prevent unacceptable consequences in this case. As a result, providing such example may preclude safety improvements.		X (e.g., uncontrolled drop of reactor vessel head)		Example is useful for better guidance, e.g., embarking country guidance.
2	3.5	During plant design, internal hazards should be identified on the basis of a combination of engineering judgement, relevant plant design and operational experience, deterministic and probabilistic considerations"	Design and operational experience can inform the internal hazard identification process and could be mentioned in this paragraph.		X During plant design, internal hazards should be identified on the basis of a combination of engineering judgement,		Relevant plant design during plant design is not understood.

					lessons learned from similar plant designs and operational experience, deterministic and probabilistic considerations” The hazard identification and characterisation process should be rigorous, supported by plant walk-down for verification, and well documented.		
3	3.11	A few hazards may be eliminated either because they are physically impossible (e.g., heavy load drop if there is no lifting equipment) or by a very high quality design (e.g., double ended guillotine break if the pipe is designed, inspected and maintained in such a way that failure or degraded conditions in service can be discounted).	The proposed wording reflects the UK position in that leak-before-break is not accepted as a primary claim of a pipe whip safety case and double ended guillotine break should be postulated unless this can be considered incredible as a result of high quality design, inspection and maintenance. Within Structural Integrity we, in the UK, do not generally accept Leak-before-Break (LBB) as a frontline		X A few hazards may be eliminated either because they are physically impossible (e.g., heavy load drop if there is no lifting equipment) or by a very high quality design (e.g., double ended guillotine break if the pipe is designed, monitored, inspected and maintained in		Monitoring added

			safety argument. I acknowledge that this may be an acceptable argument in some jurisdictions, and has been handled in previous IAEA documentation by providing an exclusion for countries where LBB is not an acceptable argument. The text in paragraph 3.11, as it stands at present, is not acceptable in the UK context.		such a way that failure or degraded conditions in service can be discounted).		
4	3.32	In the construction, commissioning, operation and *decommissioning* of a multi-unit and/or multi-source power plant, steps should be taken to ensure that an internal hazard in a unit	Should also include decommissioning activities		X In the whole life cycle from construction to decommissioning of a multi-unit and/or multi-source power plant, steps should be taken to ensure that an internal hazard in a unit		Shorter and solves also a similar comment from Germany.
5	4.1	Nuclear power plants contain a range of combustible materials, as part of the structure, equipment, fluids, cabling or miscellaneous items in storage. Since fire can be assumed to occur in any plant area where combustible materials are present, and where it is not reasonably practicable to eliminate these, design measures for fire	There should be a clear drive to remove hazards.	x			

		prevention should be applied to all the fixed and transient fire loads. Such measures include minimization of fixed fire loads, prevention of accumulation of transient combustible materials and control or (preferably) elimination of sources of ignition, and these should be explored.					
6	4.5	Removal, minimization and segregation of fixed and transient (temporary) fire loads as far as reasonably practicable, and	Minimization is only one element.	x			
7	4.6	h) Segregation and compartmentation of fire loads as far as is reasonably practicable to reduce likelihood of fire spread and effects to other SSCs important to safety.	This is a key design consideration to minimize fire loads.	x			
8	4.15	Cables should be laid on trays, installed conduits or placed in other acceptable structures made out of non-combustible materials, for example steel that is often used for this purpose.	The first sentence did not read well: (*4.15. Cables should be laid on trays, installed conduits or placed in other structurally acceptable made out of non-combustible materials, for example steel)*		X Cables should be laid on trays or installed conduits, or placed in other acceptable structures made out of non-combustible materials, for example steel that is often used for this purpose.		
9	4.22	The reliability of fire detection and extinguishing systems should be consistent with their role in	No mention of fire infrastructure.	X			

		providing defence-in-depth and with the recommendations given in Ref. [7]. This should also include ensuring that water supplies (including mains supplied) and utility connections (fire hydrants) are maintained such that they will meet any demand.					
10	4.38	Parts of the ventilation system (e.g., connecting ducts, fan rooms and filters) that are situated outside the fire compartment should have the same fire resistance rating as the compartment or, alternatively, the fire compartment penetration should be isolated by appropriately rated fire dampers.	edit	X			
11	4.46	Cabling for redundant safety systems should be run in individual specially protected routes in separate fire compartments so far as is reasonably practicable, and cables should not cross between redundant divisions of safety systems.	The expectation is that segregation of redundant trains will be provided so far as is reasonably practicable.	X			
12	4.50	The fire protection of the supplementary control room should be similar to that of the main control room. Particular emphasis should be placed on protection from flooding and other effects of the operation of fire extinguishing systems. The supplementary control room should be placed in a fire compartment separate from the one containing the main control room, and its	The additional sentence is to ensure that spurious transfer of control from the main room (or the alternative control) cannot occur as a result of an internal hazard in either the main control room or the alternative room, as these could disable both as a result of		X *The means by which the control is transferred from the main control room to the supplementary control room should be resilient against*		Slight improvement and clarification of the wording.

		ventilation system should not be a common system shared with the main control room. The separations between the main control room, the supplementary control room and their associated ventilation systems should be such as to meet the intent of para. 2.12 after any postulated initiating event such as a fire or explosion. *The means of transfer control from the main control room to a secondary control room shall be resilient against internal hazards to prevent malfunction or spurious actuation.*	a single event.		*internal hazards to prevent malfunction or spurious actuation.*		
13	4.69	Features that can resist or mitigate explosion effects, (e.g. appropriate design or operating provisions) should be in place to minimize the risks: the limitation of the volumes of explosive gases, the elimination of ignition sources, adequate ventilation rates, the appropriate choice of electrical equipment designed for use in an explosive atmosphere, inerting, explosion venting (e.g., blow-out panels or other pressure relief devices) and separation from items important to safety. Equipment that needs to maintain its functionality following a postulated initiating event should be identified and adequately designed and qualified	The existing wording could have excluded provision of mitigation when measures are in place to prevent/avoid the explosive atmosphere.		X Features that can resist or limit explosion effects, (e.g. appropriate design or operating provisions) should be in place to minimize the risks: the		More precise wording
14	4.70	The risk of explosions induced by fire exposure such as boiling liquid expanding vapour explosions	This paragraph links BLEVEs to flammable releases only, but they are		X *The potential for BLEVE's from*		Shall modified in should.

		(BLEVEs) should be minimized by means of separation between potential fire exposures and potentially explosive liquids and gases, or by active measures such as suitable fixed fire suppression systems designed to provide cooling and vapour dispersion. Consideration should be given to the blast overpressure and missiles generated by BLEVEs, and to the potential for the ignition of flammable gases at a location distant from the point of release, which could result in the explosion of a gas cloud. *The potential for BLEVE's from rapid expansion of non-flammable fluids shall be minimised by avoiding operation above the superheat limit so far as is reasonably practicable.*	also credible as a result of breaks in systems containing superheated fluids e.g. water. I therefore suggest the proposed additional text is included.		*rapid expansion of non-flammable fluids should be minimised by avoiding operation above the superheat limit so far as is reasonably practicable.*		
15	4.77	The potential for secondary missiles should also be evaluated, including consideration of fragment ricochet.	Dependent on the material of the fragment and the material of the impacting face, ricochets will occur (high probability) at impact angles less than a critical angle. The greater the impact angle the greater the reduction of exit velocity, however, for fragments that ricochet at shallow angles (typically less than 10 deg) majority		X The potential for secondary missiles that could damage SSCs important to safety should also be evaluated, including consideration of fragment ricochet, if considered credible on the		More complete formulation. See also resolution of ENISS comment No. 28.

			of the impact velocity will be retained. Thus damage could occur to SSCs that are not in direct line of sight.		basis of expet judgement.		
16	*4.78*	*In nuclear power plants, pressure vessels that are important to safety are designed and constructed by means of extremely comprehensive and thorough practices to ensure their safe operation. Analysis is performed to demonstrate that levels of stress are acceptable under all design conditions. All phases of design, construction, installation and testing should be monitored in accordance with approved procedures to verify that all work is carried out in accordance with the design specifications and that the final quality of the vessel is acceptable. A surveillance programme during commissioning and operation, as well as a reliable system for overpressure protection, should be used to determine whether the vessels remain within their design limits. The gross failure of such vessels (such as the reactor pressure vessel) is generally believed to be sufficiently improbable that consideration of the rupture of these vessels as a PIE should not be necessary*."	The proposed change reflects the wording in NS.G.1.11 and would be preferable as surveillance should not be restricted to commissioning and operation.		*In nuclear power plants, pressure vessels that are important to safety are designed and constructed by means of extremely comprehensive and thorough practices to ensure their safe operation. Analysis is performed to demonstrate that levels of stress are acceptable under all design conditions. All phases of design, construction, installation and testing should be monitored in accordance with approved procedures to verify that all work is carried*	.	More precise wording regarding the use of PIE at the end of the paragraph.

					out in accordance with the design specifications and that the final quality of the vessel is acceptable. A surveillance programme during commissioning and operation, as well as a reliable system for overpressure protection, should be used to determine whether the vessels remain within their design limits. The gross failure of such vessels (such as the reactor pressure vessel) is generally believed to be sufficiently improbable that consideration of the rupture of these vessels as an internal hazard should not be necessary."		

17	4.79	Failures of other (non-safety related) vessels containing fluids of high internal energy should be evaluated, as they could become sources of missiles and other consequential hazards if they rupture.	See comments below:		X Failures of other vessels containing fluids of high internal energy should be evaluated, as they could become sources of missiles and other consequential hazards if they rupture.		Clarification of the terminology of "non-safety-related" according to the IAEA Safety Glossary.
18	4.80	If the vessel can possibly fail in a brittle manner, a range of missile sizes and shapes to cover the range of possibilities should be postulated and analyzed to identify the missiles that determine the design basis of protective systems or structures. Alternatively, a simplified conservative approach is acceptable in order to determine the missiles to be considered. Vessels should also be designed to fail in a ductile manner or in such a way that missile and fragment hazards are reduced so far is reasonably practicable.	Terminology – a gas bottle can form a missile if it remains as the whole object, brittle failure of a vessel will generate fragmentation. In general the document needs to ensure that when they are talking about a missile, that it is not a fragment and vice versa. For ballistics an average presented areas is often determined as a fragment will in reality tumble.	x			
19	4.89 last bullet	In other cases there could be a most probable plane or angular sector, as is the case for missiles from rotating machines. The majority of evidence from failures of rotating machines			X In other cases there could be a most probable plane or angular		Resolution to address both UK and ENISS comments.

		that energetic missiles are usually ejected within a very narrow angle of the plane of rotation unless they are deflected by a barrier of some kind (e.g., casing) at the source. However, there is also evidence that a small number of missiles may land in a wider angle from the plane of rotation. Therefore, the site layout may necessitate sensitivity studies in the consideration of missile strikes.			sector, as is the case for missiles from rotating machines. There is evidence from failures of rotating machines that energetic missiles are usually ejected within a very narrow angle of the plane of rotation unless they are deflected by a barrier of some kind ~~(e.g., casing)~~ at the source or stopped by casing.“ However, there is also evidence that a small number of missiles may land in a wider angle from the plane of rotation. Therefore, the site layout may necessitate sensitivity studies in the consideration of missile strikes.		

20	4.110	Delete paragraph entirely – the UK does not accept the time-at-risk argument or leak-before-break			X 4.110. It may be acceptable to postulate only a limited leak (and not a break) if it can be demonstrated that the piping system considered is operated under 'high energy' parameters for a short period of time[1] (e.g., less than 2% of the total operating time) ~~or if its nominal stress is reasonably low (e.g., a pressure of less than 50 MPa)~~. Alternatively, assessment of the consequences assuming a full pipe rupture can be viewed as a good practice to demonstrate the hazard robustness		This resolution takes also into account similar Czechia and ENISS comments.

					of the design. [1] This approach is only applicable in some Member States, in particular those where leak-before-break has been accepted.			
21	4.111	Failure should be postulated at the following locations: At the terminal ends (fixed points, connections to a large pipe or to a component) and at welds and intermediate points where failure of a piping system designed and operated according to the rules applied for safety systems would lead to bounding effects on safety-related SSCs;	ONR considers that failure may occur in any location, although it is accepted that some locations have a higher probability of failure. However the deterministic assessment should show resilience against the break locations giving rise to bounding consequences on SSCs. Also, for the purposes of Structural Integrity classification in the UK, it is our expectation that failure should be postulated at all locations for all pipes, so as to assess the worst-case implications of any failure. The level of		X Failure should be postulated at the following locations: At the terminal ends (fixed points, connections to a large pipe or to a component) and at welds and intermediate points where failure of a piping system designed and operated according to the rules applied for safety systems would lead to bounding effects on SSCs important to		Clarification of safety-related at the end of the paragraph.

			analysis performed should be proportionate to the nuclear safety risk posed by the component		safety;		
22	4.129	Remove reference to ANSI/ANS-58-2-1988	This standard has been withdrawn. It is widely recognized that this standard needs updating to reflect modern standards	x			This resolution addresses also Czechia comment No.8.
23	4.136	For locations where break preclusion criteria are met, a leak (rather than a complete rupture) may be assumed. To determine the leak size, a fracture mechanics analysis should be performed. Alternatively, a subcritical crack corresponding to a leak size of 10% of the flow cross-section should be postulated. The leak detection system should be shown to have a sensitivity that is adequate to detect the minimum leakage from a crack that is just subcritical. This is only applicable in jurisdictions where leak-before-break has been accepted.	The proposed wording reflects that ONR does not accept break preclusion for nuclear new build as design criteria. Preferably this paragraph should be deleted, or as a compromise solution, the opening caveated text should be included.		X For locations where leak before break criteria are met, a leak (rather than a complete rupture) may be assumed * ____ *This is applicable in Member States where leak-before-break has been accepted		Add a footnote to reflect that this is applicable in Member States where leak-before-break has been accepted. This resolution addresses also Czechia comment No.9.
24	4.149	For all possible flood scenarios, a water level as a function of time should be determined not only for the room or plant area with the source of the water but also for all rooms or plant areas to which the water could spread. This should take	The flood source characteristics e.g. ultimate inventory, discharge rates and means of isolation are key features that	X			

		into account the source's overall inventory, discharge rates and means of isolation. Possible inexhaustible water supplies should also be considered. Typical pathways that flood water could traverse include pipe conduits, drains, or openings in walls or floors, stairwells, vents, elevators. Doors are also an important flood propagation pathway.	influence the overall severity of the hazard and should in my view be mentioned for clarity.				
25	Appendix I.4	Text of para. I.4 retained, i.e., I.4. In principle, three types of hazard combinations …simultaneously with an internal hazard. New para. I.5 is proposed between existing I.4 and previous I.5 as follows: I.5. It is important to determine a hazard combination sequence. A hazard combination sequence should determine the loading/ magnitude of the hazard, the duration it is applied, and sequencing of the occurrence of other hazards. For unrelated independent events, an identification process should be adopted to include all foreseeable independently occurring hazards, where the second (unrelated hazards) is sufficiently probable that it may occur in the mission time for the systems responding to the primary hazard. Correlated hazards result from the same basic failure, or other common	Additional text - Understanding the hazard sequence is very important. New paragraph combined this with some additional guidance for each of the types of hazard combination described in para. I.4.		X I.5. ~~It is important to determine a hazard combination sequence.~~ A hazard combination sequence should determine the loading/ magnitude of the hazard, the duration it is applied, and sequencing of the occurrence of other hazards. For unrelated independent events, an identification process should be adopted to include all foreseeable		Un-necessary narrative wording is removed. Improved formulation.

		cause initiator, and the frequencies are related to the cause. Consequential hazards may occur at the same frequency as the primary hazards, or at a lower frequency depending on the progression of events leading to the secondary hazard.			independently occurring hazards, where the second ~~(unrelated hazards)~~ is sufficiently probable that it ~~may~~ could occur in the mission time for the systems responding to the primary hazard. Correlated hazards result from the same basic failure, or other common cause initiator, and the frequencies are related to the cause. Consequential hazards may occur at the same frequency as the primary hazards, or at a lower frequency depending on the progression of events leading to the secondary hazard. .		
26	Appendix I.5	Hazard identification processes could lead to long lists of potential combinations and therefore pragmatic approaches should be	Further guidance on screening is important. If the previous comment is accepted, paragraph		X Hazard identification processes could		This paragraph is introduced as a new para. I.6. The sentence

		utilized. While combinations involving two (or more) simultaneous hazards could be postulated, screening criteria should be developed to ensure that the list represents a credible and reasonable set of plant challenges. These should be biased towards identifying consequences that differ from those of the more frequent single hazard. The screening criteria can be deterministic or probabilistic. Examples of screening criteria include:	numbers will change.		lead to long lists of potential combinations and therefore pragmatic approaches should be utilized. While combinations involving two (or more) simultaneous hazards could be postulated, screening criteria should be developed to ensure that the list represents a credible and reasonable set of plant challenges. ~~These should be biased towards identifying consequences that differ from those of the more frequent single hazard~~. The screening criteria can be deterministic or probabilistic. Examples of screening criteria include:		"These should be biased towards identifying consequences that differ from those of the more frequent single hazard" is not clear and does not bring additional guidance.

27	Appendix I.7	I.6 The desired outcome of this process… then no additional design measures would be necessary. I.7. For each identified hazard combination sequence, the analysis should also take into consideration any deterioration or damage to SSCs and hazard barriers after being subjected to each of the various hazards. Consider the example of a pipe failure that leads to, say, a missile and a subsequent flood. The analysis of the barrier withstand of the hydrostatic loads from flooding will need to account for any damage either by successive or simultaneous hazards (for example pressure parts failure which may lead to pipe whip, jets, and steam pressure effects on barriers or SSCs). I.7. When considering the likelihood… than its assumed normal frequency.	Need to account for the deterioration of the SSCs to perform its function when subjected to the various additional hazards. We now view this as best done by a new paragraph between the existing I.6 and I.7 (all paragraphs' numbers change if comments accepted).		X I.6 The desired outcome of this process… then no additional design measures would be necessary. I.7. For each identified hazard combination sequence, the analysis should also take into consideration any deterioration or damage to SSCs important to safety and hazard barriers after being subjected to each of the various hazards. Consider the example of a pipe failure that leads to, say, a missile and a subsequent flood. The analysis of the barrier withstand of the hydrostatic loads from flooding will need to account for any damage		More precise wording.

					either by successive or simultaneous hazards (for example pressure parts failure which ~~may~~ could lead to pipe whip, jets, and steam pressure effects on barriers or SSCs important to safety). I.7. When considering the likelihood… than its assumed normal frequency…		

28	Appendix II.27	Various design approaches have been taken to limit the significant impact of cable fires. Among these approaches are: protecting electrical circuits against overload and short circuit conditions; limiting the total inventory of combustible material in cable installations; reducing the relative combustibility of cable insulation; providing fire protection to delay fire propagation; and providing segregation between cables from redundant divisions of safety systems, and between power supply cables and control cables”	The wording in the draft “separation” of redundant trains could be misinterpreted as separation by distance being preferable for redundant safety trains, however segregation is preferable to separation by distance. From the PRISME research modern cables do burn if sufficient ignition sources are present.	x			
29	Appendix II.28	Design approaches should be taken to limit the significant impact of cable fires as follows: - providing fire protection to limit fire propagation; and - providing segregation between cables from redundant divisions of safety systems, and between power supply cables and control cables so far as is reasonably practicable. Where segregation is not possible, separation may be appropriate.”	The wording in the draft “separation” of redundant trains could be misinterpreted as separation by distance being preferable for redundant safety trains. However segregation is preferable to separation by distance		X Design approaches should be taken to limit the significant impact of cable fires as follows: - providing fire protection to limit fire propagation; and - providing segregation between cables		Better wording and paragraph structure.

					from redundant divisions of safety systems, and - providing segregation between power supply cables and control cables so far as is reasonably practicable. Where segregation is not possible, separation may be appropriate."		
30	Appendix II.32	The potential impact of cable fires can be reduced by providing suitable segregation by the fire compartment approach."	The wording in the draft "separation" of redundant trains could be misinterpreted as separation by distance being preferable for redundant safety trains, however segregation is preferable to separation by distance	X			
31	Appendix II.31	Cable coatings to reduce the potential for ignition and delay flame propagation	I agree with the first part of the sentence (if the ignition source is suitably weak, the coating may reduce the potential for ignition). However, the	X			

			coating may delay the fire spread but does not prevent propagation. The additional text would cover any other internal hazard not explicitly mentioned in the guidance					

Hungarian comments to DS494

COMMENTS BY REVIEWER Reviewer: Tamás Czerovszki/Gábor Petőfi Page 1 of 1 Country/Organization: Hungary/Hungarian Atomic Energy Authority Date:2017.10.12				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	Para 4.148.	-	The second part of this recommendation ("This identification should be supported by room walk-downs for verification.") for identification should be included for at least fire hazards too, or it can be a general recommendation for all internal hazards, because plant or room walk-downs have an important role in the identification and verification.		X Propose to modify the last sentence of paragraph 3.5 as follows: The hazard identification and characterisation process should be rigorous, supported by plant walk-down for verification, and well documented.		

Draft Safety Guide DS494 “Protection against Internal Hazards in the Design of Nuclear Power Plants”, Step 7a, September 2017

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	1	2.12	The aim of considering internal hazards in the design of nuclear power plants is to ensure that ~~the fundamental safety functions are performed in any plant state and that the plant can be brought to a safe shutdown state after any internal hazard occurrence~~ SSCs necessary to maintain the basic safety functions are not compromised by internal hazards.	It is not enough that the plant is brought to safe shutdown state, it has to remain in a safe state; the word plant is misleading, the requirement should be more general; however the bullets are in principle ok.		X The aim of considering internal hazards in the design of nuclear power plants is to ensure that the fundamental safety functions are performed in any plant state and that the plant can be brought to and maintained in a safe shutdown state after any internal hazard occurrence.		There is a need to bring the nuclear power plant to a safe shutdown state and to maintain it. The wording “basic safety functions” does not correspond to the IAEA current terminology; better to use main safety functions or fundamental safety functions.
1	2	3.7	The list of the combined hazards that should be considered in the design should be developed and the screening should be justified. In principle, three types of event combinations involving internal hazards should be distinguished: Consequential/Subsequent events: An internal hazard induces one or more additional internal hazards, Correlated events: A common event (including external hazards) results in internal hazard(s), which even may occur with certain probability	This text is in principle provided in Appendix I, par. I.4,; however the wording is a little different. Moreover, this definition of the different types of combinations is essential to consider all possible types of combinations with internal hazards.			x	There is no need to duplicate Appendix I since there is a reference to this appendix in para. 3.10.

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Country/Organization: **Germany**			Pages 11 Date: October 23, 2017	RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			simultaneously[1]. Unrelated (Independent) events: An event (including hazards) occurs independently from, but simultaneously to an internal hazard.					
1	3	Before or after 3.17	Administrative measures are also possible for prevention of internal hazards and mitigation of their effects.	This text is missing			x	The so-called 'administrative measures" are referred to in para. 3.15 as "procedure implementation". See also 3.12.
1	4	3.32	In the construction or operation or in safe shutdown or under decommissioning of a multi-unit and/or multi-source power plant, steps should be taken to ensure that an internal hazard in a unit and/or radioactive source under construction or in operation would not have any safety consequences for a neighbouring operating unit or source (e.g., spent fuel pool). Temporary separations should be used if necessary to protect the operating units.	Also facilities in the added states shall not impair those in operation inadmissibly!		X In the whole life cycle from construction to decommissioning of a multi-unit and/or multi-source power plant, steps should be taken to ensure that an internal hazard in a unit.		See also UK comment No. 4.
2	5	After 4.4	The fire hazard analysis should be carried out early in the design phase and documented. It should be updated	The reader should be made aware that useful material is given in		X 4.3. A fire hazard analysis (FHA) of a		The same is already said after paragraph 4.3

[1] "Simultaneous" in this case does not mean that the hazards occur exactly at the same time but rather that the second hazard occurs before the previous hazard has been completely mitigated.

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			before initial loading of the reactor fuel and kept up to date during plant operation. More detailed guidance on the FHA, provided in Appendix II.	Appendix II.		plant site should be carried out to demonstrate that the overall safety objectives are met. In particular, the fire hazard analysis should determine the necessary fire resistance rating of fire barriers and the fire detection and extinguishing capabilities (see detailed recommendations on fire hazard analysis in Appendix II).		that was slightly modified to take into account this comment.
3	6	4.29	Non-combustible construction materials should be used as far as reasonably practicable ~~used~~ throughout the plant and in particular in locations such as in the reactor containment and the control room.	Part of the verb was missing and the word order had to be changed		X Non-combustible construction materials should be used ~~used~~ throughout the plant as far as reasonably practicable and in particular in locations such as in the reactor containment and the control room		Similar comment of Belgium (comment No.12)
2	7	4.34 and		Inconsistency in	x			

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		4.36		terminology: in 4.34 "escape and access routes" and in 4.36 "escape and rescue routes" is used. There is a need for harmonization. See also Comments 26 and 29				
2	8	4.62	~~Consideration should be given to the provision of automatic systems for the detection of fire and flammable gases and of automatic fire extinguishing systems to prevent a fire induced explosion from affecting items important to safety in other buildings.~~	These consequences of fire to prevent explosion have to be dealt with under fire, Therefore this paragraph needs to be moved to App. I, to suitable place under fire combinations.			X	In reference to paragraph 3.6., paragraph 4.62 should stay as it is.
3	9	4.134	It might be necessary to analyse the effects of jets on targets that are not SSCs if their damage might lead to significant secondary consequences. A typical example is damage to pipe insulation inside containment. Although the insulation ~~could not~~ itself <u>may not</u> be important to safety, debris from insulation material could block the emergency core cooling or containment spray sump strainers during recirculation cooling.	Word order in the sentence is not correct, Instead of could it should be may, "might" should also be replaced by "may"			x	The wording is correct and was reviewed by the Technical Reviewer.
1	10	4.147	Examples of events that could cause a flood include but are not limited to: (a) A leak or break of the primary or secondary system; (b) <u>Spurious actuation of the</u>	The list should be completed.			x	These are examples and not a comprehensive list of flooding causes.

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			containment spray system; (c) A leak or break of the secondary feedwater system; (d) A leak or break of the emergency core cooling system; (e) A leak or break of the service water system; (f) A leak, break, or spurious operation of the fire water system; (g) Human error during maintenance (e.g., leaving a valve, an access hole or a flange open by mistake).					
2	11	4.151	Operating experience has shown that ventilation ducts can drain water to lower levels. Thus the propagation of water by ventilation ducts should be considered in the design, particularly the spraying of electrical equipment located in the vicinity of the ducts and the submergence of equipment in rooms where there is a ventilation outlet or a low point which may fail.	Addition for clarification		X Operating experience has shown that ventilation ducts can drain water to lower levels. Thus the propagation of water by ventilation ducts should be considered in the design. Examples of effects could be by water spray on electrical equipment or by submergence of equipment in rooms where there is a ventilation outlet or a low point which may fail.		This resolution addresses also France comment No. 9.
2	12	4.162	Sometimes intentional flooding is a	Addition for clarification		X		This resolution

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			design feature, and flooding phenomena should then be given full consideration in the design (e.g., some components of instrumentation and control systems should be qualified accordingly for containment sprays, and some doors and walls should be qualified as waterproof for fire protection sprays). Being a design feature, such intentional flooding may not generally be considered an internal hazard; however, owing to its similar nature, intentional flooding should be included in the set of internal floods being analyzed.			Sometimes, the activation of design features (e.g., spray, fire extinguishing sytems, reactor cavity flooding) could lead to consequential flooding. Flooding phenomena should then be given full consideration in the design (e.g., some components of instrumentation and control systems should be qualified accordingly for containment sprays, and some doors and walls should be qualified as waterproof for fire protection sprays). Such intentional flooding may not generally be considered an internal hazard; however, owing to its similar nature, it should be included in the set of internal floods being analysed.		addresses Belgium comment No.14.

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	13	4.163	… (a) Appropriate design (e.g., isolation valves on potentially hazardous pipes, drains and pumps, water-tight doors); (b) Detection systems (e.g., flood alarms) available; (c) Adequate procedures (operational and/or emergency procedures).	Addition of words for clarification		X (a) Appropriate design (e.g., isolation valves on potentially hazardous pipes, drains and pumps, water-tight doors); (b) Detection systems (e.g., flood alarms); (c) Adequate procedures (operational and/or emergency procedures).		Detection systems are assumed available.
	14	4.164		Please check the inconsistency in the document: here “plant personnel” is used, at other places “operator” is used for the same meaning	x			
1	15	4.168	In addition to the direct impacts of flooding (e.g., spray, submergence) as described in this section, the release of water into a room might also have a significant effect on the general environmental conditions. Such effects (e.g., increase in humidity, radiation, temperature) should be	Sentence proposed by consultants is missing, but needed.		X Special considerations should apply for fluids other than water (e.g., chemicals used for fire suppression).		“may” replaced by “should”. See also ENISS comment No. 42.

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			considered in the qualification process for equipment. Special considerations may apply for fluids other than water (e.g., chemicals used for fire suppression).					
3	16	4.173	c. as an impact on structures important to safety (for example, risk of loss of integrity of fuel pools and of release of radioactive material).	Addition of “as an” as editorial improvement	x			
3	17	4.184	In the particular case of crane loads…	Editorial addition of “of”	x			
2	18	4.185	An additional design objective for plant layout should be to eliminate the possibility of moving heavy objects over stored fuel and to protect stored fuel or other safety related items from any dropped loads.	Editorial addition of parts to the sentence for clarification.			X	No added value in the added text.
2	19	4.203, second bullet	• Bottled gases, if stored in sufficient quantities such that a release could cause a hazard to plant or personnel carrying out actions important to safety. These may include releases such as hydrogen or propane, which may be covered under internal fire or internal explosion.	Addition for clarification		X Bottled gases, if stored in sufficient quantities such that a release could cause a hazard to plant or personnel carrying out actions important to safety. These could include releases such as hydrogen or propane, which can be covered under internal fire or internal explosion..		Improved wording. “may” succcessively replaced with “could” and “can”.

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	20	5. Appendix I: I.4, last bullet	Unrelated (independent) events: An ~~initiating~~ event (including hazards) occurs independently from, but simultaneously ~~with~~ to an internal hazard.	The term “initiating event” has to be replaced by “event”, the term was wrongly used.		X Unrelated (independent) events: An ~~initiating~~ event (including hazards) occurs independently from, but simultaneously with ~~to~~ an internal hazard.		Improved wording. simultaneously with checked.
2	21	Appendix I 1.11 (new)	The following are examples of combined hazards that may remain after screening. Consideration of hazard combinations is highly site-specific. Therefore, these are intended only as examples and should not be interpreted as requirements for all sites. Consequential/Subsequent Events: • Fire inducing another fire, explosion, HEAF, flooding, or component failure such as pressure part failure (e.g., pipe rupture), with the potential of a further consequential hazard; • Explosion inducing fire, another explosion, HEAF, flooding, or component failure, with the potential of a further consequential hazard; • HEAF inducing fire, explosion or missiles generation, with the potential of a further consequential hazard; • Drop or collapse of heavy load	Clarification important for applicant/user of the guide		x		One or two good examples per category are enough in the same order as in DS494. The guide should not be narrative.

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			inducing missile generation, explosion or fire, with the potential of a further consequential hazard; • Missiles inducing fire, explosion, HEAF, with the potential of a further consequential hazard (e.g., flooding) • Pressure part failure inducing explosion, fire, or flooding, with the potential of a further consequential hazard; Correlated events: • Seismic hazard inducing fire, explosion, HEAF, flooding (internal one directly or caused by external one), drop or collapse of loads, or pipe rupture; • Meteorological events, such as severe weather conditions or wind inducing HEAF, explosion fire, or internal flooding, • Hydrological hazards inducing HEAF, explosion, fire, or internal flooding , • External fires (e.g., by lightning or other natural phenomena) inducing internal fire, HEAF; explosion, potentially with consequential internal flooding; • Explosion pressure wave (blast) inducing fire, explosion, HEAF, potentially with consequential flooding;					

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			• Aircraft crash inducing fire (potentially with consequential internal flooding), explosion, HEAF, missiles, drop or collapse of loads; Unrelated (independent) events: • External longer duration hydrological hazards (e.g., external flooding) and independent internal fire, • Seismic event and independent internal fire, • External or Internal electromagnetic interference (EMI) and independent internal fire; • Other longer duration external hazards and independent internal fire; • Internal flooding and independent internal fire.					
1	22	II.6	Detailed guidance on the preparation of a fire hazard analysis is given in Ref. [15]. Detailed guidance on the evaluation of a fire hazard analysis is given in Ref. [16].	Can references [15] and [16] still be cited? At least one of the references is no longer on the IAEA list of applicable documents		X Detailed guidance on the preparation of a fire hazard analysis is given in Ref. [15~~]. Detailed guidance on the evaluation of a fire hazard analysis is given in Ref. [16]~~.		There was extensive search to find more IAEA documents without success. Reference [16] is meanwhile removed until a recognized international reference is found. However, Ref. [15] is kept.

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
								This resolution addressed also Finland comment No.1.
2	23	II.13	The specific functions (load bearing capacity, integrity and insulation) and ratings (e.g., 90 min, <u>120 min, 180 min</u>) of ~~components used as fire barriers~~ <u>fire barrier elements</u> (walls, ceilings, floors, dampers, penetration seals and cable wraps) should be specified in the fire hazard analysis.	Clarification and correct terminology		X The specific functions (load bearing capacity, integrity and insulation) and ratings (e.g., 90 min, <u>120 min, 180 min</u>) of ~~components used as fire barriers~~ <u>fire barrier elements</u> (e.g., walls, ceilings, floors, doors, dampers, penetration seals) should be specified in the fire hazard analysis.		Doors added and cable wraps removed.
1	24	II.21	In situations such as those described in Appendix II, paragraph II.20., for which individual fire compartments cannot be utilized to separate items important to safety, protection ~~can~~ <u>might</u> be provided by locating the items in separate fire cells. This is known as the 'fire cell approach'. Figure II.1. illustrates applications of	The fire cell approach is today no more needed, therefore the requirement must be extremely week. "containment" is the wrong term here, and "the "fire cell approach" can be deleted.		X In situations such as those described in Appendix II, paragraph II.20., for which individual fire compartments cannot be utilized to separate items		OK for fire compartment, but no need to remove fire cell approach.

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Pages 11 Country/Organization: **Germany** Date: October 23, 2017				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			the fire ~~containment~~ compartment approach ~~and the fire cell approach~~.			important to safety, protection can be provided by locating the items in separate fire cells. This is known as the 'fire cell approach'. Figure II.1. illustrates applications of the fire ~~containment~~ compartment approach and the fire cell approach.		
1	25	Figure II.1	Figure needs to be changed Title "Application of the fire ~~containment~~ compartment approach ~~and the fire influence approach~~"	The U.S. fire influence approach is no longer a valid state-of-the-art approach and needs to be deleted		X Application of the fire ~~containment~~ compartment approach and the fire cell approach.		
2	26	Before II.25	Access ~~Escape~~ and ~~Rescue~~ Escape Routes	Escape and Rescue Routes is nearly the same, either it is only "Rescue Routes" or "Access and Escape Routes" – see earlier comment (Comment 7); consistency in the whole document is needed (This comment is valid also for II.25)	x			
3	27	II.30	~~The~~ Cable inventory as an ignition source, Cable layout,	Editorial consistency in bullets	x			

	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Country/Organization: **Germany**			Pages 11 Date: October 23, 2017	RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			Resistance to ignition, ~~The~~ Extent of fire propagation, Air flow rate, ~~The~~ Thermal isolation of the enclosure, ~~The~~ Toxicity and corrodibility associated with smoke formation.					
1	28	After II.39 II.39a (new item)	Annunciation of the actuation of any automatic extinguishing system should be provided in the main control room.	This requirement is missing, but very important.			x	Please refer to paragraph 4.25.
2	29	II.94	Fire extinguishers should be placed close to the locations of fire hoses and along the ~~escape~~ access and ~~rescue~~ escape routes for fire compartments.	See comments before (Comment 7 and Comment 26) on Escape and Rescue Routes	x			

TITLE

COMMENTS BY REVIEWER Reviewer: Country/Organization: Republic of Korea/KINS Date: 30/10/2017				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	4.167	(Current) Check valves should be used to ensure that flood water from one area does not travel backwards through a drain, causing a flood in another area. (Proposal) The common drain, which gather the flood water together, should be designed to block the flood water from one area to the other area. (e.g., check valves).	The check valve design is the one of methods to prevent that the flood water could not spread over the flood area through the common drain.		X Design provisions (e.g., drains equipped with check valves) should be used to ensure that flood water from one area does not travel backwards ~~through a drain~~, causing a flood in another area, thus compromising segregation of SSCs important to safety.		Drains, including the main one, should be equipped with check valves consistent with segregation philosophy.

TITLE : DS 494 Protection against Int. Hazards in the Design of NPPs

COMMENTS BY REVIEWER Reviewer: Page. Country/Organization: FRANCE Date: 2017-10-27				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	2.12.	• The SSCs can be protected by barriers or segregation against the effects of internal hazards or designed and qualified to withstand the effects caused by internal hazards	**New bullet to be added.** The protection of individual SSCs is not mentioned in § 2.12			X	Please refer to paragraph 3.9.

2.	3.5a	(new §) Internal hazards should be considered in all conditions of normal operation of the plant, including the shutdown states. Non credible combinations of internal hazard and initial conditions could not be dealt with if justified	**New § to be added.** The initial conditions of internal hazard should be specified		X During plant design, internal hazards should be identified on the basis of a combination of engineering judgement, deterministic and probabilistic considerations. The identification and the characterisation include the consideration of hazard initial conditions (e.g., plant shutdown states), the definition of the magnitude and the likelihood of the hazards, the locations of their sources, the environmental conditions produced and the possible impacts on SSCs important to safety. The hazard identification and characterisation process should be rigorous and well documented.		No need to add a new paragraph. Comment taken into account within the existing para. 3.5.

3.	3.24	… if that cannot be achieved, the designer should justify that the boundary conditions of the analysis of the corresponding accident are not affected by the loads resulting from the internal hazard. **The design should ensure with high level of confidence that a single internal hazard does not result in melting of fuel**	The added sentence proposes a gradation considering that according to 3.24 it is possible that a hazard lead to an accident.		X It should be a goal of the design that a single internal hazard does not trigger an accident, unless it can be considered by itself as a postulated accident (pipe rupture for instance). In particular, **the design should ensure with high level of confidence that a single internal hazard does not result in DEC with core melting**. If that cannot be achieved, the designer should justify that the boundary conditions of the analysis of the corresponding accident are not affected by the loads resulting from the internal hazard.		Better structure of the paragraph.

4.	3.30/L1	For internal hazards **initiating or** resulting from accidents without significant fuel degradation	Internal hazards may induce accidents without core melting, even if it is a goal of the design to avoid it		X For internal hazards leading to or resulting from accidents without significant fuel degradation, the objective of the assessment should be to demonstrate that the boundary conditions, in particular the systems credited in the accident analysis, are not affected by the considered internal hazard. A specific accident analysis is not needed as this is provided by the corresponding accident analysis in which the rules for DBA or the rules for DEC without significant fuel degradation [6] should be applied as appropriate.		
5.	4.10a	Organizational procedures have to be implemented to allow operators to respect fire load limitations	**New § to be added**			X	See generic recommendation in paragraph 3.12.

6.	4.134a	*Flooding* The possible flooding due to the failure of water bearing pipes should be taken into account. These failure can be the one of the pipe itself or the one that is induced by the whip or the jet effect due to a HELB on a neighboring pipe.	**New § to be added** Indeed flooding is mentioned among the consequences of pipe failures in § 4.118 but not addressed in the rest of the section PIPE BREAKS		X This comment is resolved by modifying 4.118 as follows: 4.118.Three main phenomena that could be induced by pipe failures are pipe whip, jet effects and flooding. The first two phenomena are discussed in the following sections while flooding is addressed in the Section on Internal floods.		See similar comment from Belgium (comment No.13.
7.	4.147	(c) actuation (spurious or not) of the containment spray system	**New bullet to be added.** The spray induced by an accident or spurious should be taken into account			X	Only examples are considered, not exhaustive list. See resolution of Germany comment No.10.
8.	4.147	in (d) leak, break, **actuation (spurious or not)** of the fire water system	the consequential flood due to the fire water system in case of fire should be taken into account			X	Please refer to para. 4.162.

9.	4.151L2	**Particularly the spraying of electrical equipment located in the vicinity of the ducts and the submergence of equipment in rooms where there is a ventilation outlet or a low point which may fail.**	**To be added at the end of the § 4.151** These explanations may be useful.		X Operating experience has shown that ventilation ducts can drain water to lower levels. Thus the propagation of water by ventilation ducts should be considered in the design. Examples of effects could be by water spray on electrical equipment or by submergence of equipment in rooms where there is a ventilation outlet or a low point which may fail.		This resolution addresses also Germany comment No. 11.

10.	4.184/L5	should **they** be assessed	editorial		X The impact of concern might be either the fall into the pool, or onto the slabs surrounding the fuel storage pools. This impact should be assessed as potentially compromising the integrity or leak tightness of the storage pools. Another layout practice that should be considered is to restrict the handling of fuel casks to an area remote from the pool itself and remote from other critical target areas.		More precise wording.
11.	4.185/L1	should be **the protection of**	editorial		X An additional design objective for plant layout should be ~~and~~ to protect stored fuel or other safety related items from any dropped loads.		

12.	I.10/L1	Four categories of **consequential/subsequent events** are considered in the deterministic assessment in a given location	This § deals only with consequential/subsequent events	X			
13.	I.10/2rd bullet	an AOO **or an accident**	Internal hazards may induce accidents, even if it is a goal of the design to avoid it	X			
14.	I.10/4th bullet	fire **or explosion** from hydrogen combustion	the most significant effect is the explosion (in the containment)	X			
15.	I.11	Correlated events: • Seismic hazard inducing fire, explosion, HEAF, flooding (internal one directly or caused by external one), drop or collapse of loads, or pipe rupture; • Metereological events, such as severe weather conditions or wind inducing HEAF, explosion fire, or internal flooding, • Hydrological hazards inducing HEAF, explosion, fire, or internal flooding , • External fires (e.g. by lightning or other natural phenomena) inducing internal fire, HEAF; explosion, potentially with consequential internal flooding; • Explosion pressure wave (blast) inducing fire, explosion, HEAF, potentially with consequential flooding; • Aircraft crash inducing fire (potentially with consequential internal flooding), explosion, HEAF, missiles, drop or collapse of loads,	**New § to be added** Examples of correlated events to take into account in the screening should be added as in the last version of the draft			X	No need to have so many examples for each category. Two or three relevant examples are enough to avoid having a narrative/ descriptive guidance.

16.	I.12	• External longer duration hydrological hazards (e.g. external flooding) and independent internal fire, • Seismic event and independent internal fire, • External or Internal electromagnetic interference (EMI) and independent internal fire, • Other longer duration external hazards and independent internal fire, • Internal flooding and independent internal fire,	**New § to be added** Examples of unrelated events to take into account in the screening should be added as in the last version of the draft			X	See resolution of comment No. 15.

TITLE DS-494

Protection against Internal Hazards in the Design of Nuclear Power Plants

COMMENTS BY REVIEWER Reviewer: Civil & Site Studies Group, CNS Page.... of.... Country/Organization: Pakistan Date:				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	1.5/ Page 4	This Safety Guide covers the design features necessary to protect items important to the nuclear safety of plants against the effects of internal hazards. The following internal hazards are reviewed in this Safety Guide: fires, explosions, missiles, pipe breaks, floods, **collapse of structures**/falling objects/ heavy load drop, electromagnetic interference, and release of hazardous substances inside the plant.	The collapse of structures (cooling towers, stacks and turbine buildings) should be considered as internal hazards and it need to be checked to determine their potential affect on safety related SSCs as per SSR-2/1.	x			
2.	4.173/ Page 47	The consequences of load drops/**structures collapse** should be assessed	Please add collapse of structure as per SSR-2/1.		X The consequences of collapse of structures, falling objects or heavy load drops should be assessed…		Consistency with the resolution of the previous comment No.1.

DS494 Draft Safety Guide: Protection against Internal Hazards in the Design of Nuclear Power Plants, STEP 7, Draft September 2017

COMMENTS BY REVIEWER Reviewer: M-L Järvinen, J. Sandberg Page.... of.... Country/Organization: Finland/STUK Date: 31th October 2017				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	II.6/Line 2 page 61	Remove the sentence "Detailed guidance on the evaluation of a fire hazard analysis in given in Ref [16]."	Reference [16] is no longer valid.	X			There was extensive search to find more recent IAEA documents without success. Reference [16] is meanwhile removed until a recognized international reference is found.
2	II.21 Fig. II.1 page 65	Replace "Para 4.7" with "Para II.4 (f)"	Para 4.7 does not demonstrate safety objectives of the fire hazard analysis	X			

DS 494 - Protection against Internal Hazards in the Design of Nuclear Power Plants

COMMENTS BY REVIEWER Reviewer: Pieter De Gelder, Dries Gryffroy et al. Page 1 of 4 Country/Organization: Bel V (Belgium) Date: 03/11/2017				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	2.4	Make it consistent with IAEA Glossary (2007 or 2016)	Both IAEA Glossaries (2007 and 2016) define the term of “item important to safety”. The definition given in 2.4 differs from the one given in the IAEA Glossary. We propose to make the text consistent with the IAEA Glossary or to refer to the IAEA Glossary.		X 2.4. An item important to safety is defined in the IAEA Safety Glossary [18] as an item that is part of a safety group and/or whose malfunction or failure could lead to radiation exposure of the site personnel or members of the public. According to this definition and to the definition of design extension conditions (DEC) in Ref. [1], safety		Emphasis should be made on safety features for DEC as they are special systems important to safety that are emergency powered and seismically qualified. Unfortunately, in spite of being emergency powered and seismically qualified, they are considered in the IAEA Safety Glossary, within the general category of safety related systems which includes all the systems important to safety other than safety systems.

					features for DEC are part of the items important to safety		
2	2.4	Refer also to SSG-2 Rev. 1 (now under development as DS491 [6]).	The distinction between DBA and DEC is given in DS491 [6]. In addition, DEC comprises "conditions without severe fuel degradation" and "conditions with core melting"			X	With the modification of 2.4, the comment is not anymore relevant.
3	2.12	Fourth bullet: "The design is such that **<u>an internal hazard</u>** does not lead to a common cause failure between **<u>safety</u>** systems designed to control design basis accidents and safety features designed for **<u>design extension conditions</u>**;"	The distinction between DBA and DEC is given in DS491 [6]. In addition, DEC comprises "conditions without severe fuel degradation" and "conditions with core melting"	X for adding "an internal hazard" and "safety" systems.		X for "design extension conditions "	The issue is not the distinction between DBA and DEC. We clearly know that DEC comprises DEC without significant fuel degradation and DEC with core melting. The idea <u>emphasized</u> here is to avoid that an internal hazard be a common cause failure between safety systems used for DBA and safety features used for DEC <u>with core melting</u>. (please refer to SSR-2/1 (Rev.1), para. 4.13A)
4	3.10	Indicate, if relevant, whether Appendix I is also relevant for the articles 3.11 till 3.35 that follow thereafter.	An alternative could be to integrate Appendix I (that is generic and not too long) into the main document.	X 3.10. More details on hazard combinations are provided			

				in Appendix I. The following recommendations apply, as appropriate, to the internal hazard resulting from the combinations			
5	3.27	“Internal hazards considered in the deterministic safety analyses, for a specified location in the NPP, could be classified **in the following categories**: • internal hazards **not resulting in** AOO **or** accidents; • internal hazards which could trigger an AOO; • internal hazards **which could trigger a design basis accident**; • internal hazards **which could result in design extension conditions without significant fuel degradation**; • internal hazards **which could result in** design extension conditions with core melting.”	The current text is not coherent with DS491 [6] (in particular, items 3.17 and 3.51 of [6]). Moreover, the categorization as described in item 3.27 is quite confusing, since internal hazards or combinations of hazards *leading to* AOO, DBA or DEC should be described (as in [6]), and not vice versa (not: internal hazards *resulting from* DBA or DEC, or a DBA or DEC leading to internal hazards). On the other hand, internal hazards *resulting from* DBA or DEC (e.g. flooding caused by (IS)LOCA, fire caused by hydrogen combustion during core melt accidents) are consequential events/hazards, and should be part of the safety analysis for those DBA or DEC (see, e.g., item 3.25). In that sense, it would be desirable to put item 3.25 just after item 3.31, as they both deal with DEC.		X “Internal hazards considered in the deterministic safety analyses, for a specified location in the NPP, could be ~~classified~~ **include the following categories**: • internal hazards neither triggering an AOO or an accident nor resulting from **an** AOO **or** an accident; • internal hazards which could trigger or result from an AOO; • internal hazards **which could trigger or result from a**		Add “nor resulting from an AOO or an accident” for completion. The design should be such that a single internal hazard should not result in a design extension condition with core melting with a high degree of confidence.

					design basis accident; • internal hazards **which could** **either** **result in or from design extension conditions without significant fuel degradation**. • ~~internal hazards **which could result in** design extension conditions with core melting.”~~ .		
6	3.28	“In the case of an internal hazard **not resulting in AOO or accidents**, …”	See reason given for item 3.27		X In the case of an internal hazard neither triggering an AOO or an accident nor resulting from **an** AOO **or** an accident, the assessment should demonstrate that the plant can be brought to, and maintained in, a safe shutdown		See previous comment.

					state in spite of a single failure and, if allowed, equipment unavailability due to preventive maintenance.		
7	3.28 3.29	"… in spite of single failure and, **<u>if allowed,</u>** equipment unavailability due to preventive maintenance."	The combination of a single failure and an equipment unavailability should remain coherent with DS491 [6], item 7.36 ("If maintenance is allowed, the unavailability of the concerned train of the safety system should be taken into account.")	X			
8	3.30	Replace "resulting from" with "resulting in" (two times)	See reason given for item 3.27		X For internal hazards <u>leading to or resulting from</u> accidents without significant fuel degradation, the objective of the assessment should be to demonstrate that the boundary conditions, in particular the systems credited in the accident analysis, are not affected by the considered		More complete and clear formulation.

					internal hazard. A specific accident analysis is not needed as this is provided by the corresponding accident analysis in which the rules for DBA or the rules for DEC without significant fuel degradation [6] should be applied as appropriate.		
9	3.31	Replace “triggered by a DEC” with “resulting in a DEC”	See reason given for item 3.27			X	The case resulting in a DEC with core melting is excluded because the design should be such that a single internal hazard should not result in a design extension condition with core melting with a high degree of confidence.
10	3.25 3.31	Put item 3.25 after item 3.31.	See reason given for item 3.27			X	Paragraph 3.25 logically follows paragraph 3.24 and does not need to be put after paragraph 3.31.
11	3.33	“ … from possible ~~sites~~ **sources** of internal hazards …”	Improve wording	X			
12	4.29	“Non-combustible construction materials should as far as reasonably practicable **be**	Missing word		X		

		used throughout the plant …”			Non-combustible construction materials should<u> be used</u> ~~used~~ throughout the plant as far as reasonably practicable, and in particular in locations such as in the reactor containment and the control room		
13	4.118	Mention (in new Article 4.119?) that the issues related to flooding after pipe break are covered by the Section on “Internal floods”.	It is written in article 4.118 that “Three main phenomena that could be induced by pipe failures — pipe whip, jet effects and flooding — are discussed in the following sections.” We indeed find a subsection related to “Phenomenon of pipe whip” and another subsection related to “Phenomenon of jet effects”, but nothing about “flooding”. There is however an independent main section “INTERNAL FLOODS” on page 42. For clarity, if this last section completely covers the flooding phenomenon that should be discussed in the pipe breaks section, this should be mentioned somewhere.		X Three main phenomena that could be induced by pipe failures are pipe whip, jet effects and flooding. The first two phenomena are discussed in the following sections while flooding is addressed in the Section on Internal floods.		Rather mention it in 4.118
14	4.162	No proposal; clarification needed	The term “intentional flooding” is used. What is an “intentional flooding”? If it		X Sometimes, the activation of		

			refers to sabotage, why is this aspect only treated for flooding and why is it not considered out of scope? If it does not refer to sabotage, then please clarify.		design features (e.g., spray, fire extinguishing systems, reactor cavity flooding if in-vessel melt retention is credited) could lead to consequential flooding. Flooding phenomena should then be given full consideration in the design (e.g., some components of instrumentation and control systems should be qualified accordingly for containment sprays, and some doors and walls should be qualified as waterproof for fire protection sprays). Such intentional flooding may not generally be considered an internal hazard; however, owing to its similar nature, it should		

					be included in the set of internal floods being analysed.		
15	4.182	To be moved to the section above on “Prevention of falling objects …”	Adequate scheduling of load movements is a preventive measure, not a mitigating measure.	X Add in para. 4.181 Scheduling load movements and lifts only in specified plant normal operation such as shutdown modes could be also used as preventive measures.			
16	4.214	Replace “self-air sets” by “breathing apparatus”	Better wording		X Self-rescue set.		
17	4.214	Add a third objective”…, or to continue functioning for some time at an endangered location (for instance for operators in the main control room).”	Often, main control room operators have breathing apparatus available to stay in the control room in case of toxic gas alarm.		X Or to continue performing other actions at an endangered location (for instance, for operators in the main control room).”		Better wording by changing “functioning” in “performing other actions”
18	Appendix I, I.10	Remove item I.10	Item I.10 is more general and not specific to combinations of hazards. Moreover, item I.10 is already specified in item 3.27 (see also comments on item 3.27).	x			Current paragraph I.10 removed.
19	7	References [6], [9], [10], [11], [12] need to be replaced by their final version.	It is uncommon practice to refer to IAEA SS in draft (as		X		- The IAEA Technical Editors allow to refer

			DS***).				to draft safety guides; however as revision of existing safety guides (see example for reference [6]). - Even there is change in wording in the draft safety guide, the technical background of the recommendations referred to remains.
20	Chapters 5, 6 and 7	Move the references to Chapter 5 and bring Appendices I and II thereafter (as real Appendices and not as Chapters of the main document).	It seems uncommon practice to number Appendices (here I and II) as Chapters of the main document.		X Remove the numbering of the Appendices		- Numbering of Appendices removed. - References are kept after the Appendices as usual.

DS494 Protection against Internal Hazards in the Design of Nuclear Power Plants
Step 7 – September 2017

COMMENTS BY REVIEWER Reviewer: ENISS Country/Organization: ENISS			Page: 1 of 15 Date: 03/11/2017	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.3	The objective of this Safety Guide is to provide recommendations and guidance to regulatory bodies, nuclear power plant designers and licensees on hazard assessment and design concepts for protection against internal hazards and hazard combinations in nuclear power plants.	The logic step in the design process would be to perform a hazard assessment first. Besides individual hazards, appendix I recommends a performance-based approach for combinations.		X The objective of this Safety Guide is to provide recommendations and guidance to regulatory bodies, nuclear power plant designers and licensees on hazard combination, hazard assessment and design concepts for protection against internal hazards in nuclear power plants.		Better to put hazard combinations before design concepts, etc.
2	2.3	2.3. Section 3 and Section 4 provide general design recommendations and specific design recommendations respectively to fulfil requirement 17 of Ref. [1] regarding internal hazards. It has to be pointed out that a performance based approach is also considered as an alternative approach to fulfil this	As in NFPA 805, a performance based approach can be considered as an acceptable approach to fulfil the safety requirement (already recommended in Appendix I for		.	X	- The performance –based approach does not address the whole scope of protection against

		requirement.	Combinations).				internal hazards, and then is not alone an alternative - The approach proposed in this safety guide is a combination of firm guidance and engineered practicability informed by risks.
3	2.4	An item important to safety is an item that is part of a safety group and/or whose malfunction or failure could lead to radiation exposure of the site personnel or members of the public. Items important to safety include: ~~– safety systems for design basis accidents (DBA) and their supporting systems;~~ ~~– safety features for design extension conditions (DEC) and their supporting systems; and~~ — Those SSC whose malfunction or failure could lead to undue radiation exposure of site personnel or members of the public; ~~– the remaining systems important to~~	Use IAEA-glossary definition for 'Items Important to Safety'. Definition of Items Important to Safety is not consistent with IAEA-glossary.		X Systems important to safety are defined in the IAEA Safety Glossary [ ]. According to this definition and definition of DECs [1], DEC safety features are part of the systems important to safety.		The resolution is consistent with the resolution of a similar Belgium comment (No. 1).

		~~safety used in normal operation and anticipated operational occurrences (AOO) and which are termed safety related systems.~~ — Those SSC that prevent anticipated operational occurrences from leading to accident conditions; — Those features that are provided to mitigate the consequences of malfunction or failure of SSC					
4	2.6	The hazards ~~caused by~~ occurring at the different facilities at the same site are also considered to be internal.	Clarification of the sentence is needed		X The hazards caused by or occurring at different facilities at the same site are also considered to be internal.		More precise definition.
5	§2.7 +2.8 + 2.10 and 3.6 + Appendix I	"cascading effects…secondary effects…induced effects…"	The §2.10 should be linked to 2.8 "Combination of HZs". Induced effects following an internal hazard are combined hazards.		X Propose to move 2.10 after 2.7.		
6	2.12 2nd bullet	The design of individual structures, systems and components (SSCs) is such that Design Basis accidents or Design Extension Conditions induced by internal hazards are avoided to the extent practicable;	Suggestion to specify DBA/DEC for reasons of scoping	X			
7	2.12 4th bullet	The design is such that a single hazard does not lead to a common cause failure between systems designed to reach and maintain a stable long term shutdown state, to	to include the complexe sequences (DEC without core melt) which are not addressed in the current formulation			X	The issue is not the distinction between DBA and DEC. We clearly know that DEC comprises DEC

		remove the residual heat, and to mitigate the radioactive releases ~~to control design basis accidents, and safety features required in the event of accidents with core melting~~.					without significant fuel degradation and DEC with core melting. The idea emphasized here is to avoid that an internal hazard be a common cause failure between safety systems used for DBA and safety features used for DEC with core melting. (please refer to SSR-2/1 (Rev.1), para. 4.13A). See resolution of Belgium similar comment
8	3.2	…based on the following major steps: a) Identification of internal hazards and the possible hazards combinations, and characterisation of the hazard effects, b) Design for prevention ~~of adverse effects~~ of internal hazards, c) Design of means for mitigation of adverse effects of internal hazards to items important to safety.	Prevention = reduce frequency of occurrence; Mitigation = reduce effects to Items Important to Safety when the Internal Hazard occurs.	X			
9	3.2	The approach also includes the definition of success criteria of the protections against internal hazards in consistence with the objectives of	Suggestion to add this text for completeness and clarity.	X			

		paragraph 2.12 and the verification that these success criteria are met for all hazards of the plant.					
10	3.6	Possible combinations of internal/internal and internal/external hazards and the secondary/cascading effects should be identified (for example, high energy pipe break, spray, pipe whip). The effects of combined hazards should be considered in the design of ~~the~~ new plant.	It is unrealistic to recommend such exhaustive combination list in the design of existing plant.			X	The safety guide is primarily for new nuclear power plants. See clarified scope following Switzerland comment No. 2.
11	§3.8	Bounding or conservative assumptions ~~should~~ could be made about these characteristics ~~in order to address uncertainty~~.	Not clear enough on feasibility and implementation.	X for could		X for removal of "in order to address uncertaint y".	Bounding or conservative assumptions are usual ways of addressing uncertainties.
12	3.14	The design features for protection from the effects of internal hazards should be safety classified in accordance with IAEA Specific Safety Guide SSG-30 [5]. The safety classification of protective design features should be commensurate with the safety consequences of their failure and their relative importance in DiD concept.	To avoid safety classification of features that can lead to unavailable products on the market (e.g fire detection). Adding the DiD allows the designer to combine protective design features to fulfill the safety goals.		X should be commensurate with the consequences of their failure on safety.		Is DiD concept outside safety?
13	3.25	The design features protecting the SSCs that are intended to be used under DECs should be designed or verified for the loads, conditions and durations necessary in these scenarios (e.g., effects of hydrogen	Justification for deletion: In most plants, the design features intended to be used under DEC's are one safety division design. Therefore,			X Rejection of the removal of the sentence	The design features are those protecting SSCs intended to be used under DECs, and not those dedicated for DEC.

		combustion). ~~These design features should be protected against the consequences of an internal hazard occurring before DEC has been completely mitigated[2].~~ Best estimate design loads, conditions and durations can be used for the design or the verification of these protective features.	considering internal hazard that could affect these design features during their mission time cannot be imposed deterministically. Justification for "Verification": Existing SSC could have the potential to be used in case of DEC. However, these SSC could not have been designed for these conditions. However, a verification of the appropriate operation of the SSC in these conditions is possible and would lead to the same protection level.		X for verification. However the wording should be modified. (verification of the performance of these protective features)	"These design features …."	It seems there is a misunderstanding.
14	3.27	Internal hazards considered in the deterministic safety analyses, for a specified location in the NPP, could be classified in four categories ~~associated to three approaches in the hazard assessment~~ (see Appendix I)	Appendix 1 only specifies one approach, the performance-based approach. As such, it is not clear to which 3 approaches this para is referring to.		X Internal hazards considered in the deterministic safety analyses, for a specified location in the NPP, could be classified in the following categories		Improved wording consistent with removal of previous paragraph I.10.
15	3.28	In the case of an internal hazard independent of AOO and accidents, the assessment should demonstrate that the plant can be brought to, and	The principle of unavailability from preventive maintenance is not applied for existing		X for adding something for preventive maintenance		See resolution of Belgium comment No. 7.

		maintained in, a safe shutdown state in spite of a single failure and equipment unavailability due to preventive maintenance, as far as possible.	plants.				However, please note that the safety guide is primarily for new plants.
16	3.28	In the case of an internal hazard independent of AOO and accidents, the assessment should demonstrate that the plant can be brought to, and maintained in, a safe shutdown state in spite of a single failure and equipment unavailability due to preventive maintenance as allowed by the technical specifications.	The simultaneous occurrence of single failure on systems needed to reach and maintain safe shutdown state is not consistent with the combinations of events. A fire cannot lead to common mode failure impairing the fulfilment of a safety function, there is no reason to add an arbitrary single failure to the considered system.			X	Covered by resolution of comment 15. I do not understand why there are two different comments on the same sentence (see for single failure criterion).
17	3.33	The main control rooms should be adequately separated from possible sites of internal hazards as far as applicable. 3.44 Consideration should be given to the possibility of internal hazards involving facilities shared between units (para. 5.63 of Ref. [1]).	New item to be created, as it is not related to the main control rooms separation with respect to internal hazards.			X	No need for a new paragraph.
18	§4.10	"They should be protected from vibration and other destructive effects like / against / of…."	Precise which are the other destructive effects or even their category. Examples : protected from destructive effects like whip or jet or rotating equipment? Protected from destructive effects of		X They should be protected from degradation effects (e.g., corrosion), destructive effects (e.g., vibration, effects of hazards) and maintained in		More precise and complete wording

			corrosion?		good conditions.		
19	4.21	(a) Where fire detection or extinguishing systems are credited as active elements of a fire compartment, arrangements for their design, procurement, installation, verification and periodic testing should be sufficiently stringent to ensure their permanent availability. ~~In this case, the performances of those systems should be designed taking into account the single failure criterion. The application of the single failure criterion is described in paras 5.39–5.40 of Ref. [1]~~	The appliance of single failure criterion on fire detection system would imply a redundant one (for instance for fire dampers). For instance, the failure of a fire damper to close on fire detection can be improved by using combined actuation mechanism (i.e. fusible link and closing by counterweight). The recommendation on availability is indeed very important.		X In this case, the performances of those systems should be designed taking into account the application of single failure criterion to the safety function they protect. The application of the single failure criterion is described in paras 5.39-5.40 of Ref. [1].		See resolution of Switzerland comment No.1.
20	4.22	The reliability of fire detection and extinguishing systems should be consistent with the role of the Items Important to Safety they are protecting ~~their role~~ in providing defence-in-depth and with the recommendations given in Ref. [7].	Fire detection and extinguishing has no role in DiD as such.		X The reliability of fire detection and extinguishing systems should be consistent with their role in providing defence-in-depth and with the recommendations		See also UK comment No.9.

					given in Ref. [7]. This should also include ensuring that water supplies (including mains supplied) and utility connections (fire hydrants) are maintained such that they will meet any demand.		
21	4.28	Building structures (including columns, beams, etc.) and penetrations in fire compartment barriers should have a suitable fire resistance rating. The fire stability rating (mechanical as well as thermal load bearing capacity) of the structural elements that are located within a fire compartment or that form the compartment boundaries should not be less than the fire resistance rating of the fire compartment itself.	Not only the structures are important but also the penetrations in fire compartment barriers. Usually the penetrations should have the same fire rating as the fire barriers that they penetrate.			X	See Appendix II, para. II.13. See also resolution of Germany comment No. 23.

22	4.32	The effects of postulated fires should be analyzed for all areas containing relevant items important to safety and all other locations that constitute a fire hazard to relevant items important to safety. In the analysis, the functional failure of all systems important to safety within the fire compartment or the fire cell (fire influence approach) in which the fire is postulated should be assumed, unless they are protected by qualified fire barriers or surrounded by casings/enclosures/encapsulations designed to, or able to, withstand the consequences of the fire. Exceptions should be justified.	Adding Fire cell (fire influence approach) to remain consistent with appendix II.		X The effects of postulated fires should be analyzed for all areas containing relevant items important to safety and all other locations that constitute a fire hazard to relevant items important to safety. In the analysis, the functional failure of all systems important to safety within the fire compartment or the fire cell ~~(fire influence approach)~~ in which the fire is postulated should be assumed, unless they are protected by qualified fire barriers or surrounded by casings/enclosures/encapsulations designed to, or		Consistent with modification according to Germany comment No.24.

					able to, withstand the consequences of the fire. Exceptions should be justified.		
23	§4.33	Other plausible combinations of hazards ~~other explosion effect~~	This are cases of combination to be assessed as so, maybe in §5			X	Para. 4.33 does not contain “other explosion effect”, instead it contains “explosive effects”. In addition, these are secondary effects not combinations. Reference to hazard combination is extensively made in Section 3 for all internal hazards and not only for combination involving fire.
24	4.46	Cabling for redundant safety systems should be run in individual specially protected routes, ~~preferably~~ in separate fire compartments or, if not practicable, in separate fire cells, and cables should not cross between redundant divisions of safety systems. As outlined in Appendix II, para. II.20, exceptions may be necessary in certain locations such as control rooms and the reactor containment.	The routing of cables for redundant safety cables in separate fire cells is allowed if use of separate fire compartments is not practicable. In all cases only these two possibilities exist and are to be justified by the fire hazard analysis.		X Cabling for redundant safety systems should be run in individual specially protected routes, preferably in separate fire compartments so far as is reasonably		Better wording. See also resolution of UK comment No.11.

		In such cases, the cables should be protected by means of qualified fire rated barriers or encapsulations (e.g., qualified cable wraps). Fire extinguishing systems or other appropriate means could be used, with justifications made in the fire hazard analysis			practicable, and cables should not cross between redundant divisions of safety systems.		
25	4.54	~~The safety features for DEC necessary in the long term should be protected against the effects of a fire, as it is a rather frequent event~~.	(See 3.25) In most plants, the design features intended to be used under DEC's are one safety division design. Therefore, considering internal hazard that could affect these design features during their mission time cannot be imposed deterministically.			X	See resolution of comment No. 13. Please consider that the guide is primarily for new NPP and refer to Requirement 17 of SSR-2/1 (Rev.1) which states that design features for DEC shall be proted against internal and external hazards.
26	4.56	The equipment of the ventilation systems used in the long term during severe accidents to confine radioactive material should be redundant and located in different fire compartments. Their charcoals should be isolatable and a suitable ~~extinguishing~~ fire protection system ~~inside their vessel~~ should be available	A suitable fire protection should be available to remain consistent with the availability of the charcoal in such scenario.		X Their charcoals should be isolatable and a suitable ~~extinguishing~~ fire protection ~~vessel~~ should be provided.		More complete wording.
27	4.60 to 4.68	Appropriate prevention provisions against occurrence of HEAF should be included in the design of	nothing mentioned in these §§ about prevention against high energy			X	Please refer to para. 4.71. Also, there are

		electrical protection. At least, overcurrent protection with shortest possible reaction time should be provided.	arcing faults (HEAF) while it is like overcurrent protection with shortest possible reaction time.				safety guides dedicated to the design of electrical systems (SSG-34) and I&C (SSG-39).
28	§4.77	"The potential for secondary missiles that could damage safety classified SSC could ~~should~~ also be evaluated if considered credible on the basis of expert judgment."			X The potential for secondary missiles that could damage SSCs important to safety should also be evaluated, including consideration of fragment ricochet, if considered credible on the basis of expert judgement.		Why safety classified? Should remain. See also UK comment No.15.
29	Before §4.81	In the case of valves designed, constructed by means of extremely comprehensive and thorough practices, and, followed by a surveillance programme during commissioning and operation, a failure is generally assumed to be sufficiently improbable.	The potential of being a missile for valves is linked to the quality level like for vessels.			X	Similar statement is in 4.82 modified as follows: Valve bodies are usually designed, constructed and maintained in such a manner that they are substantially stronger than the connected piping. For this reason it is generally accepted that the generation of missiles resulting

							from the failure of the valve body itself is sufficiently unlikely in most cases and that it need not therefore be considered in the design and/or evaluation of the plant.
30	§4.86	For the sake of simplicity, an approach considering the stop of rotating parts by the casing could be applied based on OPEX and manufacturer justifications although a conservative approach ~~is often~~ could be used in which it is assumed that no energy is lost in the interaction of the missile and the casing of rotating machinery.	Several practices can be used.		X For the sake of simplicity, an approach considering the stop of rotating parts by the casing could be applied based on operating experience feedback and manufacturer justifications. Alternatively, a conservative approach ~~is often~~ could be used in which it is assumed that no energy is lost in the interaction of the missile and the casing of rotating machinery.		The sentence becomes very long and should be divided in two sentences.
31	§4.87	"Missiles from the failure of rotating	Already seen in the §			x	Which paragraph?

		machinery should be characterized on the basis of their potential for doing damage ~~and should be included in the evaluation of possible primary and secondary effects~~."	about combinations.				In addition, paragraph 4.87 addresses effects and not combinations.
32	§4.88	"Typical missiles potentially generated ~~postulated to be caused~~ by the failure of high speed rotating equipment should include:"		X			
33	§4.89	"There is evidence from failures of rotating machines that energetic missiles are usually ejected within a very narrow angle of the plane of rotation unless they are deflected by a barrier of some kind ~~(e.g., casing)~~ at the source or stopped by casing."	Idem §4.86		X In other cases there could be a most probable plane or angular sector, as is the case for missiles from rotating machines. There is evidence from failures of rotating machines that energetic missiles are usually ejected within a very narrow angle of the plane of rotation unless they are deflected by a barrier of some kind ~~(e.g., casing)~~ at the source or stopped by casing." However, there is also evidence that		For completeness. See also UK comment No. 19.

					a small number of missiles may land in a wider angle from the plane of rotation. Therefore, the site layout may necessitate sensitivity studies in the consideration of missile strikes.		
34	Before §4.91	"Valve bodies are usually constructed in such a manner that they are substantially stronger than the connected piping. For this reason it is generally accepted that the generation of missiles resulting from the failure of the valve body itself is sufficiently unlikely in most cases and that it need not therefore be considered in the design and/or evaluation of the plant."	As in §4.82, recall the quality of valves bodies.		X 4.91. Valve stems should be designed with features to prevent valve stems from becoming missiles in the event of their failure (see para. 4.81 to 4.83).		Avoid repetition by using cross reference.
35	§4.109 (a)	"For H.E. pipes (except for those qualified for B.P. or LBB –Leak Before Break or "superpipe"…"	Please mention all the exceptions.		X For high energy pipes (except for those qualified for leak-before-break, break preclusion or for low probability of failure)		Consistency with resolutions of Czechia similar comment.

					circumferential rupture or longitudinal through-wall crack, or both. The high energy of the contained fluid means that dynamic effects, such as pipe whip, or jets is more important.		
36	§4.110	"…less than 2% of the total operating time…"	Please define the operating time.			X	From the paragraph it is clear that the operating time is the one of the concerned piping system.
37	§4.114	Suppress the §	This § could be delete as he presented few interest because of deterministic studies (except for break preclusion concept).			X	This para. could be useful for break preclusion justification and there is no contradiction with other recommendations.
38	§4.116	"…, and eventually debris generation."	Debris generation is not systematic. Debris generation is studied		X and possibly debris generation		Replace eventually by possibly

			apart.				
39	4.123	"~~Additionally, the stiffness of the pipe – and therefore its capacity to damage a larger pipe – might increase if there is a change in pipe shape (e.g., an elbow) near the end of the pipe. In these cases the target pipe could be broken even if it is larger than the whipping pipe.~~"	Delete the sentence please. It is a new requirement without substantation.			X	These sentences are logically following the precedent case (increased mass).
40	§4.129	"6: One example of this approach is ANSI/ANS-58-2-1988"	Suppress or add some other examples please (NUREG 2913?) ?	x			Removed. See also resolution of Czechia and UK similar comments.
41	§4.130	"If the break generates more than one jet…An example…"	Which are the other examples possible? Please define examples		X If the break generates more than one jet, the possible interference of the jets should be taken into account. This is the case of the double ended break of a pipe without restraints, in which two jets could be generated, one from each of the broken ends of the pipe. is…		Clarification.
42	4.168	Delete the §	The phenomenon increase of humidity, radiation and temperature are taken into account in the Pipes failures section. It is not part of the			X	The increase of humidity, radiation and temperature may be due to floodings resulting from ruptures other

			Flooding section.				than pipe ruptures.
43	4.171	Delete the §	It must not be addressed in the internal flooding hazards requirements due to the fact IH studies are done for normal operating situation.			X	An internal hazard can be postulated in the long term of an accident.
44	4.172	Add after the § than the following § covers <u>only</u> the risk of dropped loads during their handling in normal operating situations	See previous comment			X	See resolution of comment No.43.
45	4.178 Note 10		Add the example of the KTA Standard Design of Lifting Equipment in Nuclear Power Plants. KTA 3902	X			
46	4.185	An additional design objective for plant layout should be ~~and~~ to protect stored fuel		X			
47	App. I.4	In principle, three types of hazard combinations should be considered: - ~~Consequential/Subsequent events: An internal hazard induces one or more additional internal hazards.~~	Consequential events are usually not considered as combinations, but rather as part of the design basis against the initiating event. E.g. Seismically Induced Fire (SIF) should be part of the Seismic Design.		X		See revised paragraph I.4. Additionally, "should" at the beginning of para. I.4 was replaced by a "could" in order to give more flexibility in the categorization.
48	App. I.10	In practice, <u>at least the</u> four categories of internal hazards are considered in the deterministic assessment in a given location:	Does I.10 describe the minimal results of the screening in I.9? The link between the screening in I.9 and I.10 is not clear.		X		See resolution of Belgium comment No. 18 (I.10 removed)
49	I.10	Delete the §	It is already mentioned in 3.27 and it is not really	X	X		See resolution of Belgium comment

			the scope of the appendix which is about the combination of hazards.				No. 18
50	Appendix II, item II.2	The fire hazard analysis should take into account any credible combinations of fire and other events ~~including internal and external hazards likely to occur independently of a fire~~ according to appendix A.	The combination of events is discussed in appendix I. The proposal avoid discordance with appendix I.		X The fire hazard analysis should take into account any credible combinations of fire and other events ~~including internal and external hazards likely to occur independently of a fire~~ according to appendix I.		Appendix I and not Appendix A.
51	II.4 b	Suppress the § The fire hazard analysis has the following purposes: (a) To identify type and amount as well as location in and distribution of fire loads and potential ignition sources over the room or plant area; (b) ~~To identify the relevant items important to safety and to establish the locations of individual components in fire compartments;~~	This is not necessary for fire. Only common modes are necessary			X	This paragraph is needed to identify targets to be protected. The cancelled objective was the first one in FHA as described in NS-G-1.7.
52	II.19		The link to 4.1 is unclear	X The fire compart ment approac			

				h does not require the provision of fire extinguishing systems to meet the requirements stated in para. 2.1 applied to internal fire (see also paragraphs 4.27 to 4.32).			
53	Appendix II, item II.63	The distribution loop for fire hydrants should provide exterior coverage of the building. Internal standpipes with a sufficient number of fire hoses of sufficient length, and with connections and accessories adequate for the hazard, should be provided to cover all interior areas of the plant excepted if justified by the fire hazard analysis.	Reference to fire hazard analysis to remain consistent with the safety goals to verify in case of fire.		X The distribution loop for fire hydrants should provide exterior coverage of the building. Internal standpipes with a sufficient number of fire hoses of sufficient length, and with connections and		Improved language.

					accessories adequate for the hazard, should be provided to cover all interior areas of the plant <u>unless duly justified by the fire hazard analysis</u>.		
54	Appendix II, item II.66	~~Each branch line to a separate building should be provided with no fewer than two independent hydrant points. Each branch line should be provided with an indicating shut-off valve.~~	Unclear statement to delete or to clarify in the text with drawing if necessary.			X	The sentence is clear. If really needed, the figure 1 (A possible layout of the supply system for water for the fire extinguishing system) of NS-G-1.7 might be added.
55	Appendix II, item II.74	When a common water supply is provided for fire protection and for the ultimate heat sink, the following conditions should also be satisfied: — The capacity needed to meet the recommendations for the water supply for the fire protection system should be a dedicated part of the total water inventory. — Failure or operation of the fire protection system should not violate the intended functions of any water supply for the ultimate heat sink, or vice versa <u>according to the considered combination of events</u>.	Adding the fact that this recommendation needs to be consistent with the combination of hazards (one of the important change in this guide with respect to old ones).		X When a common water supply is provided for fire protection and for the ultimate heat sink, the following conditions should also be satisfied: — The capacity needed to meet the recommendations for the water supply for the fire		More complete wording.

					protection system should be a dedicated part of the total water inventory. — Failure or operation of the fire protection system should not violate the intended functions of any water supply for the ultimate heat sink, or vice versa according to the considered case, including combination of events.		
56	Appendix II, item II.106	An assessment should be carried out to determine, in accordance with other safety requirements, the need for smoke and heat venting, including the need for dedicated smoke and heat extraction systems, to confine the products of combustion and prevent the spread of smoke, to reduce temperatures and to facilitate manual firefighting.	The uncontrolled and unfiltered release of radioactive materials to the atmosphere throughout the smoke and heat venting system is, a priori, not acceptable everywhere in the plant.		X An assessment should be carried out to determine, in accordance with other safety objectives, the need for smoke and heat venting, including the need for dedicated smoke and heat extraction systems, to confine the		Better wording.

					products of combustion and prevent the spread of smoke, to reduce temperatures and to facilitate manual firefighting.		