DS498 External Events Excluding Earthquakes in the Design of Nuclear Installations, Draft xx.xx.2018, STEP 7

COMMENTS BY REVIEWER Reviewer: M-L Järvinen, J. Leino Page.... of.... Country/Organization: STUK Date: 24th October 2018				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	General	Please add chapter: Consideration of external events in design of systems important to safety	The focus of the safety guide DS498 draft has been on the plant layout and building design. However, effects of external events on plant functional design and on design of safety systems should also be considered in this safety guide. As an example the extreme temperatures have an impact on the ultimate heat sink. Consideration of external events in plant functional design and in design of safety systems should be treated in a separate chapter similarly to layout and approaches to building design. From the DPP the limited approach is not evident.			Rejected.	The draft covers not only plant layout but also design of SSCs. The draft completely complies with the approved DPP. Because the design of SSCs important to safety against external events is already included in the scope of the existing safety guide (NS-G-1.5) and of SSR-2/1 Rev.1, and this draft clearly indicates the main topical areas in the paragraph 1.3 from (1) to (6), there is no need to add the suggested text.
2	2.20.	Unless national regulations require otherwise, the categorization for EEs should follow the principles of seismic categorization, which are provided in Ref [11]. Items identified using para. 2.18	see comments on DS490, These two guides should be in	Yes. Coordination between these two documents is			

		should be considered against para. 2.14 of Ref [11]. The items, the characteristics of which are comparable to those of items of the Seismic category 1, should be categorized as EE category 1. The items of EE category 1 should be designed to withstand against the respective DBEE. They should also be checked against conditions exceeding the DBEE, i.e. BDBEE in order to demonstrate an adequate margin and avoidance of cliff edge effects at the levels close to DBEE. For NPPs, if items identified using para. 2.18 include items below, consideration should be given to provide for an adequate margin including items: • a) Items that are ultimately necessary to prevent an early radioactive release or a large radioactive release • b) Items of heat transfer functions to an UHS • c) Items of the control room	line with each other.	being maintained.			
3	5.68	snow precipitation (also blizzards), freezing rain and …	Freezing rain should be mentioned in the guide.	Accepted.			
4	5.69	… ventilation and diesel generator combustion air intakes …	Diesel generator combustion air intakes may also be vulnerable to external hazards, e.g., accumulation of snow in air ducts before start-up.	Accepted.			
5	5.69	Extreme air or water temperature could affect the heating, ventilation air-conditioning (HVAC) systems of rooms housing safety important systems, especially electronics equipment, and the	The effect of extreme temperatures on room cooling and on electronics and I&C systems should be pointed out.	Accepted.			

		availability of the UHS.					
6	5.72	Unless special national or other applicable codes and standards are available for the design methods of nuclear installations …	In the absence of national codes or standards, some international codes or standards on the design of nuclear facilities may be relevant. Codes and standards for conventional buildings may be acceptable regarding design methods, but usually not regarding the design basis.			Rejected.	The paragraph refers to design process, NOT design basis.
7	5.77	To prevent service water blockage due to frazil ice, measures to prevent frazil ice formation (outlet water recirculation to intakes, bar screen heating) and alternative path(s) for cooling water intake should be provided.	Prevention of frazil ice formation should be the primary approach.	Accepted.			
8	5.133	Suggested addition at the end: Safety important air intakes should be provided with automatic pressure wave protection shutters.	Provided in recent NPPs on security and safety grounds.	Accepted.			

DRAFT SAFETY GUIDE No. DS 498 – DRC Comments

COMMENTS BY REVIEWER Reviewer: Page.... of.... Country/Organization: FRANCE ASN Date: 26/10/2018				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	6.4	The recommended approach to grading is to start with attributes relating to NPPs and, if possible, to grade down to installations with which lesser radiological consequences are associated. If no grading is justified, the recommendations ~~relating to~~ for NPPs are applicable, as far as practicable, to other types of nuclear installations.	Some recommendations for NPPs may not be applicable for other types of installations	Accepted			
2	6.7	Decisions related to the BDBEE for non-NPP installations should be based, if relevant, on the grading considerations following the Requirement 22 in Ref [2] and the Requirement 21 in Ref. [3].	[2] is for research reactors, [3] is for fuel cycle facilities. Research labs or nuclear waste facilities may have difficulties to implement these requirements.	Accepted			
	6.13	As a result of this grading process, three or more categories of installation may be defined depending on State practice: (a) (…) (b) The highest grade of hazardous installation would be installations for which ~~the hazards approach is similar to the hazards associated with NPPs~~ the risks involved to the environment and population are comparable to the risks from NPPs ; (c) (…)	It is more relevant to mention the risks to population and the environment than a hazards approach.	Accepted			

TITLE: External Events Excluding Earthquakes in the Design of Nuclear Installations (DS498)

COMMENTS BY REVIEWER Reviewer: AERB Page.... of.... Country/Organization: India / AERB Date: 26.10.2018				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	5.6	Add in the paragraph corresponding to wind wave: ……..In addition, relevant parameters (typically, wave kinematics) associated with dynamic effects of wave on plant structures should be considered. *Loading and unloading analyses should include hydrodynamic effects, static loading effects, erosion and sedimentation, and other associated effects.*	Text to be added for completeness	Accepted.			
2	5.42	For some sites, in addition to design wind speeds corresponding to 'extreme' meteorological phenomena, ~~and~~ 'rare' meteorological phenomena, such as tornadoes and hurricanes should also be considered. ~~In design, the former is usually considered as an extreme condition and the latter, as a rare condition~~	First change is editorial and the second one for clarity.	Editorial change (deletion of 'and') is accepted.		Partly rejected.	Deletion of the second sentence is rejected because the terms 'extreme' and 'rare' also refer to design conditions.
3	5.43a	New clause: *In case of (rotational) wind due to tornadoes, direction of wind on one surface of a structure could be different or opposite of the direction of wind on another surface. Design should consider such loading conditions specific to rotational wind due to tornadoes.*	New para is proposed to address specific loading conditions expected in tornadoes.	Accepted.			

Japan NUSSC Comments on DS498, "External Events Excluding Earthquakes in the Design of Nuclear Installations"

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 12 Country/Organization: Japan / NRA Date: 29 Oct. 2018				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	General	All types of the external events, including earthquakes that might affect the safety of nuclear installation are defined in NS-R-3 (Rev. 1), which is under being revised as DS484 and will be endorsed by the CSS very soon. Those external events in this publication should be derived based on DS484 (NS-R-3 (Rev. 1)). For examples, some paragraphs of this publication refer to SSG-18, however, meteorological events in SSG-18 come from NS-R-3 (Rev. 1), and then may be modified after establishment of coming SSR-1 (DS484). Therefore, referring to SSG-18 should be avoided from this publication, instead the meteorological events of this publication should be derived from SSR-1 (DS484).				Rejected.	Coordination between the various standards in the pipeline is being maintained, and SSG-18 remains effective even after DS484 is endorsed. There is no need to avoid referring to SSG-18, and there's not any problem with referring to SSG-18 in this regard.
2.	1.1.	This Safety Guide provides recommendations on the design of nuclear installation for External Events (EEs) excluding earthquakes to meet the requirements established in IAEA Safety Standards Series No. SSR-2/1 (Rev. 1), Safety of Nuclear Power Plants: Design [1], IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [2] and IAEA Safety Standards Series No. SSR-4, Safety of Nuclear Fuel Cycle Facilities [3], with referring to IAEA Safety Standards Series No. SSR-1, Site Evaluation for Nuclear Installations, which defined external events that might affect the safety of nuclear installations.	Clear description of relationship of this guide with SSR-1 (DS484), which is characterized the external events that might affect the safety of nuclear installations.	Accepted.			
3.	1.17.	This Safety Guide is mainly focused on the design phase, however most of the recommendations are also applicable in the evaluation of new installations (described in Ref. [18, 19]), in the periodic safety review phase (described in Ref. [14]) and in the re-evaluation of existing plants in compliance with the relevant regulatory requirements for the specific phase.	This safety guide should be used for new installations only. For existing plants, the assessment for BDBEE is not mandatory unless it is required by the regulatory body.			Rejected.	Because of the paragraphs 5.21 and 5.21A of SSR-2/1 Rev.1, there is a clear need to provide guidance on margin assessments against

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 12 Country/Organization: Japan / NRA Date: 29 Oct. 2018				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							external events (DBEE and BDBEE). Additionally, this safety guide intends to provide guidance on evaluation of existing nuclear installations (see the para 1.4). The Regulatory Body is always free to require or not require IAEA recommendations. Pursuing compliance with relevant regulatory requirements is out of the scope of this safety guide.
4.	2.9.	With regard to the design of structures and components, margins result from both the methodology followed to define the loading conditions and compliance with stress limits defined by the design/manufacturing codes. For the purpose of this Safety Guide, the term "adequate margin" refers to: (i) the nuclear installation's overall adequate capacity to withstand the loading conditions of DBEEs and meet the applicable safety requirements; (ii) the adequate capacity of individual SSCs to perform their required function when subjected to the loading conditions of DBEEs; and (iii) the avoidance of any cliff edge effects due to BDBEEs.	Clarification. The meaning of the word "EEs" is ambiguous.	Accepted.			
5.	2.11.	Conditions that are beyond the design basis should be taken into account for the potential for cliff edge effects, considering the likelihood of EEs more severe than DBEE. The design process should ensure that the requirements of	In some EEs, defining the certain loading conditions induced by BDBEE are not practical or even possible.		The idea of the proposal is reflected with		

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 12 Country/Organization: Japan / NRA Date: 29 Oct. 2018				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		adequate margin are met. Some example of how BDBEEs could be defined are as follows: − To adopt a lower annual frequency of exceedance for the DBEE; − To adopt a higher amplitude of the DBEE loading conditions for all important to safety SSCs or a subset for SSCs ultimately necessary to prevent an early radioactive release or a large radioactive release; one way of doing so is to add a factor of conservatism to the DBEE loading conditions for those SSCs. If BDBEE cannot be defined in practical, adequate safety margins should be provided in an appropriate manner.	There should be an option to demonstrate the margin instead of defining BDBEEs.		editorial changes.		
6.	4.37.	When applicable, qualification should consider the ~~very stringent~~ requirements derived from functionality under conditions of dust, smoke, humidity, extreme temperatures, corrosive atmospheres, or radioactive environments, combined with mechanical stress.	All of requirements should be treated equally. .	Accepted.			
7.	4.42.	The rules for design (DBEE) and the rules for assessment (BDBEE) are different. The purpose of the assessment should be to show that, reasonably, the BDBEE will not compromise the intended safety functions. For this purpose, the assessment for BDBEE should take credit for all safety margins intentionally or unintentionally introduced by the design process. For example, an adequate margin is expressed as minimum facility level HCLPF in seismic margin assessments [12].	It is unreasonable to design all the SCCs to withstand BDBEE condition. The assessment for BDBEE should be intended to confirm that the installation maintain the containment function.			Rejected.	The idea expressed in the 'reason' column is correct and reflected elsewhere in the document. The proposed additional sentence does not convey this idea. The guidance on the concept of designing SSCs against BDBEE is given by the paras from 3.25 to 3.29.
8.	New para After the title of	5. SAFETY DESIGN PROVISIONS AGAINST EXTERNAL EVENTS GENERAL	Describe clearly relationship with SSR-1(DS484) that define those external events whose			Rejected	This list is provided in Scope Paragraph 1.11. This part is specific to

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 12 Country/Organization: Japan / NRA Date: 29 Oct. 2018				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
	Section.5	5.0 External events other than earthquake, that might affect the safety of nuclear installations are defined in SSR-1, as follows; • volcano • meteorological and hydrological events - wind - precipitation - snow and ice - air and water temperature - humidity - storm surges - sand or dust storms - credible combinations of above • rare meteorological events - lightning - tornados - cyclones • flooding • other natural hazards - wild-fires - drought - hail - frazil ice formation - diversion of a river - debris avalanche - biological hazards • human induced events - events associated with nearby land, river, sea or air transport - Fire, explosions, missile generation and releases of hazardous gases from industrial facilities near the site - electromagnetic interference - other human activities that might influence the type or severity of natural hazards, such as resource extraction or other significant re-contouring of land or water or reservoir-induced	effect must be evaluated. Those external events are considered in design of nuclear installation without any exception from the items listed in SSR-1.				meteorological and hydrological hazards. Please also note the statement of the paragraph 1.12.

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 12 Country/Organization: Japan / NRA Date: 29 Oct. 2018				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		seismicity - aircraft crashes - Chemical hazards in the region surrounding the site that involve the handling, processing, transport and/or storage of chemicals These are the external events that will be considered in design of nuclear installations. The following items are derived from the above list with necessary details.					
9.	5.30.	Flood monitoring systems should be properly designed to withstand the design basis flooding. If necessary, protection of the ~~warning systems~~ monitoring systems from damage due to hydrodynamic forces and collisions of floating bodies should be considered.	This seems to be an editorial mistake because the explanation about warning systems is written in 5.29.	Accepted.			
10.	5.40. footnote 19	In some Member States, design extreme wind speed is chosen with a 100-year return period (1% annual probability of exceedance), whereas design rare events causing high winds (tornado, typhoon) are ~~typically~~ chosen ~~with a return period of 10000 years~~ in accordance with reference [6].	As the return period of the rare events is chosen differently in each state, the word typically should be deleted.		Accepted with a change as follows: …are typically chosen with a much longer return period.		
11.	5.44.	Beyond design basis wind speeds (BDBEE) should be established at an annual probability of exceedance about one order of magnitude less than that of the DBEE.	Clarify the reason why it can be described as "one order of magnitude less than that of the DBEE". Otherwise, modify it as follows; "Beyond design basis wind speeds (BDBEE) should be established at an appropriate annual probability of exceedance		Para. 5.44 is modified as follows: Beyond design basis wind speeds (BDBEE) should be established at an appropriate annual		

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No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			less than that of the DBEE by using the existing database." (Para.4.43. is also the same)		probability of exceedance about one order of magnitude less than that of the DBEE.		
12.	5.45.	Structural loading derived from the wind speed and duration should be obtained in the form of pressure/suction on wind exposed surfaces.	For the influence of extreme wind, tornado (intense in a very short time) and typhoon (long time) are not the same because of different duration. So, "duration" should be taken into account.	Accepted.			
13.	Sec. 5.7	5.7 ASPHYXIATE, TOXIC GASES, TOXIC AND CORROSIVE CHEMICALS AND FLAMMABLE VAPOUR CLOUDS	Editorial. There is no term of "flammable vapor clouds" in Section 5.7. Please check the consistency between title and contents.	Accepted.			
14.	5.47.	Wind loads can normally be treated as static loads for structures as normally designed and built in nuclear installations. Dynamic structural effects ~~should~~ can usually be considered for structures whose natural frequencies are smaller than 1 Hz.	The basis of the 1 Hz is ambiguity. So, 'should' be changed to 'can usually' or something.	Accepted….are usually considered…			
15.	5.52.	The second set of failure modes that should be considered corresponds to the global failure or global instability of the main structural system of the buildings under the wind loads. These failures would be able to produce a major collapse of	Editorials.	Accepted.			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 12 Country/Organization: Japan / NRA Date: 29 Oct. 2018				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		the building. Wind capacity analysis for global failure modes should consider the assessment of structural capacity of the main structural system under the wind loads. As for the ~~local~~ global response, dynamic effects can usually be neglected when natural frequencies are larger than 1 Hz.					
16.	5.54. footnote 21	~~[21]. As a rule of thumb, maximum velocities for wooden missiles are generally about 75% of the horizontal wind velocity. For steel pipe missiles, the maximum missile velocity is about 40 to 60% of the horizontal wind velocity. For automobile missiles, the maximum missile velocity is about 18 to 20% of the horizontal wind velocity.~~	This description may be confusing because maximum response velocity of every kind of missiles are largely depend on the horizontal wind velocity.	Accepted.			
17.	5.81.	In general, phenomena such as pyroclastic flows, lava flows, opening of new vents and ground deformation (including debris avalanches) are considered to be exclusionary. If these phenomena have not been ~~completely~~ screened out during the hazard evaluation stage, criteria related to any protection measures should be discussed with the Regulatory Body for their acceptability.	In general, using the word "completely" is not appropriate because the occurrence of natural events has some uncertainties so it is not required as completely screened out here..	Accepted.			
18.	5.87.	~~Similar to volcano generated missiles, gases and aerosols from a volcanic eruption affect a limited area within which an nuclear installation should not be sited.~~ If hazard from gases and aerosols from a volcanic eruption has been identified and a design basis has been derived, then design features and procedural measures should be provided ~~similar to those due to human induced events~~. Parameters that should be obtained from the hazard analyst should include the type of gas (including all physical and chemical properties) and its concentration when it arrives at safety related SSCs including the control room.	The word "similar to" is confusing because the area affected by gases and aerosols is not the same as that of missiles. In addition, these influence is not always similar to human induced events.	Accepted.			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 12 Country/Organization: Japan / NRA Date: 29 Oct. 2018				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
19.	5.89.	Volcanic earthquakes should be considered in the seismic hazard analysis for the nuclear installation. If volcano-seismic hazards at the site are not lower than those associated with other sources of seismic activity, ground motion from volcanoes should be assessed. ~~If this has not been done, then it should be verified that the seismic hazard calculated for the site envelopes at all frequencies that may be associated with potential volcanic earthquakes. Otherwise, ground motion from volcanoes should be assessed using probabilistic methods and combined with those due to tectonic earthquakes.~~	In general, the observed data for the volcanic earthquakes at the site is not sufficient to evaluate the hazard in design. Therefore, deterministic methods can be used for comparing the magnitude of volcanic earthquakes and tectonic earthquakes.	Accepted.			
20.	5.136. /L3-5	The result of the release hazard assessment should be a list of potential release sources including their characteristics (form of release, ~~distance to site~~ location of release, amount and nature of the hazardous substance).	The release hazard assessment is required not only "distance to site" but also height and direction. Therefore, “location of release” is preferable to “distance to site”.	Accepted.			
21.	5.141. /2nd sentence	In boil-offs and slow leaks, the effects of density on vertical diffusion ~~should~~ can be considered ~~only if~~ when adequately supported by experimental data or numerical simulation.	Numerical simulation should be allowed in consideration of vertical diffusion.		Accepted and modified as: In boil-offs and slow leaks, the effects of density on vertical diffusion should be considered only if when adequately supported by experimental data or numerical simulation.		

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 12 Country/Organization: Japan / NRA Date: 29 Oct. 2018				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
22.	5.153.	For corrosive ~~releases~~ chemicals, it should be demonstrated that ……	To keep a consistency with the section title.	Accepted.			
23.	Before 5.166.	MEANS OF PROTECTION 5.166. When protection of SSCs against an aircraft crash is provided by the design, ...	For user friendly. This paragraph describes means of protection against accidental aircraft crash.	Accepted.			
24.	5.173.	The model of the structure can be differed in the local and the global area. The local area is the impact and the surrounding area, where the structure reacts nonlinear. The nonlinear material laws should be used whereas in the global area linear material behavior can be applied. Applicability of above mentioned structural modelling should be validated based on the purpose of evaluation described in 5.165.	In the evaluation for 'vibration effects', the application of nonlinear material low to the local area may make analysis results non-conservative.	Accepted.			
25.	5.182.	Outside the local area (equal to the global area in 5.173.) the model of the structure can be simplified in type of elements, detailing of elements and material laws.	Relationship between outside the local area in the 5.182 and the global area in the 5.173 should be described.	Accepted.			
26.	5.189.	The containment should withstand the impact (without perforation) and one train of systems and components should function after the impact of a design basis aircraft ~~aircraft~~ with appropriate fuel load for a long-distance flight.	Typo.	Accepted.			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 12 Country/Organization: Japan / NRA Date: 29 Oct. 2018				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
27.	5.192.	For the calculation of the building responses, proper damping system ~~velocity proportional (linear viscous) damping~~ should be used, with care taken to avoid unreasonable values in the high frequency range.	Velocity proportional damping system has a tendency to give a large modal damping factor for higher mode.	Accepted.			

TITLE:
DS498 Storage of Spent Nuclear Fuel (WASSC, NUSSC)

COMMENTS BY REVIEWER Reviewer: KINS Page 1 of 1 Country/Organization: Republic of Korea / Korea Institute of Nuclear Safety Date: Nov. 5, 2018				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	5.42	For some sites, in addition to design wind speeds corresponding to 'extreme' meteorological phenomena, ~~and~~ 'rare' meteorological phenomena, such as tornadoes and hurricanes [6] should also be considered	The expression of "*and*" was eliminated to make the sentence clear.	Accepted			
2	5.63	For instance, collapse of heavy and high rising cranes parked outside the containment and other important to safety structures, as well as chimneys, and cooling towers *should be considered*.	The expression of "*should be considered*" seems to be added to make the sentence clear.		Accepted and para. 5.63 is modified as follows: The spatial systems-interaction effects from wind on safety related structures could be of concern; for instance, collapse of heavy and high rising cranes parked outside the containment and other important to safety structures, as well as chimneys, and cooling towers.		

COMMENTS BY REVIEWER Reviewer: NUSSC Member Country/Organization: Pakistan / PNRA			Page.... of.... Date: 26 October 2018	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	**General Observation**	SSR-1 (DS484) is being finalized and is expected to be approved in the 44th meeting of the CSS. It is therefore, proposed that DS-498 may be deferred for this time and may be linked with the approval of SSR-1 from CSS. After approval of SSR-1 (DS484) from CSS, technical committee may re-visit the DS-498 and submit to NUSSC for approval.			Para. 1.1 is modified as: …… with referring to IAEA Safety Standards Series No. SSR-1, Site Evaluation for Nuclear Installations, which defined external events that might affect the safety of nuclear installations.		
2.							
3.							

TITLE: External Events Excluding Earthquakes in the Design of Nuclear Installations (DRAFT SAFETY GUIDE No. DS 498)

COMMENTS BY REVIEWER Reviewer: WASSC Member Country/Organization: Pakistan/PNRA			Page.... of.... Date: October 26, 2018	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	3.11/last	To confirm compliance with the objectives of para. 3.9, an appropriate deterministic ~~or~~ **with taking insight from** probabilistic analysis should be performed at the level of detail necessary for demonstrating satisfaction of the objectives.	The insight from probabilistic approach will contribute significantly to confirm the compliance and may be considered simultaneously.			Rejected.	A probabilistic analysis is also recommended. A secondary role for probabilistic methods is not intended in this paragraph.
2	3.28/	Two different methodologies should be considered to develop information about how BDBEEs affect the risk profile of a NPP: - A **probabilistic safety analysis (PSA) of external events other than earthquake** (EE-PSA) method that quantifies Core Damage Frequency (CDF), Large Early Release Frequency (LERF), Large Release Frequency (LRF)	The EE-PSA may be further explained for "external events other than earthquake" otherwise it may be confused with Seismic PSA.	Accepted.			

3	1.17/4	This Safety Guide is mainly focused on the design phase, however most of the recommendations are also applicable in the evaluation of new installations (described in Ref. [18, 19]), in the periodic safety review phase (described in Ref. [14]) and in the re-evaluation of existing plants **considering new defined DBEE & BDBEE.**	The re-evaluation of existing plants should identify and consider the incorporation of newly determined external events.			Rejected.	Not necessary at this point. These are explained in the following sections.
4	5.3/3	Groundwater may affect the stability of soil or backfill **and foundations of nuclear installation buildings.**	Stability of soil or backfill material will ultimately affect the foundation base causing; tilt, excessive settlement etc. need to be addressed through static analysis.			Rejected.	The first sentence of the paragraph includes this proposal.
5	2.3	The methods of hazard assessment can be deterministic or probabilistic. **However, in both approaches, uncertainties should be determined and a detail sensitivity study should be performed.**	Sensitivity analysis is used to determine the uncertainties. Appropriate sensitivity analysis should be conducted to ensure that the DBEE incorporates all the uncertainties involved.			Rejected.	This is a hazard related recommendation. This paragraph is simply a link to the Requirements without going into detail.
6	7.5	**(o). conduct of independent peer review for evaluation of EE.**	The purpose of the peer review is to provide assurance that a proper process has been used to conduct the evaluation of EE, that it has addressed and evaluated relevant uncertainties.			Rejected.	This again seems to be a hazard related recommendation.

External Events Excl. Earthquakes in the Design of NIs (rev. NS-G-1.5)

COMMENTS BY REVIEWER Reviewer: Anders Hallman, Lars Bennemo Page 1 of 1 Country/Organization: SSM Date: : 26th October 2018				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	General	Why is the expression "Existing Nuclear Installations" explicitly used in a few paragraphs? (Taking into account the information given in paragraph 1.17). There is no reason.				Rejected.	It is emphasized both in background and in the objective of the document.
2	1.4	"This Safety Guide is mainly focused on the design phase however it also provides guidance on …"	Fore clearance the paragraph 1.4 should be completed with the first part of 1.17.			Rejected	It is mentioned in Para. 1.1.
3	1.11	The paragraph should be completed with ICING and icing should also be mentioned as a separate item under the headline 5.3 "Other Extreme Meteorological Conditions".	Icing is an important EE.	Accepted and it is mentioned and guidance given under Para. 5.76.			
4	1.11	Paragraph 1.11 mentions SUBSURFACE FREEZING but the phenomena is not further described under the headline 5.3 "Other Extreme Meteorological Conditions".	There should be a description at least.		Accepted and general guidance is given under Para. 5.76.		

DS498 Draft Safety Guide "External Events Excluding Earthquakes in the Design of Nuclear Installations"

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: SSTC NRS Country/Organization: Ukraine			Page 1 of 1 Date: 26 Oct 2018				
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	2.20, 2.21, 3.14		1) These DS498 paragraphs establish links between the categories of components depending on their safety functions to be performed in External Events and the seismic resistance categories established in IAEA NS-G-1.6. It should be noted that NS-G-1.6 is now under revision (see DS490). The number of seismic categories decreased from 4 (NS-G-1.6) to 3 in the draft of the revised document (DS490), and may be changed further since DS490 has been submitted for review to member states. Therefore, the data in these paragraphs in DS498 should agree with the final version of the revised NS-G-1.6. 2) It is additionally recommended to introduce category EE-3 in DS498 for External Events, like seismic resistance category 3 in DS490.	Accepted. Coordination between these drafts is being done.			
2.	5.38	"For existing nuclear installations, the second option of §**5.37** is applicable".	Reference to para 5.3.7 seems to be more appropriate.		Accepted. This should be 5.37.		

Comments on IAEA Draft Safety Guide
SPESS Step 7c
***External Events Excluding Earthquakes in the Design of Nuclear Installations* (DS498)**

COMMENTS BY REVIEWER Reviewer: US Nuclear Regulatory Commission Country/Organization: United States of America/US NRC Date: 26 Oct 2018				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	General	This document includes repetitive contents. Eliminate repletion where possible to reduce the document length. Change 'redundant' in paragraph 2.38 and others to 'defense-in-depth' or other appropriate terminology.	To improve readability and clarity of the guidelines,	A general check is done to the document to eliminate repetition.		Second comment (on Paragraph 2.38) is rejected.	The concept of 'redundancy' is different from DiD and this paragraph is primarily based on the Design Requirements.
2.	General	In evaluation of external events hazards, we recommend that DS498 address potential hazards during decommissioning of facilities as structures, components and controls may need to be examined using a graded safety approach to ensure minimization of hazards from feeble structures or deteriorating components or from high dismantling cranes.	Completeness to address integrity of structures and components during dismantling and decommissioning as potential hazard from external events may become crucial.	A paragraph will be added to the 'graded approach' to explain the applicability to decommissioning.			
3.	General Non-Radiological Hazards	We recommend DS498 address non-radiological hazards during external events as related to exposed asbestos surfaces particularly during fire or violent events.	Completeness to address non-radiological hazards in more detail during external events.			Rejected.	Considering the current paragraphs 1.11-1.13 of this draft, the suggested items (asbestos etc.) would be included in 'industrial hazards' and there may be a very big number of these. There is no established

							guidance from the higher tier documents for these events.
4.	General	We recommend DS498 address in more detail *the "design basis for external events (DBEE)* and *"beyond design basis for external events (BDEE);"* considering cost benefit analysis and the approach to reasonable assurance for safety.	Completeness to address risk/cost benefit analysis in the context of reasonable safety assurance for DBEE and BDEE.			Rejected.	This would be the subject of the Principle 4 of SF-1, and is beyond the scope of this document. There is no requirement in higher tier documents in this regard.
5.	Para.2.5/ line 4	Revise it as: "…and used in the evaluation of the nuclear installation in order to evaluate the ~~adequacy of margins~~ uncertainty in external hazard estimations and safety margins."	Consistency with the following section (Safety Margin).	Accepted.			
6.	2.8/1	Change to: 'The margin is understood to be the result of the ~~conservative assumptions and conservative~~ variability and uncertainty of the different methods, data, assumptions, and rules applied for the design that provides the SSCs the capability to safely perform…of cliff edge effects. The uncertainty analysis must include all applicable epistemic and aleatory errors in estimation. Another source of margin…"	Clarify the source of uncertainties in analyses.	Accepted, however the term 'error' implies that it can be corrected whereas some aleatory uncertainties are irreducible. This will be modified.			
7.	2.14/last	Add the following: "Well-calibrated deterministic models can be used as a starting point for developing probabilistic models. That is, the result of deterministic model simulations can be used to determine the plausible range of data and parameters used in the probabilistic models, especially for determining the	This would be a more logical step to develop a probabilistic model.			Rejected.	The proposed addition is tutorial and does not contain a recommendation.

		upper bound of them which are by and large critical but uncertain especially at low annual exceedance probability level."					
8.	2.23/last	Add the following: "Or a combination of deterministic and probabilistic methods could be used in practice. Storm surge flood analysis is an example case where a numerical surge model is set up and calibrated deterministically, and then used to build a probabilistic surge model to estimate storm surge hazard curves."	In line with the current practice.			Rejected.	The proposed addition is tutorial and does not contain a recommendation.
9.	2.25/1	Change to: 'Unless a combination of events is shown to have a ~~sufficiently high probability of occurrence~~ reasonable dependency in occurrence,…' Change the last sentence to: 'When assessing a combined event, the possibility of a concurrent or causal relationship should be evaluated,… '	To clarify the guideline.	Need for clarification is accepted. It is proposed to change the first part of the paragraph to: "Unless a combination of events, i.e. their concurrence is shown to have a sufficiently high probability ~~of occurrence,~~			
10.	2.37 (2)	Recommend switching the term '~~redundancy~~' to 'defense-in-depth' or other appropriate terminology.	Change to a positive term.			Rejected.	Please see response to Comment 1.
11.	2.46/5	Change to: "…such as: ~~tsunami warning, hurricane, typhoon, tornado warnings, warnings for release of hazardous gases~~." "…warning time and preparation time for tsunami, hurricane, tornado, and release of	To clarify the text	Accepted.			

		hazardous gases and liquids."					
12.	3.3/1	Revise to: "For human-induced EEs, screening by physical distance as well as severity or probability of occurrence should be used$_{11}$."	Change to more reflect a more realistic approach.	Accepted.			
13.	3.8	Change to: "When the hazard is defined in a probabilistic context, the site hazard should be analyzed and ~~a single value of an annual frequency of exceedance should be selected~~ presented in a set of hazard curves. During the design stage, the hazard curves or a single hazard value at a given annual frequency of exceedance would be used."	In line with current practices.	Accepted.			
14.	3.9/1	Revise to: "The final safety objective of the design basis selection is to keep the radiological risk due to the EE acceptably low (e.g., as low as reasonably practicable and/or within prescribed regulatory limits; for NPPs, mean annual core…)"	In line with current practice.	Accepted.			
15.	3.23	Change to: "Sensitivity and uncertainty analyses should be conducted ~~on input data~~ with varying input data, parameters, and among different acceptable approaches."	Uncertainty and error analyses are also needed, which is different from sensitivity analysis.			Rejected.	Uncertainties need to be considered during the whole analysis. The proposed text gives the impression that this is done at the end.
16.	4.12/3	Revise to: "…consider flood event characteristics and their uncertainties ~~including~~ for flood levels as well as duration and associate effects."	Expand flood parameters	Accepted.			
17.	4.13/1	Revise as: "…it is considered a good layout practice to ~~locate~~ place important-to-safety flood sensitive equipment inside buildings or at elevations ~~inside buildings~~ above the level of the flood.'	Propose two practical flood protection layouts commonly used in practice.	Accepted.			
18.	4.17	Change to:	Add relevant texts	Second		Rejected	First comment is

		"Some of the EEs can be considered as less extreme but more frequent events." Add as the last sentence: "A combination of probable maximum storm surge with 10-year wind wave effects is an example of such cases (see ANS/ANSI 2.8 (1997) for more examples)."	with an example case for help understanding the proper site layout.	comment is accepted, but the reference will be deleted.			rejected. The difference in the concepts of 'extreme' and 'rare' need to be kept.
19.	4.24/3	Revise to: "…unity load factors for all loadings. Example of this case is the USNRC-recommended load combinations as in its Standard Review Plan (NUREG-0800). Multiple independent external event loadings need not be combined."	Follow the current practice.			Rejected.	It is not possible to give a national regulation of a Member State as a reference in IAEA Safety Standards.
20.	4.44	Explain briefly the term "..hazard-agnostic approach..."	For clarification	Accepted. A footnote is added.			
21.	5.12	Revise to: 'Parameters to characterize floods due to the sudden release of impounded water should include the series of anticipated flow rates during the entire flood event, …	Dam breach analysis for the safety of nuclear facilities must be performed not for historical events but for postulated events that could potentially occur in the future	Accepted.			

22.	5.14	Incorporate the following into the text: 1. Ground water impact is only to static loads of water and/or backfill soils. No dynamic loads are not applicable in general. 2. The effects of groundwater loads could be important for the design analysis of structures and liquefaction. 3. Combinations of flood and groundwater are rare because of different response times.	For clarification.			Rejected.	The proposed addition is tutorial and does not contain a recommendation
23.	5.31	Modify the following items: - Hydrostatic, hydrodynamic, and wave forces - Collision of floating bodies (e.g., logs, boats, barges, etc.) - Erosion and deposition of sediment - (delete) ~~Movement of sand sediment~~	For clarity	Accepted.			
24.	5.32	Dam failure and its combined effects flooding are important as they could often create damaging on-site flood for some riverine sites. Therefore recommend adding the following sentences: "In particular, upstream dam failures and combined effects with other plausible flood mechanisms could create damaging flood at riverine plant sites. A dam could fail naturally (e.g., sunny-day piping or seismic failure) or induced by heavy rainfall (overtopping) or seismic event. Dam breach parameters (e.g., width, volume, and time of breach, etc.) must be reasonably estimated as these parameters are critical in determining flood hazard. All plausible failure scenarios must be considered at the beginning, and then one selected that produces a bounding on-site flood. The approaches and assumptions used in dam breach analyses must	Suggest adding important technical issues as guidelines			Rejected.	The proposed addition is tutorial and does not contain a recommendation

		be documented thoroughly and reviewed carefully as dam failure analyses are highly uncertain and subjective in general."					
25.	5.34~38	Recommend deleting the texts for estuary site flooding and incorporate them into coastal site flooding (if needed) as estuary and coastal flood are nearly the same.	For simplification.			Rejected.	While partly agreeing with the comment, it is considered to be useful to caution estuary sites of the increased hazard, compared to either a purely coastal or a purely river site.
26.	5.37	For a new nuclear installations construction, SSCs ultimately necessary to prevent an early radioactive release or a large radioactive release, consideration should be given that the SSCs either be located at an elevation high enough above the BDB flood, or to have adequate engineered features to protect these SSCs and ensure that mitigating actions can be maintained.	New plants should be designed to the DB flood, not the BDB flood.			Rejected.	This is not a design measure because it concerns only a very limited number of SSCs and it is in compliance with the Design Requirements document.
27.	5.38	For ~~an~~ existing nuclear installations, the second option of §~~5.36~~ 5.37 is applicable.	Correctness.	Accepted.			
28.	Page 40 Para 5.79 Last sentence	The nuclear installation should be protected against all volcano-related hazards that have been identified in light of the potentially adverse phenomena outlined in Table 1 of Reference 7.	[1] Hyphenate "volcano-related" [2] Clarify that the phenomena for evaluation are outlined in Table 1 of Reference 7	Accepted.			
29.	Page 40 Para 5.81 First sentence	In general, phenomena such as pyroclastic flows, surges and blasts, lava flows; debris avalanches, landslides and slope failures, volcanic debris flows, lahars, floods, opening of new vents and ground deformation (including debris avalanches) are considered to be exclusionary because they may	A complete listing of the phenomena from Table 1 of Reference 7 is deemed useful, along with the			Rejected.	The list in Paragraph 5.81 includes all events with 'Yes' and 'No' in the columns of Table 1

		result in dynamic physical loads that affect the nuclear installation.	statement of their potential importance because they could result in dynamic physical loads that affect the installation.				of the Volcanic hazard guide (SSG-21, Reference 7). This means that the phenomena may be exclusionary and there would be no reasonable engineering solution.
30.	Page 40 Para 5.84 First sentence	Tephra fallout may have two consequences, both of which should be considered, because this fallout could result in static physical loads and abrasive and corrosive particles in air and water.	Incorporating information from Table 1 of Reference 7 directly qualifies the potential for static physical loading and effects of abrasive and corrosive particles in air and water due to tephra fallout.	Accepted.			
31.	5.91/1	"Fire that originates outside nearby the site (such as from fuel storage, vehicles and other transportation sources including roadways, waterways, and airways, as well as pipelines, chemical processing and manufacturing facilities, bushes, peat and wood)…"	Revised text for clarity and to include other potential sources nearby	Accepted.			
32.	5.104/5	"(e.g. explosion pressure waves, heat fluxes, and generated missiles)."	Potential heat flux due to fire should be evaluated that may impact the SSCs and plastic coverings on cables	Accepted.			
33.	5.107/1 and 2	"Safety related cables, instrumentation and control systems, which have been demonstrated to be particularly exposed and vulnerable to heat flux, smoke, and dust,…"	Potential heat flux due to fire should be evaluated that may impact the SSCs	Accepted.			

			and plastic coverings on cables				
34.	5.109/7	"However, other possible effects should also be considered: fire, heat flux, smoke and heated gases,…"	Potential heat flux due to fire should be evaluated that may impact the SSCs and plastic coverings on cables	Accepted.			
35.	5.140/2	"…meteorological conditions at the site: wind speed, atmospheric stability, wind direction, insolation and cloudiness."	Atmospheric stability is required, in addition to other meteorological conditions covered for dispersion/dilution calculations.	Accepted.			
36.	5.216	Revise to: "The UHS and the water intake for the service water systems that are important to safety are exposed to …"	Clarify as some intakes are not safety-related	Accepted.			
37.	5.220/3	Change to: "The approach should be based on the potential maximum size~~s~~ or weight of floating bodies…."	Weight of floating material is more important than size in determining debris/boat impact loads.	Accepted.			
38.	5.238/6	Add the following sentences: "…between the events felt at the site. This case also includes multiple dependent events occurring concurrently. Some examples of this later case are storm surge accompanied with heavy rainfalls, dam failures induced by heavy rainfall, serial upstream dam failures in a cascading manner, and others."	Expand the relevant cases.			Rejected.	The proposed addition is tutorial and does not contain a recommendation

DRAFT GUIDE DS498 *External Events Excluding Earthquakes in the Design of Nuclear Installations*

ENISS Comments – October 2018

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: ENISS Country/Organization:			Page 1 of 10 Date: 26/10/18				
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.11	Text to be modified in several bullet points in order to remove on-site hazards/sources/events	It is important to stick to the common definition of External Hazards or External Events. For instance (from the IAEA Glossary): *External events are events unconnected with the operation of a facility or the conduct of an activity that could have an effect on the safety of the facility or activity* So these are the natural hazards and the man-made originating from outside of the site.			Rejected.	On-site events need to be included here otherwise they will not be addressed at all. The Glossary should follow the definition coming from the Safety Standards.
2	1.15	… ~~However, methods described herein also have certain application to sabotage protection of a nuclear installation~~.	No added value of making this statement in this safety guide			Rejected.	There is an added value. There is a lack of guidance for methods of designing the protection against acts of sabotage.
3	2.7	…prevent an early radioactive release, or a large radioactive release[10]… [10]An 'early radioactive release' in this context is a radioactive release for which off-site protective actions would be necessary but would be unlikely to be fully effective in due time. A 'large	Please complete with footnote, defining early or large release, consistent with footnote 3 in SSR-2/1, rev. 1, p 8.	Accepted.			

		radioactive release' is a radioactive release for which off-site protective actions that are limited in terms of lengths of time and areas of application would be insufficient for the protection of people and of the environment.					
4	2.10	Loading conditions associated to the DBEE should be defined with margins. ~~A DBEE and its corresponding loading conditions should be defined conservatively in terms of the associated margins, because the assessment of DBEE and the loads associated with the DBEE typically involve uncertainties.~~	DBEE loadings have to be defined with margins independently of the existence of uncertainties			Rejected.	The margin that is taken into considerations of the design depends on the uncertainties to a large extent.
5	2.12	~~Following a best estimate approach, values of external event parameters causing cliff edge effects should be established. Adequate margin should be demonstrated. For this purpose, the demonstration should include the determination of the severity of the event causing a cliff edge effect and the estimates of the probability of occurrence at which the cliff edge effect can occur.~~ Analysis should, as far as practicable, include demonstration of sufficient margins to avoid "cliff-edge effects" that would result in unacceptable consequences.	The purpose of extreme EE analysis is not to identify the ultimate level of EE that the plant could endure before large releases. The purpose is to prove that the plant is able to manage the consequences of a plausible extreme hazard. Moreover, it is generally difficult to determine the ultimate strength of a lot of functions facing mechanical loads such as wind, or ultimate strength of electric devices to temperatures (it generally depends on time the temperature is maintained). Existence of sufficient margins up to credible events beyond the design is a more industrial approach.			Rejected.	The point of the paragraph is not to establish the purpose of EE analysis. Neither, the paragraph attempts to provide guidance to identify a kind of ultimate strength. It is to point out that best estimate approaches are appropriate for establishing confidence avoiding cliff edge effects.
6	2.15, a	• Simultaneous challenge to on-site and off-site ~~severe accident management measures~~ emergency response measures.	More appropriate	Accepted.			
7	2.16	~~The goals for the engineering design of SSCs should be: (i) functionality; (ii) capability; (iii) margins; and (iv) reliability when subjected to all loading combinations and in all plant states (operating, design basis accident conditions, and~~	No added value.	Accepted.			

		~~Design Extension Conditions (DECs)).~~					
8	2.30	In general, for mitigation actions involving the support of off-site facilities, credit to be taken should be based on the analysis of the specific DBEE, BDBEE, and particular site conditions, and should include adequate margins for uncertainties. Credit of heavy off-site resources earlier than 72 hours should be justified. Light off-site equipment can be credited after the first 24 hours. ~~As a minimum, for any event or site, no credit for such action should be taken for at least 72 hours following the onset of the event.~~ (Note: This comment line has been amended by the Secretariat, based on its interpretation.)	The guide is too specific as regards the length of the period during which the site should be assumed to be isolated from external resources. SSR-2/1 is rather clear (para. 5.17) that "The design shall take due account of *site specific conditions* to determine the maximum delay time by which off-site services need to be available." Thus, the guide ought not to spell out an explicit time period by which the site is isolated from off-site resources. The 72 hour criteria, which is sometimes used in BDBEE analyses, normally concern delivery of *heavy* off-site equipment. Portable *light* equipment can arrive to the site from other locations after 24 hours. See e.g. ENSREG "EU stress tests specifications." For EDF fleet, FARN (Rapid Nuclear Response Force) is designed so that actions can be performed 24h after the onset of the event.		When presuming the occurrence of external natural and human-induced events, no credit for the support of off-site facilities, resources and services (e.g., equipment, electricity supply, firefighting services) should be allowed in the short term. Site-specific conditions should also be taken into consideration of the time for the facilities, resources and services to become available.		
9	2.42	The systems not protected against BDBEEs (~~items not important to safety~~) should be assumed to be 'operable' or 'non-operable', depending on which status provides the 6more conservative scenario in the evaluation of protection measures against the BDBEE.	Inadequate transposition of §2.41	Accepted.			
10	3.25	~~Design basis should avoid the cliff edge effects within the uncertainty of the DBEE values. The~~	See 2.12			Rejected	Please see the response to the

		~~following information should be obtained, when possible, regarding cliff edge effects: the identification of the EE for which a cliff edge effect could occur; the severity of the event at which the cliff edge effect occurs; the loading condition corresponding to triggering the cliff edge effect; and the probability of occurrence of this hazard level.~~					Comment number 5.
11	3.26	The key element of BDBEE is the definition of the conditions to be imposed during the design or evaluation process. In principle, BDBEE should challenge the nuclear installation~~, especially loading conditions that could lead to "cliff edge" effects~~.	The BDBEE is not necessarily determined as a function of the severity level at which the cliff-edge would occur.			Rejected.	The term 'especially' provides this context.
12	4.2	The text should be improved.	Understanding is uncertain	Accepted. It is proposed to modify the text as follows: …confined to a specific location, e.g. no directional effects, the designer			
13	4.4	…non-permanent (temporary, mobile) equipment…	To clarify what is meant	Accepted.			
14	4.8	The list provided should be introduced as examples, or refer to good and proven practices	Technical solutions should not be imposed. This list is not exhaustive.	Accepted. Introduce: 'For example..' in the beginning of the second sentence.			
15	4.44	For some other external hazards, the approach above may lead to non-credible scenarios. In those cases, a hazard-agnostic approach should be taken and the BDBEE may be selected by taking an adequate margin with respect to the DBEE. ~~The BDBEE should challenge the structural design, especially when loading conditions could lead to "cliff edge" effects~~	What is deleted in the proposal is redundant with 3.26 (and see above comment on 3.26).			Rejected.	Please see the response to 3.26.
16	5.38	… the second option of 5.36… : Improve text	Second option in 5.36 in unclear	Accepted. It should be '5.37'			

17	5.54 Nota 21	~~As a rule of thumb, maximum velocities for wooden missiles are generally about 75% of the horizontal wind velocity. For steel pipe missiles, the maximum missile velocity is about 40 to 60% of the horizontal wind velocity. For automobile missiles, the maximum missile velocity is about 18 to 20% of the horizontal wind velocity.~~	Figures indicated for missiles velocities are very superior to those used by the majority of the European operators, on the basis of the application of the guide NRC RG 1.76 for Regions II and III.			Rejected.	Missile velocities are not given here, only the ratios between vertical to horizontal.
18	5.78	Beyond design basis for other meteorological events should be considered taking into account ~~pessimistic~~ predictions of ~~extreme~~ climate change that may affect the design basis parameters already considered.	Be careful not to be overly conservative	Accepted.			
19	5.67, 5.108, 5.134, 5.154, 5.197 5.235	The same text is more or less repeated in the following paragraphs: 5.67, 5.108, 5.134, 5.154, 5.197 and 5.235 Please change according to: Methods in the assessment for beyond design basis external events (BDBEE) should normally apply a more realistic approach and best-estimate methodology in comparison to design basis assessment. ~~be the same as in the design for design basis wind (DBEE).~~ The differences should be reflected in the analysis methodology and assumptions, acceptance criteria, radioactive release criteria and the material properties used in the assessment (see Section 4).	There are a number of clear and basic differences regarding the treatment of DBEE and BDBEE. This applies to all types of EE (winds, fire, flood, etc). In case of beyond design, methods for assessment should normally apply - Realistic approach, i.e., best-estimate methods and no additional postulates such as single failure. Best-estimate methodology is even preferred to help identify reasonable improvements. - Less restrictive technical acceptance criteria and based on more realistic assumptions for DEC. - Higher radioactive releases are tolerated (if it is demonstrated that early or large releases are avoided)			Rejected.	The indicated paragraphs have been checked. The differences are justified in the context of the external event.
20	5.69	~~Damage due to these hazards, is usually represented by the unavailability of the power supply or the electrical grid, but some hazards such as snow could also affect ventilation intakes and discharges, structural loading, access by the~~	Back to the precedent version , which was more precise on the systems that could be affected by the different hazards			Rejected.	The previous version does not contain a recommendation.

		~~operator to external safety related facilities and mobility of emergency vehicles. Extreme temperatures could affect the availability of the UHS. These should be considered in design and safety analysis of the installation.~~ Most of these hazards affect very specific plant systems and are not usually considered in the structural integrity evaluation of the buildings, namely: —The availability of the UHS, which is mainly affected by ice and drought; —The availability of off-site power, which is mainly affected by wind, snow, frost and lightning; —The functionality of safety related equipment, and particularly the I&C equipment, which is mainly affected by temperature, moisture and lightning.					
21	5.73	Special protection from lightning should be designed and implemented, with periodic assessment of the dedicated protection means, following the international industrial standard, special national code and standards, or qualified modelling. ~~a proper earthing system and regular inspections of the insulation of exposed equipment~~ Sufficient protection should be provided against both conductive and radiative effects of lightning. ~~the protection of conductors at short distances from each other and/or protruding from the cage protected volume.~~	Since 2003, the knowledge on lightning protection has been growing. Some standards has appeared like IEC 62305, an international industrial standard or KTA 2206, a German nuclear standard. The means of modelling the electromagnetic effect have been strongly expanded. This standards may be completed or substituted by some qualified modelling. There are other ways for lightning protection than by narrow mesh reinforcing bars in the building walls, e.g. lightning-conductor, local protection of individual systems and components, protective screens, etc. Avoid wording such as “comprehensive Faraday cage” and “narrow mesh”. Instead	Accepted.			

			use “sufficient protection”.				
22	5.77	Alternative path(s) for water cooling should be provided to counter the formation of frazil ice at the service water intake, if justified by site conditions. In this case, provision should be made for adequate instrumentation and alarms and relevant procedures and training. Hot water recirculation could be an alternative way to cope with the formation of frazil ice	Added because redundancy of heat sink is not the only solution in case of frazil.	Accepted. Combined with Finish comment on the same Para.			
23	5.112	Explosions during the processing, handling, transport or storage of potentially explosive substances **outside the safety related buildings should be considered in the site hazard assessment**	The relating hazards are not External Events (see also comment on 1.11)			Rejected.	Please see comment above.
24	5.114	~~The approach should be based on the potential maximum sizes of transportation containers during the plant life and the potential development of routes and facilities around the site area~~.	The evaluation cannot reasonably be based on unknowns. The first part of the paragraph is sufficient in principle.	Accepted.			
25	5.137	~~The approach should be based on the potential maximum sizes of transportation containers during the plant life and the potential development of routes and facilities around the site area~~.	The evaluation cannot reasonably be based on unknowns. The first part of the paragraph is sufficient in principle.	Accepted.			
26	5.157	Beyond design basis releases (BDBEE) should be established if necessary, by increasing the amount of substances and/or reducing the distances with respect to the design values (DBEE).	See 5.114			Rejected.	The recommendation is already ‘optional’.
27	5.167	Isn’t this point too specific?	It is not deemed needed in this guide.			Rejected.	As long as there is consensus, detail may be useful.
28	5.183	Consideration on BDB Aircraft crash	See 5.114			Rejected.	Cannot see the relationship with 5.114.
29	5.199	The results of the hazard analysis should be well understood and a clear distinction should be made for sources of EMI/RFI that are offsite **and those which originate within the installation boundaries**. Both the design approaches and administrative controls may be different depending	If it originates within the installation boundaries, it is an Internal Hazard/Event (see also comment on 1.11)			Rejected.	Please see the associated response above.

		on the location of the source					
30	5.211	… A third stage of filtration using fine strainers is also likely to be needed, depending on the service water characteristics and heat exchanger design.	A third stage of filtration could be not necessary. For instance, with good water characteristics, the rotating drum screens insure the fine filtration.	Accepted.			
31	5.220	~~The approach should be based on the potential maximum sizes of floating bodies during the installation life, the bathymetry around the plant and the physical limits to navigation conditions around the site~~.	The evaluation cannot reasonably be based on unknowns. The first part of the paragraph is sufficient in principle.			Rejected	External hazard evaluation for human induced event needs to consider the non-stationarity of the hazards, at least during the lifetime of the installation.

DS498, External Events Excluding Earthquakes in the Design of Nuclear Installations.

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	General	Replace "Beyond Design Basis External Events" by "**Design Extension External Events**" (DEEEs)	The wording "beyond design" is rather unfortunate. It may be relevant for an existing plant but for a new reactor, extreme hazards have to be actually considered in the design in order to cope with SSR2/1 § 5.21A ("*The **design** of the plant shall also provide for an adequate margin*…"). Extreme hazards should clearly be part of the design for new reactors, with rules different from those applied to DBEE, which clearly match with the concept of design extension. "Beyond design" may let think the designer that the design should be performed based on DBEE only and that a mere verification is enough to deal with extreme hazards. For instance, if a dike has to cope with extreme flooding, it has to be specified at design stage, so it is actually part of the design and not beyond design. As the guide deals with "*design of nuclear installation*" (§1.1), it is not understandable that it includes "beyond design" considerations (which usually			Rejected	The wording is deliberate and was already used in a working group of Nuclear Safety Standards Committees (cf. TECDOC 1791, IAEA, 2016). The term 'design extension' is not used for external events in order not to confuse with plant conditions.

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
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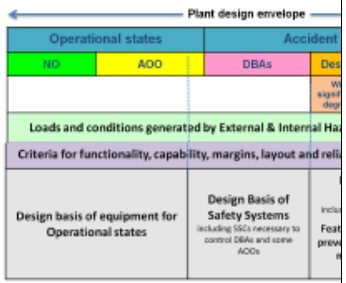
			means "out of the design").				
2	1.5	level of external hazard exceeding those considered for design **basis**	See general comment on BDBEE			Rejected	See reasons provided above.
3	1.5	derived from the hazard evaluation for the site ~~and that has the purpose of evaluating the margins that exist in the design as well as the identification of potential cliff edge effects~~	Do not mix definition and objectives of extreme hazard analysis			Rejected	The first part of the phrase is also not a definition.
4	1.9	This safety guide provides methods and procedures for defining an appropriate design ~~basis~~ **enveloppe** for a nuclear installation based on …	The term "design basis" applies to particular SSCs whereas the term "design envelope" is recommended when relating to the installation in a global manner (see below)  *Figure 2. Main elements of the design basis of SSC*	Accepted			
5	2.5 footnote 8	8 For EEs that exceed the design basis, derived from the site evaluation, i.e. the magnitude for which the safety ~~systems~~ **functions** are **still ensured and cliff edge effects avoided** ~~designed to remain functional~~ both during and after the external event, the term '~~BDBEE~~ **Design Extension External Events** is proposed and used in this publication.	There is no need to ask for SSC robustness to all EE. For example, if a SSC is just necessary in an accidental situation that can occur only when the plan is in state A and that easily the plant can be brought in a state B where this accident cannot occur, This SSC does not need to be robust			Rejected.	The draft does not recommend all SSCs designed robust to all EEs. Please read the paragraph 2.18, for instance. Being designed to remain functional is the important

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			to the EE as long as there is no risk that the EE induce the accidental situation				factor to indicate. The proposal would setback the intent of the paragraph. The second proposed change (regarding terminology) is addressed in the response to the Comment number 1.
6	2.6	2.6b For nuclear power plants, the objective of DBEE analysis should be to demonstrate that core melt can be prevented and a safe shutdown state can be reached.	Objectives of EE analysis are missing. For nuclear power plants, 2.6b to f are proposed.			Rejected	Objectives of design for external hazards are given by the paragraphs from 2.1 to 2.6. This proposal implies that core melt would be expected for BDBEE.
7	2.6	2.6c As a decoupling criteria, it should be demonstrated as far as possible that a DBEE does not induce any DBA event.	Objectives of EE analysis are missing			Rejected	Objectives of design for external hazards are given by the paragraphs from 2.1 to 2.6. The proposed text is a redundant recommendation in light of our response to the Comment number 5.
8	2.6	2.6d in case an AOO or a DBA would be	Objectives of EE analysis are			Rejected	Objectives of

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
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		induced following a DBEE, any system required to bring the plant to a safe shutdown mode should be either protected or designed in order to withstand the loads generated by the EE.	missing				design for external hazards are given by the paragraphs from 2.1 to 2.6. See reasons provided above.
9	2.6	2.6e In case of Design Extension External Events, large or early releases should be prevented. For this purpose, DEC features dedicated to manage the consequences of core melt should be remain available.	Objectives of EE analysis are missing			Rejected	Objectives of design for external hazards are given by the paragraphs from 2.1 to 2.6. See reasons provided above.
10	2.6	2.6f For plant conditions that have to be practically eliminated, the demonstration of actual elimination relies on several lines of defense. At least one of those lines of defense should remain available after any EE (DBEE and DEEE)	Objectives of EE analysis are missing			Rejected	Objectives of design for external hazards are given by the paragraphs from 2.1 to 2.6. See reasons provided above.
11	2.8	… the capability to safely perform even in situations more severe than those postulated in the design basis without the incurrence of ~~cliff edge effects~~ **large radioactive releases**.	"Cliff edge effect" is not appropriate when dealing with extreme hazards, according to definition provided in SSR2/1 p15 (note). Cliff edge effect refers to large variation in consequences following a small deviation in the inputs. Extreme hazards are not small variation compared to DBEE.			Rejected	The possibility of inducing cliff edge effects is a major differentiating attribute to external events. While acknowledging the footnote 9 of SSR-2/1 Rev.1 (on its page 15), the term “plant parameter” in the IAEA definition of cliff edge effect needs to be interpreted in a broad sense, as

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
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							any plant physical variable, design aspect, equipment condition, magnitude of a hazard, etc., that can influence equipment or plant performance.
12	2.9	(iii) the avoidance of any ~~cliff edge effects~~ **large radioactive releases** due to ~~BDBEEs~~ DEEEs	Same reason			Rejected	Same reason
13	2.11	Conditions that are beyond the design basis should be taken into account for the potential for ~~cliff edge effects~~ **large radioactive releases**	Same reason			Rejected	Same reason
14	2.11	~~The design process should ensure that the requirements of adequate margin are met.~~	Margins are provided in the design process regarding DBEE. Regarding extreme hazards, no additional margins are required in the design process per se but in the design evaluation.	Accepted.			
15	2.12	~~2.12. Following a best estimate approach, values of external event parameters causing cliff edge effects should be established. Adequate margin should be demonstrated. For this purpose, the demonstration should include the determination of the severity of the event causing a cliff edge effect and the estimates of the probability of occurrence at which the cliff edge effect can occur.~~	This text contradicts 2.5 that says that 2 levels of hazards have to be considered and 2.11 that proposes principles to define those levels. The purpose of extreme EE analysis is not to identify the ultimate level of EE that the plant could endure before large releases. The purpose is to prove that the plant is able to manage the consequences of a plausible extreme hazard.			Rejected	The purpose of EE design against BDBEE is to fulfill the requirement 17 of SSR-2/1 Rev.1, especially the paragraphs 5.21 and 5.21A. See also the response to the Comment number 5 presented by ENISS.

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
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16	2.13	2.13. If required, e.g. by national regulation, margin assessment of a nuclear installation (and/or SSCs housed within) subjected to loading conditions of an EE should be performed to determine	This reflects the practices in some member states, not all. Basically, it has to be demonstrated that large radiological releases can be prevented when assuming an extreme but plausible EE (only 1 load considered, not multiple loads)			Rejected	National regulations may always require more than the IAEA Safety Standards. The paragraph 2.13 is necessary not because some member states have such practices, but because the design of the plant must provide for an adequate margin (cf. paragraphs 5.21, 5.21A 6.19B and 6.40A of SSR-2/1 Rev.1).
17	2.16	The goals for the engineering design of SSCs should be: (i) functionality; (ii) capability; (iii) margins; and (iv) reliability when subjected to ~~all~~ applicable loading combinations and in all relevant plant states (operating, design basis accident conditions, and Design Extension Conditions (DECs)).	Additional qualifiers are proposed (applicable and relevant) in order to avoid misunderstanding. Indeed, without such qualifiers, it could be understood that all combinations have to be considered in all plant states! For example, if there is no reason for the DEC situation to be induced by the EE, the DEC situation should not be postulated after the EE and the corresponding loadings do not have to be considered in the design.	Accepted. The paragraph has been deleted based on a comment by ENISS.			

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
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18	2.18	Cumulative safety margin ??	It is not clear how cumulative safety margin is to be calculated. It is not a simple algebraic summation. The guidance should clarify.	Accepted. The paragraph is changed to reflect the comment as follows: In terms of "margins", nuclear codes and standards implicitly or explicitly yield the "margin" achieved in the design process for individual SSCs. Safety margin for individual SSCs (i.e. the margin that results from the consideration of a variety of load cases) or for the complete nuclear installation should be achieved through the chain of steps from specification of the loading parameters to defining and achieving the SSC			

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
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				performance acceptance criteria.			
19	2.20	~~They~~ **Some of them** should also be checked against conditions exceeding the DBEE,	Not all EEcategory1 items have to be checked against extreme hazards because the objectives are different. In DBEE, the objective is to prevent core melt and in extreme hazard it is to prevent large or early releases. Then it is possible to reduce the scope of items that have to be checked against extreme hazard, compared with DBEE.			Rejected	The intent and the reasoning of the comment is not clear.
20	2.24	typically associated with EEs that are expected to have adverse effects over relatively large areas in the site. **If a DBEE may induce an AOO or DBA, then it should be demonstrated that a sufficient number of redundancies remain available to bring the plant to a safe shutdown state.**	Requirement is missing			Rejected.	The paragraph refers to the requirement from the Design Requirements (Requirement 17 of SSR-2/1 Rev.1). The proposed text goes beyond the intent of the paragraph.
21	2.36	In designing for DBEEs, the systems design of the installation should adhere to the single failure criterion **for active components**,	It is not expected to apply the single failure criterion to any item that contributes to the protection against the consequences of EE: walls or dykes are generally not redundant.	Accepted.			
22	2.39	~~2.39. For new designs, the design should represent the best balance among system layout, safety aspects (system and nuclear~~	This statement is not specific to EE and should be moved in another general guide		Add to the end of the paragraph: '…taking into		

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
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		~~installation), operational aspects, and other important factors.~~			account relevant external events for the installation.'		
23	2.41	The systems not protected against BDBEEs ~~(items not important to safety)~~ should be assumed to be 'operable' or 'non-operable', depending on which status provides the more conservative scenario in the evaluation of protection measures against the BDBEE.	For certain external hazards, certain safety classified SSC do not need be not protected. There is not a bijection between items important to safety and protection against BDBEE.	Accepted.			
24	2.45	2.45. If required, e.g. by national regulation, for each EE, an evaluation should be made to determine the possibility of a cliff edge effect at some beyond design basis loading condition and, if this is the case, an estimate of its probability of occurrence should be made (paras 2.10 and 2.11).	In some member states only. Actually, it could be deleted as the recommendation is already written in § 2.12	Accepted. Covered by 2.12.			
25	3.12	to be deleted	similar as §2.12 and 2.45. What is the purpose of repeating this recommendation? In addition, it is country specific			Rejected	Because the design of the plant must provide for an adequate margin to protect items important to safety and to avoid cliff edge effects. While some of the wording is similar, the paragraphs in the different sections have specific purposes. See also the response to the Comment number 15.

COMMENTS BY REVIEWER Reviewer: **WNA/CORDEL** Page.40.of. x Country/Organization: WNA Date: 24/10/2018				RESOLUTION			
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26	3.25	to be deleted	similar as §2.12, 2.45 and 3.12			Rejected.	Same as the above.
27	4.19	The following paragraphs refer mainly to alternative (a) above. For alternative (c) risk informed performance based approach can be taken.	Need to give guidance for (c) to limit the consequences of damage to the building			Rejected	The paragraph does not read in the way quoted. There is no reference to 'risk informed approach'