Form for Comments
DS 498, External Events Excluding Earthquakes in the Design of Nuclear Installations

COMMENTS BY REVIEWER **Reviewer: Volker Holubetz** **Country/Organization: Austria, Federal Ministry for Sustainability and Tourism** **Date:28.3.2019**				**RESOLUTION**			
Comment No.	**Para/Line No.**	**Proposed new text**	**Reason**	**Accepted**	**Accepted, but modified as follows**	**Rejected**	**Reason for modification/ rejection**
1	p.1, Footnote 3	Footnote 3 defines DBEE, include also definition of BDBEE and difference to DEC	Since DBEE are introduced at this point, BDBEE should also be introduced here. And since recently the definition of plant states was changed (from BDBA to DEC), for clarity the difference to DEC should be mentioned as well			x	This is done in Paragraph 1.4. The term 'design extension' is not used for external events in order not to confuse with plant conditions.
2	p.3, para 1.10	Instead of "Floods such as due to tides, …": "Floods due to events such as tides, …"	Editorial comment	x			
3	p.10, para 2.19	Instead of "For NPPs, if items identified in accordance with para. 2.18 include the items below, consideration should be given to provide for an adequate margin": "For NPPs, if items identified in accordance with para. 2.18 include the items below, an adequate margin should be provided"	SSR 2/1 requires adequate margin for UHS and control room items, in Requirement 53 and 65, not only to consider to provide adequate margin. It is proposed to stay close to SSR-2/1	x			

4	p. 14, para 2.39	Instead of “In such cases, consideration should be given to providing additional protection in the form of barriers or retrofitting portions of systems to achieve the functional capacity needed.” “In such cases, additional protection should be given if reasonably practicable in the form of barriers or retrofitting portions of systems to achieve the functional capacity needed.”	It is proposed to align the wording for safety improvements in existing plants compatible to the VDNS	x.			
5	p. 15, para 2.44	“Pre-event occurrence administrative measures should be based on the considerations presented in para. 2.19” Para 2.19 talks about classification of components important for safety, not about administrative measures	Editorial, probably reference to another paragraph should be made			x	It is suggested that the administrative measures are also graded in terms of the Structure, System and Component (SSC) categorization.
6	p. 17, para 3.9	Instead of :”The objective of the design basis selection is to keep the radiological risk due to the EE acceptably low, i.e. as low as reasonably practicable and within prescribed regulatory limits.” ”The objective of the design basis selection is to keep the radiological risk due to the EE as low as reasonably practicable, not only within prescribed regulatory limits.”	SF-1, Principle 5: “Optimization of protection”: Protection must be optimized to provide the highest level of safety that can reasonably be achieved” – in general the highest level, that can be reasonably achieved, will be above the prescribed regulatory limits, which are requirements for construction/operation license			x	The proposed wording does not change the meaning of the paragraph. The word ‘and’ provides for both criteria to be complied with.

7	p. 19, after para 3.23	Consider introducing a new paragraph on effects of climate change: "If historical data are used to extrapolate the design loading for meteorological EE for a given annual frequency, adequate margin to account for the uncertainties due to climate change	Extrapolations to derive events like the highest flood level with a return period of 10000 years based on historical recordings are known to be inaccurate due to climate change			x	Inclusion of climate change is treated in the associated Safety Guides relating to the evaluation of hazard.
8	p. 20, after para 3.29	Consider introducing a new paragraph for existing plants: "Existing plants should revisit their hazard analysis to assess whether cliff edge effects as described in para 3.25 to para 3.29 were considered appropriately during PSR.	The importance of cliff edge effects was recognized after Fukushima Daichi accident and, considering the VDNS, existing plants might consider to re-evaluate hazards in respect to cliff edge effects.			x	Inclusion of revisiting the hazard analysis is treated in the associated Safety Guides relating to the evaluation of hazard.

COMMENTS BY REVIEWER **Reviewer:** **Page 1 of 3** **Country/Organization: Belgium** **Date: 2019-04-29**				**RESOLUTION**			
Comment No.	**Para/Line No.**	**Proposed new text**	**Reason**	**Accepted**	**Accepted, but modified as follows**	**Rejected**	**Reason for modification/ rejection**
1	2.23	Add "Requirement 25 of SSR-2/1" and link footnote 10 to this Requirement.	Para 2.23 deals with common cause failures (i.e. Requirement 24 of SSR-2/1), whereas the associated footnote 10 deals more with single failures (i.e. Requirement 25 of SSR-2/1). This is confusing.	x			
2	2.27	"For phenomena of DBEEs and BDBEEs that are expected to develop slowly, the	The existence of a warning system is a prerequisite.			x	The existing paragraph already indicates that

		possibility of warning and precautions should be considered only if a warning system is provided. …"	Warning systems are mentioned in para 2.34 and 5.29 only and should also be mentioned in para 2.27.				this is a prerequisite. The intent of the comment is unclear.
3	2.24 and 2.33	Incorporate 2.33 into 2.24 Consider also referring to DS 494 (Protection against Internal Hazards in the Design of Nuclear Power Plants)	2.33 only asks for probabilistic evaluations for the definition of combinations of EEs with internal events, whereas 2.24 is broader and also considers deterministic evaluations (e.g. by referring to SSG-2). For selecting suitable combinations of events, both deterministic and probabilistic evaluations should/can be used. It may be useful to refer also to DS 494, which contains more detailed recommendations about the identification and characterization of combinations of hazards, including combinations with external hazards (note: this DS will replace NS-G-1.7 [10] and NS-G-1.11 [11])	x			
4	2.33	Probabilistic evaluations should be carried out for the definition of suitable design combinations between EEs and internal incidents[1], addressing their potential correlation. Add a footnote: 1 Internal incidents: this does not include the PIEs considered in the design - see §2.19 for the EE-categories	It is important to clarify that the §2.33 does not change the content of §2.19 over EE-categories of SSCs– which refers to NS-G-1.6 §2.18 (point c: "… in the event of any postulated initiating events considered in the design, regardless of their probability of occurrence"	x			

5	2.34	Remove or clarify para 2.34	The purpose of the (stand-alone) para 2.34 is not clear. What is meant with “a challenge to a level of defense in depth” in this context?	x			Para 2.34 is deleted.
6	5.22 &5.23	Merge both paragraphs: 5.22: option A or B for new installations 5.23: option B is valid for existing installations	There is no need to distinguish new and existing installations. We do not see the difference. Why option A should not be considered for existing installation?	x			It may be impractical to raise SSCs to a higher level for an existing NI.
7	5.37 & 5.38	Merge both paragraphs	idem	x			It may be impractical to raise SSCs to a higher level for an existing NI.
8	5.69/line n°1	“Damage due to the hazards described in para. 5.68 …”	Bad reference in the original text (para. 5.58 in place of 5.68)	x			
9	5.90/ line n°1 on page 41	“Precautionary measures should be taken to reduce the amount of combustibles and inflammables in the vicinity of the plant …”	Quantities of inflammable substances in the vicinity of a site also play a large role in external fire, not only combustibles	x			
10	7 / title	“Application of management system”	Bad typo: system and not system	x			
11	References	replace “No. NS-G-X.Y” with “No. SSG-XX” if possible	References [10], [11], [12] and [18] are publications for which a revision is in preparation. Use (or add) the new “No. SSG-XX” if already known.	x			This will be fixed at the last stage of development process of the Safety Guide.

COMMENTS BY REVIEWER Country/Organization: Canada Date: April 29, 2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.3 (2)	Safety analysis for Design Basis External Events (DBEEs), Design Extension External Events (DEEEs) and Beyond Design Basis External Events (BDBEEs).	There is a need to be consistent with Safety Report Series 86, a recently issued IAEA document related to this topic. Design Extension External Events are a subset of Beyond Design Basis External Events taken into consideration in the design phase. It should be explained in this document as well.			x	The term DEEE is found to confusing with the plant state DEC. The decision was made to delete this term also based on the feedback from some member states.
2	1.4	In this Safety Guide, the term “Beyond Design Basis External Event” is used to indicate a level of external hazard exceeding those considered for design and “Design Extension External Events” a subset of Beyond Design Basis External Events taken into account in the design phase. These events are derived the hazard evaluation for the site and has the purpose to provide margins and to avoid potential cliff edge effect.	The difference should be made between the existing facilities and new designs. The title of the document is External Events Excluding Earthquake in the Design of Nuclear Installations. Therefore, the document should be focused on design not on the assessment. There is a huge resistance in industry design standard committees to use the term Beyond Design for Design purposes. This conflict should be avoided. Design Extension is a term that is accepted by technical standard committees.			x	Design of a NI includes considerations for margin assessment to events exceeding the design basis levels. This is also part of checking for cliff edge effects.
3.	1.9	See Comment 2				x	Pls see response above.
4	2.5	Two levels of external event hazards should be considered for the design of those structures, systems and components (SSCs) identified to be important for nuclear installation safe performance when subjected to EEs. The fist level is	The difference should be made between the existing facilities and new designs. The title of the document is External Events Excluding Earthquake in the Design of Nuclear			x	Pls. see above response.

		the DBEE. The second level should be selected to be higher than design basis and used to provide design margins and to avoid cliff edge effects. This is called the DEEEs. If DEEEs level is not taken into account in the design phases, the SSCs should be evaluated for BDBEEs to assess existence of safety margins.	Installations. Therefore, the document should be focused on design not on the assessment.				
5.	2.11	External events that are more severe than the design basis should be taken into account for the potential cliff edge effects, considering their likelihood. Some examples of how DEEEs could be defined are as follows:				x	There is no reason provided for the comment. The intent of the comment is unclear.
6.	2.16	In the design of nuclear installations to DEEEs, acceptance criteria applicable to the treatment of design extension conditions (DEC) should be applied.	DEEEs and DECs are at the same level regarding design acceptance criteria.			x	DEEEs are not defined in this Safety Guide.
7.	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 BDBEE, and particular site conditions, and should include adequate margin for uncertainties.	In general mitigation actions are not meant for DBEE.	x			DBEE will be deleted from the paragraph.
8.	2.41	The following aspects should also be considered in a design to meet safety requirements: - In considering the occurrence of DEEEs, the design should ensure …	DEEEE are taken into account in the design phase, nor BDBEE.			x	DEEE is not defined in this Safety Guide.
9.	2.43	"In the nuclear installation design for protection against DBEEs, adequate robustness should be ~~used~~ adopted to provide the installation with ~~additional capacity~~ adequate margin for BDBEEs for conditions in the selected EE scenario"	Clarification of the intent of the requirement, improved with formal technical terms. Also, please provide technical terminology of "robustness" in a similar way as the draft did for "adequate margin."	x			
10.	2.44	Administrative measures for BDBEEs.	Administrative measures should not be credited for DBEE, only for DEEEs.			x	DEEE is not defined in this Safety Guide.
11.	3.10	To satisfy this objective, the specification of the DBEE and DEEE should include an	BDBEE should be changed to DEEEs. DBEE and DEEE are			x	DEEE is not defined in this Safety Guide.

		evaluation…	not conditions they are events. Please remove the word "Conditions"				
12.	3.26	- Define the DEEE by a factor of times…	BDBEE should be changed to DEEEs. BDBEE are not conditions they are events. Please remove the word "Conditions"			x	DEEE is not defined in this Safety Guide.
13.	3.26	The key element of DEEE is definition of the conditions…	BDBEE should be changed to DEEEs. BDBEE are not conditions they are events. Please remove the word "Conditions"			x	DEEE is not defined in this Safety Guide.
14.	3.27	The definition of DEEE conditions…	BDBEE should be changed to DEEEs. BDBEE are not conditions they are events. Please remove the word "Conditions"			x	DEEE is not defined in this Safety Guide.
15.	4.8	"The principle of physical separation ~~cannot~~ may not be used for the containment building structure, since there is normally no redundant building."	Use of "may" considering the applicability of the clause and the high-level purpose of this safety standard since there might be part of the containment designed being physically separated. The containment may extend in a broad range (not only include the part within the reactor building) depending on different design.	x			
16.	4.11	"The 'dry site' concept defined in para. 7.5 of SSG-18 [7] should be considered ~~the best~~ as the layout approach for protection against floods."	Technical language improvement.		x		…as the preferred layout approach…
17.	4.22	"A ~~very careful~~ systematic assessment of the basic assumptions and applicability ..."	Use of formal technical terms.	x			
18.	4.24	"EEs may be of a very infrequent nature. In these cases, statistically independent loading from any single event ~~are~~ can be combined with	Correctness of the technical language. The loading factors should be defined within the risk-informed framework	x			

		normal operational load ~~using unity load factors for all loadings.~~ Multiple external event loadings normally need not be combined"	based on the acceptance level approved by regulatory authority. In addition, multiple external events (causal or concomitant events) sometimes need to be combined as described in the subject safety standard.				
19.	4.31	"Refined modelling and analysis (e.g. structural joist, steel rebar in reinforced concrete, structural interfaces and liners) should be reviewed and verified using other approaches as required."	Some refined models could provide very accurate representation of the engineering for the design purpose, depending on the material, loading and nature of the refined analysis.	x			
20.	4.35	"Equipment necessary for performing safety functions during and after the occurrence of a DBEE, should be ~~functionally~~ qualified for the induced conditions, including vibration."	Qualification should include a broad range of the performance evaluation of the equipment including the functionality, integrity, stability etc.			x	The point of the paragraph is functional qualification. Other types of qualification are treated elsewhere.
21.	4.46	"BDBEEs should be considered as a very infrequent event and corresponding loads should be combined only with normal operational load ~~using unit load combination factors~~."	Correctness of the technical language. See comment #8.	x			
22.	5.67	"Methods in the assessment for beyond design basis wind (BDBEE) ~~should normally be~~ may be the same as in the design for design basis wind (DBEE)"	Correctness of the technical statement. There is no technical obligation that methods in BDBEE assessment should be the same as that for the DBEE. For DBEE, wind effect is normally accounted by the prescriptive provisions in a deterministic way, while for BDBEE, probabilistic assessment is normally used (e.g. fragility analysis) for the			x	The word 'normally' allows for exceptions.

			best estimation of both structure and loadings.				
23.	5.168	"~~A specific equipment qualification program should be carried out for~~ The potentially affected items should be qualified if the equipment is not explicitly qualified for short transient load but only for steady state vibration in the low frequency range typical for seismic qualification"	Whether a program needs to be established for the subject purpose should be governed by the quality assurance requirement of the nuclear plant at different States.	x			
24.	4.42 5.66 5.77 5.106 5.133 5.153 5.196 5.234		The title Approach to structural assessment for beyond design basis external event is out of the scope of the document. The focus of the document is on the design.			x	Design of a nuclear installation includes considerations for margin assessment to events exceeding the design basis levels. This is also part of checking for cliff edge effects.
25.	General	This safety standard may consider the way of using "shall", "should", "may", "can" in writing the technical requirements or recommendations. □ "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; □ "should" is used to express a recommendation or that which is advised but not required; □ "may" is used to express an option or that which is permissible within the limits of the standard; □ "can" is used to express possibility or capability.	Writing of the technical language.	x			However, this does not really bring any changes except those pointed out by the reviewer and already accepted above.
26.	General	This safety standard made many specific technical conclusions or recommendations without referring	Include the source of the supporting technical references.			x	Reference to documents other that IAEA (or other UN)

		to the supporting technical reference in Reference section.					publications is not possible.

COMMENTS BY REVIEWER Reviewer: M-L Järvinen Page.... of.... Country/Organization: Finland/STUK Date:23th April 2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	General	IAEA has developed the term Design Envelope to deal with design basis including DECs. The terminology in the Safety Guide should consider the existing definitions and new development should be in line as appropriate. DBEE Design Basis External Event BDBEE Beyond Design Basis External Event The terminology introduced in the Safety Guide draft DS498 is confusing. There is no definition for the terms in IAEA Glossary or in the Safety Guide. Both types of external events should be considered in the design. Adequate margins in the design should be considered already at the design phase. The existence of margins is demonstrated by DEC analysis.				x	The term BDBEE is used instead of DEC in order to avoid confusion of the EE with the plant state. The term 'plant' is used to provide the most stringent recommendations, then using the graded approach these are slackened for other types of nuclear installations. Nuclear facilities also include 'waste' related facilities which are outside of the scope of this Safety Guide.
2	Footnote 2 on p. 1 and 2.1 quotation of SSR-2/1 Art. 5.17 and IAEA Safety Glossary	The definitions of external event are confusing: Footnote 2 on p.1: "… originates outside the site …", " …Events originating on the site but outside the safety related buildings should be treated the same as offsite EEs."	In practice ambiguous definitions may result in overlooking some types of events in design or review, although the substance of guidance in DS498 seems to be clear.		x		The external events in the draft covers the events originating on the site but outside the safety related buildings should be treated the same as offsite EEs. Safety Glossary will be change in the future,

		SSR 1/2 5.17 " … EEs (i.e. events of origin external to the plant) …". Safety Glossary "*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*.." Suggestion: add a note that slightly different definitions of External Event are used in different contexts in IAEA publications.	The meaning of plant or facility may also be unclear: what are, e.g., missiles from different units of the same plant?				accordingly. So, note was added as "Slightly different definition of External Event is used in this publication.
3	Footnote 11, p. 16	~~initial event~~ > initiating event	See Safety Glossary			x	The meaning in the footnote is different from the Glossary definition of an initiating event.
4	1.10/28	… ~~Cyclones (hurricanes, tornadoes and tropical typhoons) and straight winds;~~ High wind speeds due to tropical cyclones (hurricanes, typhoons), extratropical cyclones, tornadoes and downbursts …	From a meteorological point of view, the current text, as "Cyclones (hurricanes, tornadoes and tropical typhoons) and straight winds" is not quite clear. Tornadoes are neither tropical nor extratropical cyclones.	x			
5	2.3	SSR-1 [4] requires proposed sites for a nuclear installation6 to be evaluated for external natural and human induced events with emphasis on the frequency of exceedance and severity of the events. For this purpose, external event hazards should be assessed. The methods of hazard assessment can be deterministic or probabilistic. Potential combination of events should be considered. The representativeness of recorded data should be considered and phenomena such as climate change should be considered	Please add: The representativeness of recorded data should be considered and phenomena such as climate change should be considered when assessing design basis of the nuclear facility. Para 5.77 does not cover all the aspects of climate change that should be considered.			x	Climate change is considered in the evaluation of the associated hazards and considered in the context of SSR-1.

		when assessing design basis of the nuclear facility.	5.77. Beyond design basis for other meteorological events should be considered taking into account predictions of climate change that may affect the design basis parameters already considered.				
6	2.40, 2.41	see comment on DBEE and BDBEE	Sections 2.40 and 2,41 are very similar. Can they be combined?			x	DBEE and BDBEE are considered in the two paragraphs respectively.
7	2.42	Provisions in the design to protect the installation against DBEEs and BDBEEs should not impair its response to other design basis events or operational procedures. In designing for additional protection, it should be borne in mind that barriers can introduce difficulties for inspection and maintenance~~, while a greater spread in installation layout may require more staff to handle the increased task of surveillance, as well as longer routing of piping, cable trays and ventilation ducts.~~ A balanced design of protective measures should be made.	Please consider revising or deleting the sentence "while a greater spread in installation layout may require more staff to handle the increased task of surveillance," The staff requirements shouldn't be explicitly mentioned			x	There are other considerations in the proposed deleted text such as longer piping etc.
8	3.9	... and mean annual early release of radioactivity frequency (LERF) <u>and/or large release frequency (LRF)</u> need to be within regulatory body guidelines. or frequency of large release (LRF)	In some member states requirements are set on LRF.	x			
9	3.10	~~important to safety SSCs~~ SSCs important to safety		x			
10	3.14/3		Since DS498 excludes earthquakes, it might be good to give here another example of causal events.	x			
11	3.16	Please add:			Accepted with modification –		Current terminology.

		In the walkdowns "household" aspects should also be addressed, e.g., loose equipment and furniture, fastening of equipment (gas bottles, ladders) and transient fire loads.			change ‘household’ to ‘housekeeping’.		
12	4.19	~~safety relates~~ safety related		x			
13	4.24	… The need to combine multiple external event loadings should be assessed. All effects from a single design basis external event should be properly combined, with due attention paid to the physical meaning of the combinations. Furthermore, when a causal relationship or a correlation exists between events, the effects should be properly combined, as necessary. In the case of meteorological events and floods, causal relationships are discussed in SSG-18 [7].	It is oversimplified to say that multiple external event loadings need not be combined. The need for justification should be emphasized. Sometimes the plant designer may have poor prior understanding of the external events and their dependencies at the site.	x			
14	4.44	The logic presented in article 4.44 needs some explanation. Perhaps a reference to expert judgement could be added.	If the size and frequency of a hazard are unknown, how can the adequacy of the margin be evaluated?			x	Guidance is provided in the footnote.
15	5.1	- Tsunami (seismic or meteorological) - Seiches (seismic or meteorological)	In some regions meteotsunamis may be important cases of rapid water level rise.			x	In the context of IAEA Safety Standards, there are no meteotsunamis. They are caused only by a displacement of the sea (or lake) bed.
16	5.7	The last sentence need clarification: "The water level of the design basis flooding can be defined at a location or a series of locations off-shore where the linear long wave theory applies and reflected waves from the coast are not significant."	The meaning of the statement is not clear.	x			The sentence is deleted. The clarification that is needed would be unduly long and too detailed.
17	5.42	The meaning of terms "rare condition" and "extreme condition" in connection with design should be explained.	The terms are not defined in the Safety Glossary.			x	They are taken from the corresponding Safety Guide on hazard evaluation.

18	5.59	… and chemical and physical properties of the sand or dust particles.	Particle properties, salinity, particle size, hardness etc. may influence their effects on the plant.	x			
19	5.61	- conductive missiles, e.g., steel sheet wall panels, may cause short circuits at the switchyard;	This has happened in conventional power plants.	x			
20	5.69/1	Damage due to the hazards described in para. 5.~~5~~68 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, ventilation and diesel generator combustion air intakes, access by the operator to external safety related facilities and mobility of emergency vehicles. Extreme air or water temperature could affect the heating, ventilation and air-conditioning systems of rooms housing systems important to safety (especially electronic equipment) and the availability of the UHS. These should be considered in design and safety analysis of the installation.	Please correct the reference. It is now "5.58", but based on the context, it should be "5.68".	x			
21	5.76	~~do not blocked~~ are not blocked		x			
22	5.77	~~climate change~~ climate variability and change	It might be useful to mention natural variability due to long term oscillation (years to decades) as it may complicate trend treatment in hazard analyses.	x			
23	5.94	~~Diesel generators usually need air~~ Diesel generators and other emergency power source need air …	Should other emergency power sources such as gas turbines be mentioned besides diesels?	x			Since it is similar to para 5.105, it is deleted. Change is made in para 5.105.
24	5.111	The interface with security issues should be mentioned in connection with explosions.	The draft guide includes few references to security requirements or guides, (general reference in article 1.14 and EMP in article			x	There is no IAEA security document on this topic for interfacing.

			5.201), although the effects and analysis and protection methods are in many cases the same for both malevolent and accidental events.				
25	5.134	Treatment of oil spills as a hazard to the UHS could be more extensive.	Oil spills are treated mainly in connection with ship collisions. At some sites major oil spills from tanker ship accidents at nearby shipping routes may constitute a significant risk of long term loss of the UHS.			x	Oils spills are mentioned in several places in the text related to the topic under discussion.
26	5.196	Please rewrite the paragraph. For large airplane crash best estimate methods are used and N+1 criteria is not required. The criteria such as no extensive fuel damage occurs are used. ~~If for any reason beyond design basis aircraft crash is considered involving fully fueled commercial airplanes, acceptance criteria should be chosen such that as a minimum the safety related items of the nuclear installation that are involved in the fourth level of defence in depth remain functional.~~	Reference to DiD level 4 is confusing. DiD level 3 functions may be more appropriate. It would be better to define the technical goal instead of using DiD levels.			x	The exact purpose of the comment is not understood.
27	5.205	Please add: Especially regarding mussels and clams, growth in the plant seawater systems and outside growth entering with seawater should be considered, as the methods for detecting and protection are different.		x			

COMMENTS BY REVIEWER Country/Organization: FRANCE Date: pages				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	General	DS498 quote SSR-1 which is not a published standard while NSR-3 is published: the relevant quotation should be done in final version of DS 498				x	SSR-1 is published. Reference is given to SSR-1.
2.	1.4	The term "Beyond Design Basis External Event" is used to indicate a level of external hazard exceeding those considered for design, derived from the hazard evaluation for the site and that has the purpose of evaluating the sufficient margins to avoid ~~that exist in the design as well as the identification of potential~~ cliff edge effects	Consistently with SSR-2/1 (e.g 5.21, 5.21a), the guide should be clear regarding margins (which is vague and should be "qualified") and cliff edge: for the design of a new facility, it seems essential to provide as early as possible sufficient margins to deal with extreme hazards. It must not limit to knowing cliff effects, but we must try to avoid them.			x	The proposed text suggests that the margin will always be sufficient.
3.	1.10	*Natural events* - Floods - … - Any combinations of the above as a result of a common initiating event.	Combinations are only mentioned for human induced events but not for natural events. However, it exists many natural events which are linked. For example, storm and lighting, storm surge and storm, low water (drought) and heat wave. Combination of hazards shall also be considered for natural hazards		Accepted. Additional bullet to be 'any combination of the above'		'Initiating event' has a specific meaning which is avoided in this Safety Guide.

4.	§ 2.0	~~SAFETY MARGIN~~ 2.7. Paragraphs 5.15A and requirement 14/16 of SSR-2/1 enhance that items important to safety should be adequately designed to ensure that the installation could be maintain in a safe state in case of DBEE. Paragraphs 5.21 and 5.21A of SSR-2/1 (Rev. 1) [1] emphasize the need for the design organization to provide a design with adequate margin8 to (i) protect items important to safety against levels of external hazards and to avoid cliff edge effects; (ii) protect items ultimately necessary to prevent an early radioactive release, or a large radioactive release9 , in the case that natural events greater than those considered for design occur.	Objective/requirement is missing in chapter 2 regarding DBEE. Requirement 14 and 16 for SSR-2/1 and equivalent requirements for SSR-3 and 4 should be considered also	x			
5.	2.1	To avoid or minimize any interaction	For news building the first option is to try to avoid interaction between buildings			**x**	Para 5.19 is quoted from SSR/1.
6.	2.4	~~The end products of hazard assessments should be hazard descriptors, expressed by information on the annual frequency of exceedance versus information on the severity levels of the hazards, descriptions of ail hazard assessment methodological elements and parameters of importance (including screening methods and results), assumptions made in the hazard assessment process and characteristics of the hazard descriptors. This information should be communicated to the responsible design organization~~	Consider deletion: this article is not understandable (what is a descriptor, this objective is to achieve safety not to obtain information, why to communicate to the designer as the current guide is yet for the design…)			x	This is paragraph intends to establish the interface between hazard and design.

7.	2.5	[…] the second level should be selected to be higher than the design basis and used in the evaluation of the nuclear installation in order to take into account sufficient ~~evaluate the uncertainty in external hazard estimations and~~ safety margins to avoid a cliff edge effects. This is called the BDBEE7.	The sense of margin assessment is not to consume theses margins to cope a BDBEE but to ensure the protections availability with an high level of confidence. As a reminder: For internal events, DEC is not a margin assessment of SSC important to safety used to cope with DBA. DEC are quite another level of defense in depth implemented to search credible accident (generally following probabilistic methods or common failure more severe than single failure criteria) and to set SSC to deal with these accidents.	x			
8.	2.8	2.8. The margin ~~is understood to be the result of the variability and uncertainty of the different methods, data, assumptions and rules applied for the design that~~ provides the SSCs the capability to safely perform even in situations more severe than those postulated in the design basis without the incurrence of cliff edge effects. ~~The analysis should consider all applicable epistemic and aleatory uncertainties. Another~~ A source of margin is design of the SSCs for a wide range of internal and external extreme loads, for example, pressure and other environmental loads due to accident conditions, aircraft crash, tornado, pipe break, seismic loads, and the governing loads for some SSCs could be different.	Consideration of uncertainties and application of adequate rules, assumption… does not provide margins, they provide confidence that SSCs will be able to perform their safety functions. Margins come after			x	Uncertainties that need to be considered for internal extreme loads, for example, provide margins for external loads.

9.	2.13-2.17	Paragraphs 2.13 to 2.17 : consider deletion	These articles are close to proposals of methodology and are not relevant in a chapter dedicated to general concept. Moreover these methodologies could be highly questionable since there is a mix between the margins to be taken into account on the DBEE and the BDBEE margins: margins remain a vague term and there should not be misunderstanding between margin assessment to reinforce confidence in DBEE assessment and margins that should be implemented regarding event more severe than those considered in the design basis according to SSR-2/1, SSR-3 and SSR-4. As a consequence, it is not possible to endorse these articles			x	While strictly speaking the proposal is reasonable, there is room for explanations that would provide for a clearer understanding in the international community.
10.	2.18	In the design and evaluation process for each individual EE to be considered, ail SSCs ~~items~~ that are affected by or exposed to the EE under consideration should be identified. The list of the identified SSCs ~~items~~ should include all equipment ~~SSCs~~ including ~~as well as~~ any barriers or protective structures built to specifically deal with the EE	The term “items” may be too vague.	x			
11.	2.22	When evaluating the effects of EEs on the installation, it should be ensured that realistic and credible scenarios are identified and covered ~~developed~~ by a conservative scenario. A scenario enveloping all possible effects with a single loading condition is unduly conservative.	Precision in the text	x			

12.	2.24	~~Unless a combination of events is shown to have a sufficiently high probability~~ If the combination of two independent events is plausible, a DBEE or a BDBEE should ~~not~~ be considered in combination with other ~~rare~~ event~~s~~ that may occur independently, such as other external human induced events, natural phenomena, equipment failures and operator errors. When assessing a combined event, the possibility of a concurrent or causal relationship should be evaluated […]	"A sufficiently high probability" seems to refer to only a probabilistic approach and it is not the only way to identity combination consistently with SSR-2/1, SSR-3 and SSR-4 (see 5.32 of SSR-2/1 for example). When the combination is plausible/credible, the question should be studied	x			
13.	2.29	Off-site infrastructure and assets, which, under normal circumstances, may be expected to provide various types of support to the nuclear installation may be unavailable. ~~If the extreme conditions postulated for the site could exist for a considerable~~ After the occurrence of a hazard (DBEE or BDBEE), so that the safety of the facility is guaranteed in a long period of time (long term), the feasibility of providing any backup measure from off-site resources should be evaluated. Therefore, realistic assessments should be made of the ability to receive off-site support under ~~extreme~~ conditions corresponding to DBEE or BDBEE in the site region. An adequate capacity of off-site infrastructure and assets should be ensured for such circumstances, otherwise such backup measures should be excluded from the safety analysis.	“extreme”/”considerable” are not defined terms			x	Not all terms are defined in the Safety Guide. It is difficult to ‘guarantee’ the safety of the plant – a term which is also not defined.
14.	2.33	Probabilistic or deterministic evaluations should be carried out for the definition of suitable design combinations between EEs and internal incidents. ~~addressing their potential correlation~~.	Probabilistic assessments are not the only possible approach. A deterministic approach can also be used ‘see for example 5.32 of SSR-2/1). Combinations can even be retained without necessarily having correlations.	x			Para 2.33 is merged with 2.24.

15.	2.34	If a challenge to a level of defense in depth is envisaged, operating procedures should be put in place for normal operation, supported by adequate warning Systems (where possible) and monitoring (see the following subsections) and recognizing that pre-~~BDB~~EE and post-~~BDB~~EE actions need to be included.	This is also the case for DBEE		x		Para. 2.34 is deleted. Please see Belgium's comment 5.
16.	2.35	In designing for DBEEs, the systems design of the installation should adhere to the single failure criterion for active components, which may be achieved by means of the redundancy of safety systems or trains in a system taking due account of the potential common cause failure incepted by external hazard. It is also relevant for passive components, unless it has been justified in the single failure analysis with a high level of confidence that a failure of that component is very unlikely and that its function would remain unaffected. The acceptance criteria used in relation to DBEEs should be based on those which are applicable for DBAs.	The specificity of EE regarding external hazard should be enhanced. Moreover, article 2.35 should be consistent with SSR-2/15.40 and SSR-3 6.77. Besides, as many protections against EE are passive, this paragraph is not ambitious and forgets main vulnerabilities.	x			

17.	2.36	Protection of a nuclear installation against EEs should be provided using one or more of the following basic methods; (a) The causal influences of an external event are reduced by means of a 'passive barrier', e.g. 'dry site' for flood, site protection dam for flood, external shield for aircraft crash and barriers for explosions; (a') when the causal influence can not be manage by barrier, protective SSC (such as HVAC) are needed to ensure that safety related SSC remain in ambient conditions compatible with their availability; (b) Safety systems effectively resist the effects of EEs due to: (i) adequate system design, including diversity, redundancy, physical separation, and functional independence (see Requirements 21 and 24 of SSR-2/1 (Rev. 1) [1]); and (ii) adequate engineering design of SSCs when subjected to the EE loading conditions; (c) Administrative measures, such as the establishment and enforcement of no-fly zones.	The Safety Guide is oriented EQ/aircraft/flood and miss safety issues. Some EE, such as external temperature cannot be cope with these methods		x		HVAC would be under item (2) of the paragraph.
18.	2.42	Provisions in the design to protect the installation against DBEEs and BDBEEs should not impair its response to other design basis events or operational procedures. ~~In designing for additional protection, it should be borne in mind that barriers can introduce difficulties for inspection and maintenance, while a greater spread in installation layout may require more staff to handle the increased task of surveillance, as well as longer routing of piping, cable trays and ventilation ducts. A balanced design of protective measures should be made.~~	OK with the first sentence. The rest of the § is not clear. When a modification is added, in any case, the designer shall anyway ensure that there is no risk of regression for safety.	x			

19.	2.43	In the nuclear installation design for protection against EEs, adequate robustness should be used to provide the installation ~~with additional capacity for BDBEEs~~ for conditions in the selected EE scenarios. In general, this capacity should be provided by a combination of the following: high quality design, low sensitivity to variation in design parameters, and high and demonstrable conservatism in material selection, construction standards, and QA. ~~An evaluation of the design conservatism should be carried out either with probabilistic tools or by deterministic bounding analysis.~~	Adequate robustness is expected for both DBEE and BDBEE Probabilistic tools do not generally provide conservatism			x	The paragraph aims to point out additional capacity for BDBEE. It is not true that probabilistic tools cannot provide conservatism.
20.	3.13	All operational modes should be considered at the time of occurrence of any DBEE or BDBEE, such as full power, hot shutdown, cold shutdown, refueling outage, maintenance and repair. Relevant combinations postulated initiating event and EE should also be considered. During long term phase following a postulated initiating event, DBEE shall be assessed to justified that relevant SSC remains available.	Scenarios of EE combined with internal event shall be screened in or out in particular, for frequent transient (scram, abnormal event/ common transients…). EE can also occur during long-term phase of an accident.		Addition of the BDBEE accepted. Additional sentences rejected.		While EE may occur during a long term phase of an accident, the occurrence of a BDBEE during a short period of time would be screened out.
21.	3.16	Systematic inspections by expert engineers organized in a formal installation walkdown should be performed for new installations during commissioning: to provide final verification of the design for EEs, including also internal interactions through internal fire, flood, mechanical impact and electromagnetic interference; to verify that there are no unanticipated situations; and to provide sample verification of specific design features. […]	No comment on the article itself, but it mentions the risk of interactions between internal hazards to verify during the commissioning of a facility. The risk of interactions between internal hazards is to be taken into account in the design phase: why isn't mentioned for the design in the current document			x	The point of the comment is unclear.

22.	3.18	The performance criteria should target, as appropriate, the overall and local structural integrity of SSCs (e.g. leak tightness, lack of perforation13, lack of scabbing14; operability of equipment, components, and distribution Systems) and the level of reliability ~~fidelity~~ associated with the design procedures to be applied (e.g. static, dynamic, linear, non-linear, one-, two-, or three-dimensional analyses).			x		A better word would be 'compliance'.
23.	3.24	DERIVATION OF **DBEE** LOADING CONDITIONS: EE SPECIFIC Subsequent sections of this Safety Guide address specific EEs. For each external event, the DBEE and BDBEE is presented starting with screening by SDV and SPL, the categorization of SSCs, the definition of the loading conditions (parameters) associated with the DBEE and BDBEE, the design and evaluation of the SSCs when subjected to the loading conditions, and the likelihood and consequences of failure of SSCs. For each EE of interest, the possibility of the EE loading condition(s) creating a "cliff edge" effect should be assessed.	The title mentions the DBEE, the text mentions also BDBEE. Not homogeneous. SDV and SPL should be explained		x		Title is revised. SDV and SPL were mentioned first in para 3.3 and 3.4 and reference given to NS-G-3.1 in footnote 14. Explanation of SDV and SPL are given in NS-G-3.1.
24.	3.26	~~DBEE should be based on the hazard evaluation for the site~~. In order to assess the margins and evaluate cliff edge effects, alternatives to define the BDBEE and the associated loading conditions are: - Define the BDBEE conditions by a factor times the DBEE loading conditions similar in concept to the requirements for Beyond Design Basis Earthquake loading conditions for new nuclear installation designs, - Define the BDBEE conditions based on the probabilistic hazard assessment and its estimated occurrence frequency.	See previous comment This bullet is not clear. By it should not be understood as if PSA is the methodology for BDBEE assessment		x		First part is accepted. For second part, probabilistic approach is one alternative.

25.	3.27	The definition of BDBEE conditions is innately coupled to the performance and acceptance criteria for SSCs and/or the nuclear installation. Similar to those for DEC, methodologies to evaluate BDBEEs may be best estimate, i.e. relaxed from design methods or material properties ~~and acceptance criteria~~.	Use best estimate values of material properties, or advance calculations for BDBEE. But acceptance criteria should not be changed if the requirement is still the same. If water-tightness is required under BDBEE, what is a relaxed acceptance criterion? Generally, it would be better for the redaction to use the notion of safety requirement instead of acceptance criteria			x	For example, allowing some inelastic behavior for the BDBEE is a relaxation of the acceptance criteria.
26.	3.28	Consider deletion	**3.28 is purely probabilistic, thus not consistent with safety requirements and cannot be endorsed as a consensus**			x	The first bullet is probabilistic and the second one is deterministic.
27.	4.8	Primary containment located potentially within either a secondary containment or an external structure capable of withstanding postulated EEs	Single wall containment is also acceptable.	x			
28.	4.15	~~Roof design should not permit the build up of snow, rain or ice exceeding the roof design loads~~. Roofs design should take into account the possibility of building up of snow, rain and ice.–The layout should include provisions that account for accidental clogging of drainage.-	It is the other way round: the design loading should always exceed the potential load. Maybe to be address in a specific § about snow (see remark below)		x		‘Roof design’ instead of ‘Roofs design’.

29.	4.17	~~Some of the EEs can be considered as extreme events, which are more frequent than rare events. This is the case, for instance, of wind load when it does not include tornado or hurricane conditions. In these cases, external event loads should be combined with normal operational loads and with loads from other extreme events, with combination factors dependent on the Member State practice. A combination of probable maximum storm surge with 10 year wind wave effects is an example of such cases.~~	The "concept" of rare compared to extreme is not understandable Tornado or hurricanes are different than wind (not the same phenomenon), they must be studied independently than wind. The design shall cover all hazards that can be occurred on the site. The notion of "extreme events" shall be considered here like the intensity of the EE and not like the probability of occurrence.			x	This originates from the hazard evaluation Safety Guides and needs to be retained. For example, wind loading is always present, and its extreme values are important. However, a tornado is a rare event. There is a phenomenological difference.
30.	4.20	For each external event to be considered in the design, hazard parameters should be used to derive DBEE and BDBEE parameters usable in the design and evaluation process. ~~Care should be exercised to maintain consistency between the results of the hazard analyses and the parameters to be used for design.~~	The study of the safety analyze of the hazard is a part of the design. Suggestion to remove the second sentence			x	Often, there are problems in hazard evaluation/design interface. This is a cautionary remark.
31.	4.21	The derivation of the design basis parameters and the relevant loading scheme for the selected design basis EEs should be carried out consistently with the level of detail necessary for the design limit assessment	not understood			x	Pls see response to the previous comment.
32.	From 4.24 to 4.28	Load combinations and acceptance criteria Preliminary note: the following articles are partially dealing with the topic as only referring to civil works and EE that may impact them. For other hazards and SSCs, they may be useful.	Paragraphs referring to civil works are not relevant for all hazards and all SSC. It shall be specified at the beginning of the section because when we read the title, we wait for recommendations on how to combine hazards in general and here the paragraph is limited to civil engineering			x.	Most mechanical and electrical equipment are not directly exposed to EEs considered in this Safety Guide. That is the reason for emphasizing structural analysis.

33.	4.28	…provide protection against external event loads, as long as the displacements remain acceptable.	Displacements should remain allowable in order to exclude the risk of ruin due to interaction with buildings.	x			
34.	4.42	The rules for ~~design~~ (DBEE) and the rules for ~~assessment~~ (BDBEE) are different. The purpose of the BDBEE consideration 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. Nonetheless, it should be emphasized that the criteria should remain consistent with the safety requirements and consider adequate margins.	BDBEE is part of the design and its assessment should lead to design provisions if necessary: it is not only assessment without actual actions The term "unintentionally" seems inappropriate in the nuclear Safety Guide. A designer must identify and understand the margins origins. The added sentence intends to be more accurate than the previous general ones			x	The added value of the proposed text is not clear.
35.	4.44	For some other external hazards, the approach above may lead to non-credible scenarios. In those cases, a 'hazard agnostic'19 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.~~	Unclear sentence: it seems to recommend to have a challenge!	x			

36.	5.x	SAFETY DESIGN PROVISION AGAINST EXTERNAL EVENTS *No specific § about EE "snow", "high temperatures" and "very cold temperatures" : they should be developed*	It is important that this guide proposes recommendations regarding "high temperatures", notably in the context of global warning. This is all the more necessary as the "high temperatures" can potentially affect the entire nuclear island. Combinations are possible such as losses of external power supplies or problems of low water. Moreover, experience feedback has shown that the EE "high temperatures" and "very cold temperatures" could lead to significant risks for the safety of nuclear installations. Besides, almost nothing is said in the document about snow, whereas some more hypothetical loadings are fully developed. Information about snow and risks of accumulation should be provided. Another option is to write a common § wind & snow **Generally, each EE mentioned in the paragraph 5.68 should be dealt with separately**, like the other EEs of this guide. They are just as important in terms of safety objectives than the other EE developed in detail in these guide.	x			Para.5.74 and 5.75 were added.

37.	5.2 and 5.3	~~Extrem~~ Strong winds Other ~~extreme~~ meteorological conditions	The term “extrem” used let think about BDBEE intensity			x	The term is consistent with the hazard evaluation Safety Guide.
38.	5.52	Of a metal frame building	Concrete building are not concerned by collapse under wind loadings	x			
39.	5.67, 5.133, 5.153	Consider deletion	For some loadings, what is expected for BDBEE is specified. For others nothing is said. Is this article understandable, for example, for asphyxiant (5.153). Moreover, the proposed text is quite fuzzy and opens the possibility to have inconsistency between criteria and safety requirements. If these articles are maintained, they should be modified as follows: “*The differences should be reflected in the material properties used in the assessment and in the acceptance criteria if the requirements under BDBEE are less stringent (see Section 4).“*			x	The same text was introduced to avoid inconsistency in the approaches.
40.	5.44	~~Beyond design basis wind speeds (BDBEE) should be established at an appropriate annual probability of exceedance less than that of the DBEE.~~	Para 5.44 simply trivial? Nothing more than para 2.5			x	The comment has a point, however, it is better than not providing any guidance.

41.	5.68	[…] Other hazards may be connected with these, such as frazil ice, frost and hail.	**Cf comment on temperature** Moreover, Frasil ice is a hazard of the UHS, Frasil ice should be dealt with the other hazards of the heat sink because the risks in terms of consequences on the safety of the facility are the same: the total loss of the heat sink.	x			
42.	5.72	Unless available, special national codes and standards ~~are available~~ for the design of nuclear installations in relation to these hazards~~,~~ of structural design should be developed taking into account the insight of ~~follow~~ the codes and standards for conventional buildings, while equipment should be qualified in accordance with its safety and EE classification	This paragraph is not very ambitious for nuclear facilities. At a minimum, the designer shall ensure the sufficiency of conventional codes and standards with respect to safety objectives. If not, the designer must develop specific safety approaches for these EE.			x	The proposed text is unclear.
43.	5.94	Diesel generators usually need air for combustion. The nuclear installation design should ensure an adequate supply of air to all diesel generators that are needed to perform necessary safety functions. Indeed, an external fire could affect external power supply line.	Additional explanation			x	Since the para is similar to para 105, it is deleted.
44.	5.96	The fire hazard analysis team should be informed that the characteristics of the postulated fire to be modelled include radiant energy, flame area and flame shape, view factor from the target, speed of propagation and duration. Secondary effects such as spreading of smoke and gases should also be specified. Ignition by lofted firebrands, and damages on ventilation inlet filters, should be studied.	Ignition by lofted firebrands is a significant mechanism of fire spread.	x			

45.	5.102	Protection of the plant against external fires initiated outside the site may be achieved by minimizing the probability of a fire and by strengthening the barriers against external fires when necessary. Other design characteristics, such as redundancy of safety systems, physical separation by distance, by separate fire compartments or by specific barriers, and the use of fire detection, deluge fire sprinkler systems and extinguishing systems should also be provided.	Deluge fire sprinkler systems are intended to prevent the radiant heat from spreading and to cool down surfaces of buildings or equipment, especially against external fire.	x			
46.	5.106	Safety related cables, instrumentation and control systems, which have been demonstrated to be particularly exposed and vulnerable to heat flux, smoke and dust, should be qualified or protected for such a scenario.	Additional possible protection measure	x			
47.	5.108	The word 'explosion' is used in this Safety Guide in a general way, to designate all physical event, chemical reactions involving solid, liquid, vapour or gas, that may cause a substantial pressure rise in the surrounding space and, possibly, fire or heat…	Burst, of a pressure gas cylinder for example, is an physical event. It is an explosion phenomenon.	x			
48.	Between 5.117 et 5.118	The potential for flame acceleration and overpressure generation due to obstacles in gas clouds have to be studied. The obstacles were mainly considered to be equipment, piping, structure etc. There may however also be a potential for flame acceleration due to trees and bushes.	New article on the effects of the obstacle, for gas cloud explosions, on the deflagration-induced flame propagation and the variation of the explosion characteristics.		x		Accepted. 'have to be' in the first sentence is changed to 'should'.

49.	5.164	- […] - The effects of fuel initiated fires and explosions on SCCs - The effects of fuel or extinguishing water flows entering into the building, for example through the ventilation system, on moderation control for maintaining nuclear criticality safety of fissile material that may be present.	The consequences of explosions should also be evaluated. It is worthwhile to enhance that fuel (even without fire) and extinguishing systems could have also consequence on fundamental safety functions such as control of reactivity (or avoidance of criticality)	x			
50.	5.207	Analysis of the environmental conditions should be the starting point for the evaluation of such hazards. An inspection environmental monitoring regime should be established which takes due account of the need for passive or active control measures and of the rate of growth of the biological matter.	Suggestion to replace the term "inspection" with the term "environmental monitoring"		Accepted with modification. Second sentence should start with: 'A monitoring regime…'		To avoid confusion with the environmental monitoring program of the nuclear installation.

51.	From 5.205 to 5.234	*Paragraphs (biological phenomena, collisions of floating) dealing with only some hazards and **mix different aspects**. The EE on the safety heat sink should be treated separately than these other EE, the safety issue is not mentioned anywhere, it is missing in the guide*	The EE on the safety heat sink should be treated separately with the specific safety objectives. As a reminder, the safety objectives on the safety heat sink are the guarantee of water supply in terms of transit and water quality. Safety issues are not presented. As a reminder, avoid the total loss of the safety heat seak. safety heat seak **➔Suggestion to review all of these paragraphs and separate the EE on the safety heat sink separately than these other EE** **When reviewing all these paragraphs, suggestion to address all the EE that can affect the heat sink: clogging, low water, frazil, oil, pollution, and so on.** **On other part of the guide, create § on the other biological phenomena**			x	The added value of the involved reorganization of the text is not clear.
52.	reference		Reference 5 should be confirmed: IAEA safety glossary – 2018 edition?	x			

COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)** (with comments of Framatome GmbH, TUEV NORD EnSys, ESK, GRS, Öko-Institut and Physikerbüro) Pages: 27 Country/Organization: **Germany** Date: 18.04.2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	1.1 Line 1	"…nuclear installation[1]…"	As far as term "nuclear installation" is explained in this document with the footnote, namely in para 6.1. (as footnote 28), our suggestion is to move this footnote here, to the first appearance of the term "nuclear installation". All footnotes need to be renumbered in this case.	x			
2.	1.4 Line 3	…. In this Safety Guide, the term "Beyond Design Basis External Event" is used to indicate a level of external hazard exceeding those considered for design basis, 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~~.	The Design Basis External Hazards DBEE are used in a deterministic approach as a design basis for items important to safety. To cope adequately with Beyond Design Basis External Event BDBEE consideration might lead to the necessity to extend the design basis in order to avoid a resulting cliff edge effect (e.g. a dike for extreme flooding require increased height). This means that consideration of BDBEE might lead to a design extension (with adapted design rules for such kind of event), when it cannot be			x	The principal reason for the BDBEE is for assessment of the design for the evaluation of margins.

			covered by margins in the design basis. The end of sentence should be deleted in order not to mix definition and objectives of extreme hazard analysis.				
3.	1.12 Line 1	Hazards of human induced events may be affected by possible changes that have occurred in both the industrial and the transport environment since the siting process was performed. This may also be true for changes in natural hazards (e.g. because of climate changes), as indicated in SSR-1 [4] SSR-2/1 (Rev. 1) [1]. Such changes should be considered in periodic safety reviews [13]~~.~~ However the hazard definition and protection concept should also be reviewed following significant events which identify shortfalls in current knowledge and understanding, and if other significant new information has become available.	A 10 years period may not be adequate in case of human induced events, because the boundary conditions due to human activities might change on much shorter time scales (e.g. building of new industrial facilities in the surroundings, changes of air ways or building of new transport routes). Therefore, the hazard definition and protection concept should also be reviewed as soon as information on potential (new) sources for human induced events becomes available.	x			
4.	2.3 Line 3	[...] ~~The methods of hazard assessment can be deterministic or probabilistic.~~ Hazard assessments should be performed using deterministic and, as far as practicable, probabilistic methods taking into account the current state of science and technology.	It is state of the art to use both methods as far as possible and not only rely on one of both, compare i.e. WENRA RL T3.2.		Accepted. Modified as follows: …current state of practice, science and technology.		Current practice is an important consideration also.
5.	2.4	The end products of hazard assessments should be hazard descriptors, expressed by information on the annual frequency of exceedance versus information on the severity levels of the hazards, descriptions of all hazard assessment methodological elements and parameters of importance (including screening methods, ~~and~~ results and uncertainties), assumptions made in the	To be able to conservatively define the DBEE (c.f. Para. 2.10), it is necessary to take the uncertainties in the hazard assessment into account. Therefore, the information on uncertainties is an essential part of the "end products of hazard assessments".	x			

		hazard assessment process and characteristics of the hazard descriptors. This information should be communicated to the responsible design organization.					
6.	2.5 Line 1	Two levels of external event hazards should be considered for the design and evaluation of those structures, systems, and components (SSCs) identified to be important for nuclear installation safe performance when subjected to EEs. The first level is the DBEE. The second level should be selected to be higher than the design basis and used in the evaluation of the nuclear installation in order to evaluate the uncertainty in external hazard estimations and safety margins. This is called the BDBEE[7]. The exceedance frequencies of DBEEs should be low enough to ensure a high degree of protection with respect to external hazards. It should be specified whether the exceedance frequencies of the DBEEs refer to the mean, median or any other percentile. Footnote: A common target value of frequency, not higher than 10–4 per annum, is used for DBEEs in many countries.	At least a minimum qualitative requirement for the DBEE should be given, compare i.e. WENRA RL T4.2		Accepted. Modified to add: …not higher than 10-4 mean per annum…		Clarity and to be in line with the sentence before.
7.	2.7, Line 1	Paragraphs 5.21 and 5.21A of SSR-2/1 (Rev. 1) [1] emphasize the need for the design organization to provide a design with adequate margin to (i) protect items important to safety against ~~levels of~~ external hazards and to avoid cliff edge effects; [...]	Either something is missing before “levels” (and should be added in the next revision of the draft) or “levels of” is superfluous and should be deleted.	x			
8.	2.8, Line 1	The margin is understood to be the result of conservative design approaches taking duly into account the variability and uncertainty of the different methods, data, assumptions and rules ~~applied for the design~~ that provides the SSCs the	“Variability and uncertainty” themselves do not result in margins. - In fact, the effect might be to the contrary. Only if “variability and uncertainty” are	x			

		capability to safely perform even in situations more severe than those postulated in the design basis without the incurrence of cliff edge effects…	conservatively considered in the design, this could result in a safety margin.				
9.	2.19 Line 1	~~Unless national regulations require otherwise~~, the categorization …	The IAEA Safety Standard defines a Standard. This does not prevent national regulations to be fulfilled as well.	x			
10.	2.19 Line 6	…. ~~They~~ Those SSCs necessary to prevent large or early releases should also be checked against conditions exceeding the DBEE	Not all EE1 items have to be checked against extreme hazards because the objectives for DBEE and BDBEE are different. In DBEE, the objective is to prevent core melt and in BDBEE it is to prevent large releases.	x			
11.	2.19 (also apply to para 2.20)	Unless national regulations require otherwise, the categorization for EEs should follow the principles of seismic categorization, which are described in ~~NS-G-1.6 [12].~~ Items identified in accordance with para. 2.18 should be considered against ~~para. 2.14 of NS-G-1.6 [12~~]. ……	We would like to pay your attention that NS-G-1.6 is under revision currently Referring to requirements from other standards seems not advisable, because these standards might change. Our suggestion is to replace statements in Para. 2.19 and also in Para. 2.20 with adapted versions of the paragraphs dealing with the seismic classification in NS-G-1.6 (there are Para. 2.14 - 2.22) or the corresponding paragraphs from the current version of NS-G-1.5 (these are Para. 2.6 - 2.17)			x	Coordination between the drafts of various interconnected safety standards was made.
12.	2.19 c)	Items that ensure ~~of~~ the control room and supplementary control room functions.	As the supplementary control room is also listed explicitly in 2.40, it should also be listed here.	x			

13.	2.22, first bullet point	When evaluating the effects of EEs on the installation, it should be ensured that realistic and credible scenarios are developed. A scenario enveloping all possible effects with a single loading condition ~~is~~ may be unduly conservative.	The assumption that "enveloping all possible effects with a single loading condition is unduly conservative" seems not justified (cf. our comment concerning Para. 3.19).	x			
14.	2.35 Line 1	In designing for DBEEs, the systems design of the installation should adhere to the single failure criterion ~~for active components~~, which may be achieved by means of the redundancy of safety systems or trains in a system.	Application of the single failure criterion is specified in IAEA SSR 2/1 (Rev. 1). According to 5.40, the design shall take due account of the failure of a passive component, unless it has been justified in the single failure analysis with a high level of confidence that a failure of that component is very unlikely and that its function would remain unaffected by the postulated initiating event. Thus, it is not clear, why a restriction of the single failure to active components is proposed here.		x		Para. has been revised. considering comment of France on the same para.
15.	2.36 (c)	Administrative measures, such as a precautionary plant shutdown based on meteorological forecasts of an imminent storm ~~the establishment and enforcement of no-fly zones~~.	According to some IAEA representatives and general experience, no-fly zones are not effective in the long term (i.e. not respected or revoked by the authorities). Therefore, it seems recommendable to use a different illustration for administrative measures. The proposed example is just one possibility.			x	This was probably true before the events of 9/11. Now, no-fly zones are the most common examples for administrative measures.
16.	2.36 after the bullet list	[...] The justification of the protection concept should identify the rationale for the choice	According to 2.36, administrative measures alone would be sufficient.	x			

	(after Line 10)	of protection and include the demonstration of the reliability. Administrative measures as a replacement for passive or active protection should be avoided as far as reasonably practicable.	Usually, they should not be used to replace possible passive or active protection measures, compare i.e. Para. 2.45 and WENRA Guidance Document Issue T.				
17.	2.37 Line 7	… ~~Exceptions to the single failure approach may be accepted by the regulatory authority on a case by case basis.~~	The regulatory authority is to a certain degree free to decide on exceptions on a case by case basis, but this is neither specific to the single failure criterion, nor should this be defined for isolated cases in the regulatory texts.	x			
18.	2.40 Line 1 and 2.41 Line 1	2.40 The following aspects should also be considered in a design to meet safety requirements for DBEEs: [...] 2.41 The following aspects should also be considered in a design to meet safety requirements for BDBEEs: [...]	Para. 2.41 partially repeats considerations from Para. 2.40. It should be made clear in the introductory sentence that 2.40 deals with DBEEs and 2.41 with BDBEEs.	x			
19.	2.40 Line 2	- Following the occurrence of a DBEE, the design should ensure accessibility to the main control room, to the supplementary control room, and to the locations (compartments, rooms and facilities) necessary for meeting the operational requirements after a DBEE;	Similar to paragraph 2.41 (first bullet) it should be precised that such operational requirements are related to the needs after a DBEE (in order not to mix it up with normal operation of plant).	x			
20.	2.41 Line 5	- The systems not protected against BDBEEs 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. In case of adequate justification, the non-operability of not protected systems may be assumed.	In order to allow realistic evaluation for not protected systems, an extension of text is proposed. Otherwise completely unrealistic scenarios could be constructed.	x			
21.	2.42 Line 1	Provisions in the design to protect the installation against DBEEs and BDBEEs should not impair its response to other	Restrictions w.r.t. non-safety related procedures are acceptable in view of the	x			

		design basis events or safety related operational procedures. …	potential consequences of external hazards.				
22.	2.43 Line 1	In the nuclear installation design for protection against EEs, adequate robustness should be used to provide the installation with additional capacity for BDBEEs ~~for conditions in the selected EE scenarios~~. [...]	Text obviously left over from a previous version of the paragraph. Is not suitable here	x			
23.	2.44 Line 1	Administrative measures for DBEEs and BDBEEs are procedures and protocols that partially address the safety of the nuclear installation. Administrative measures, in conjunction with other measures, should be developed as part of the protection scheme for each EE as appropriate. Pre-event occurrence administrative measures should be based on the considerations presented in para. ~~2.19~~2.27. ….	As Para. 2.19 deals with the EE classification, this seems not to be the appropriate reference. Maybe Para. 2.27 is appropriate.	x			
24.	2.44 Line 7 last sentence	[...] Furthermore, procedures and protocols should be put in place to avert hazardous situations, e.g. ~~a no-fly zone within a given radius around the nuclear installation site,~~ restriction of storage of on-site materials that could become wind-borne or water-borne missiles on-site or in close proximity to the site, and restriction of storage of combustible materials on site.	According to some IAEA representatives and general experience, no-fly zones are not effective in the long term (i.e. not respected or revoked by the authorities). Therefore, it seems recommendable to use a different illustration for administrative measures. The proposed example is just on possibility.			x	Pls see response to Comment 15.
25.	3.14 Line 3	- A causal event occurs ~~when an earthquake induces vibratory ground motion~~ a storm causes damage off-site and on-site. Off-site, damage	As this safety standard excludes earthquakes already in its name, it is proposed to give another example not related to earthquake.	x			
26.	3.19 Line 1	~~Care should be taken with the derivation of equivalent static loads to represent time-varying effects of loading functions; this procedure is intended to be conservative when applicable and it~~	It is recommended to delete this paragraph. The whole point of considering BDBEE, safety margins and cliff-edge-effects is that robustness of the design is	x			

		~~may lead to overly conservative design loads.~~	achieved. This goal is undermined if "overly conservative design loads" (for DBEEs) are criticised.				
27.	3.26 additional bullet	[...] - Define the BDBEE conditions as the maximum credible hazard severity.	We suggest to add a new bullet. This is additional possibility for defining BDBEEs according to WENRA RL T3.2.	x			
28.	4.8 Line 9 4th bullet point	- [...] - Redundant, physically separated safety trains ~~with~~ inside the ~~single~~ containment capable of withstanding postulated EEs.	As Para. 4.8 deals with the layout of the "containment building structure", it should be made clear that the safety trains "inside" this building are meant.	x			
29.	4.17 Line 1	~~Some of the EEs can be considered as extreme events, which are more frequent than rare events. This is the case, for instance, of wind load when it does not include tornado or hurricane conditions17. In these cases, external event loads should be combined with normal operational loads and with loads from other extreme events, with combination factors dependent on the Member State practice. A combination of probable maximum storm surge with 10 year wind wave effects is an example of such cases.~~ ~~Footnote 17~~ ~~In some Member States, design wind speed is chosen with a 100 year return period (1% annual probability of exceedance), whereas rare design events are typically chosen with a return period of 10000 years.~~	The idea of this paragraph is covered by Para. 2.24 and 5.237. Therefore, the paragraph should be deleted.			x	While there are overlaps between the indicated, Para. 4.17 provides clear guidance and does have new elements. It is better to have repetition than miss a point.
30.	4.21 Line 3	"…design limit~~18~~…"	Footnote already introduced in para. 3.17/ Line 3 (page 18).	x			
31.	4.34, Line 2	[...] Appropriate strain rate dependent material model should be used for impact analysis.	Typo	x			

32.	4.43 Line 1	For some external hazards, it may be possible to identify scenarios that are extremely unlikely yet still credible, which could be selected as the basis for the BDBEE. In these cases, the annual probability of exceedance of the BDBEE should correspond to at least about one order of magnitude less than that of the DBEE.	The reasoning for the last sentence is not given, either delete it or add “at least”.	x			
33.	5.9 Line 1	The seiche hazard analysis should provide the maximum and minimum runup heights, duration, static loading effects, and hydrodynamic effects listed in para. 5.2.	Missing word	x			
34.	5.12 Line 4	[...] as well as other phenomena listed in para. ~~5.1~~5.2. [...]	Mistake in reference	x			
35.	5.17 Line 4	“…as presented in paras. 5.5-5.~~13~~16.”	High ground water levels (5.14), local precipitation flood (5.15) and the tidal water range (5.16) belong to flood initializing events.	x			
36.	5.21, (after) bullet point (g)	[…] (g) Implement temporary watertight barriers, such as aqua dams, sandbags, inflatable berms, to be installed when necessary. Permanent protection means should be preferred over temporary protection means.	At least for new installations, permanent flooding protection is state of the art. Therefore, a sentence should be added to clarify the hierarchy of protection means.	x			
37.	5.22 Line 1	For new nuclear installations, equipment ultimately necessary to prevent core damage, an early radioactive release or a large radioactive release should be located at an elevation high enough above the design basis flood, or adequate engineered safety features (such as water tight doors) should be in place to protect this equipment and ensure that mitigating actions can be maintained.	The current requirement seems reasonable for BDBF (cf. Para. 5.37). But for DBF also equipment necessary to avoid core damage should fulfil this requirement. Otherwise this paragraph could be deleted as it is covered by Para. 5.37.	x			
38.	5.31 Line 1	The following effects associated with design loading conditions should be considered:	The current wording is specific to tsunamis (and seiches). To account also for	x			

		- Run up / sea water level [...]	other coastal flooding mechanisms (e.g. storm surges), a more general terminology should be used.				
39.	5.33 Line 1	River floods in cold climates should be analysed for the formation of ice dams and transport of large ice floes or sediment and debris that could physically damage structures, obstruct water intakes or damage the water drainage system. Potential ice dam formation and failure can flood the site or create low water conditions. Special considerations should be given to the occasionally rather short warning times concerning ice dam formation and failure.	Ice dam build-up and collapse may happen in hours. Consequently, high or low water levels may be reached in very short time periods - rather different from normal riverine flood or low water events. Therefore, a sentence should be added to highlight this specific hazard.	x			
40.	5.55 Line 1	"Missile impact effects include local response (penetration[21], perforation, and spall)…"	This is the first appearance of the term "penetration" regarding missile impact, we suggest to place the footnote here. Currently this footnote is located in para. 5.164.	x			
41.	5.69 Line 1	Damage due to the hazards described in para. 5.5~~6~~8 is usually represented by…	The natural hazards are described in para. 5.68.	x			
42.	5.70 Line 1	Damage that may be caused by lightning has been shown to be very extensive and therefore additional protection from lightning exceeding the conventional requirements should be taken into consideration.	General lightning protection is already mandatory due to conventional standards. For nuclear installations a higher level of protection seems advisable.	x			
43.	5.72 Line 1	~~Unless special national codes and standards are available for the design of nuclear installations in relation to these hazards, structural design should follow the codes and standards for conventional buildings, while equipment should be qualified in accordance with its safety and EE classification.~~	Conventional standards are binding anyway. Thus, this paragraph can be deleted.			x	While the comment is essentially correct, in practice there may be confusion on applicability of conventional standards.
44.	5.76, Line 5	[...] To prevent service water blockage due to frazil ice, measures to prevent frazil ice formation (outlet water recirculation to	The penultimate sentence seems to be a leftover from a previous version. As the	x			

		intakes, bar screen heating) and alternative path(s) for cooling water intake should be provided. ~~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, p~~Provision should be made for adequate instrumentation and alarms and relevant procedures and training.	topic is already covered by the sentence before, it should be deleted.				
45.	5.80 Line 1	~~In general, p~~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 screened out during the hazard evaluation stage, the site should be considered unsuitable as these effects cannot be mitigated by measures for design or operation ~~criteria related to the acceptability of any protection measures should be discussed with the regulatory body~~.	In SSG-21 (Tab. 1) pyroclastic flows, lava flows, opening of new vents and ground deformation (including debris avalanches) are clearly identified as exclusion conditions for which no mitigating measures are available. The state of the art concerning these types of hazards has not changed since the publication of SSG-21. Therefore, these hazards should be considered exclusionary without any exception. Consequently, the weakening last sentence needs to be replaced by a clear statement in line with SSG-21.			x	Not all cases are clear-cut. Opening of new vents may need probabilistic guidance if the site is close to a field and the vents are not geologically young.
46.	5.84	<paragraph should be deleted>	In SSG-21 (Tab. 1) pyroclastic flows, lava flows, opening of new vents and ground deformation (including debris avalanches) are clearly identified as exclusion conditions for which no mitigating measures are available. The state of the art			x	There may be cases where the annual probability of a pyroclastic flow reaching a site would be less than 10-4 for example and the thickness of the flow would be insignificant.

			concerning these types of hazards has not changed since the publication of SSG-21 and practice has shown that there is almost no way to effectively redirect such flows. Therefore, a site should be considered unsuitable if it cannot be excluded that lava flows or pyroclastic flows reach the site (or new vents open close to the site).				
47.	5.89 Line 1	Non-exclusionary aspects related to volcanic hazards should be treated as DBEE loads. If any of the potentially exclusionary aspects cannot be adequately screened out with sufficient margins, the site should be considered unsuitable as these effects cannot be mitigated by measures for design or operation ~~these should, with the agreement of the regulatory body, be treated in the framework of~~ ~~BDBEE~~.	In SSG-21 (Tab. 1) pyroclastic flows, lava flows, opening of new vents and ground deformation (including debris avalanches) are clearly identified as exclusion conditions for which no mitigating measures are available. The state of the art concerning these types of hazards has not changed since the publication of SSG-21. Therefore, these hazards should be considered exclusionary without any exception. Consequently, the weakening part of the sentence needs to be replaced by a clear statement in line with SSG-21.			x	Pls see response to Comment 46.
48.	5.91 Line 1	At sites for which an aircraft crash scenario is postulated, the crash event is generally associated with the release of significant amounts of fuel, most of which will probably be ignited, and this may lead to subsequent explosions. Combustible	Only aircraft fuel is mentioned. Since significant amounts of fuel will be burned in a fireball, the combustible parts of the aircraft (e.g. interior, for	x			

		parts of the aircraft as well as the payload will also be involved in the fire scenario. The design measures for such an event generally envelop the provisions necessary to handle other external fire scenarios as mentioned above. [...]	new aircraft designs carbon fiber, under certain conditions light metals) as well as the combustible payload should not be ignored.				
49.	5.94 Line 1	~~Diesel generators usually need air for combustion. The nuclear installation design should ensure an adequate supply of air to all diesel generators that are needed to perform necessary safety functions.~~	Largely identical to 5.105. Could be deleted here.	x			
50.	5.95 Line 1	Fires that may occur at several locations because of the spreading of the aircraft's fuel and combustible debris should be considered in this analysis.	See under 5.91	x			
51.	5.95 Line 7	"…(see para. 5.19~~9~~5)."	Para. 5.195 deals with fuel effects due to airplane crash, which should be the reference here.	x			
52.	5.101 Line 5	[...] Intern~~N~~ational codes and standards provide guidance on fire hazards and fire resistance of …	It should be international standards and not only national standards. National standards might be lower.	x			
53.	5.107 Line 1	Extreme ~~yard~~ fires that have the potential to affect several safety related structures including the containment (e.g. caused by the fuel spillage from a large airplane crash), should be treated within the framework of BDBEE.	"yard" seems to be out of place here.		x		This is the current terminology for fires outside the buildings.
54.	5.112 Line 4	[...] (1) If there is a potential source in the vicinity of the plant that can produce a pressure wave postulated external event, ~~as determined in SSG-18 [7],~~ propagation of the wave to the installation should be calculated and the resulting pressure wave and associated drag force should be the basis for the design.	The reference to SSG-18 on Meteorological and Hydrological Hazards should be clarified by quoting the section, otherwise deleted.		Accepted. The reference should be to the hazard related Safety Guide for HIE.		The reference was given in error. The correct reference was provided.
55.	Title of Sec. 5.7	~~5.7. ASPHYXIANT, TOXIC GASES, TOXIC AND CORROSIVE~~	The headline is unclear: It distinguishes between "gases", "chemicals" and	x			

		~~CHEMICALS AND FLAMMABLE VAPOUR CLOUDS~~ 5.7. TOXIC, FLAMMABLE, CORROSIVE AND ASPHYXIANT CHEMICALS AND THEIR MIXTURES IN AIR	"vapour clouds" which does not make sense. Then it links chemical properties (asphyxiant/toxic/corrosive/flammable) to gases/chemicals/vapour clouds in an arbitrarily, incomplete manner – e.g. flammable gases are missing.				
56.	5.132 Line 5	… Safety important air intakes should be provided with automatic pressure wave protection shutters. Alternatively, it may be proven that the incoming pressure wave does not lead to loss of required safety functions.	Protection by pressure wave protection shutters is not necessary for all cases. The stated alternative is used for some NPPs.		Accepted with modification. Alternatively, it should be demonstrated that…		The sentence needs to be a recommendation.
57.	5.134 Line 1	~~Asphyxiant and toxic gases~~ Toxic, flammable, corrosive, and asphyxiant chemicals might on release into air affect the [...]	Flammable and corrosive were added. "Gases" was changed by "into air", because the pathway is important. (gases may also be dissolved into water or vapours may be released into air)	x			
58.	5.140 Line 1	Toxic, flammable, corrosive, and asphyxiant gases and vapours may be heavier or lighter than air. [...]	Flammable and corrosive gases added, vapours added.	x			
59.	5.141 Line 1	Once a toxic, flammable, corrosive, or asphyxiant gas or vapour cloud [...]	Flammable and corrosive gases added, vapours added.	x			
60.	5.147 Line 1	Given a known source of toxic, flammable, corrosive or asphyxiant gases or vapour, gas detectors able to detect these gases at control room air intakes should be provided.	Flammable and corrosive gases added, vapours added.	x			
61.	5.149 Line 1	Some types of toxic, flammable, corrosive or asphyxiant gas or vapour, such as those that might be released along traffic routes (such as on land, sea, rivers and railways), cannot be identified in advance. Although the provision of detectors capable of	Flammable and corrosive gases added, vapours added.	x			

		detecting all types of hazardous ~~toxic or asphyxiant~~ gas is not practical where multiple sources of gases could be a hazard, …					
62.	5.163, Line 2	[...] before the final EE classification is determined.	Missing word	x			
63.	5.164 Line 5	"…, including penetration[24], spalling[24], scabbing[26] and perforation ('local effects');"	Footnote concerning "penetration" already introduced in para. 5.55/Line 1, see comment above New footnote number for "spalling". Footnote concerning "scabbing" already introduced in para. 3.18/Line 2.	x			
64.	5.164 (fourth dash) Line 11	[...] - The effects of ~~fuel~~ crash-initiated fires on SSCs.	The crash is the fire initiator, the fuel is part of the fire load.	x			
65.	5.168 Line 8	- Redundant equipment should be located in a different area with an adequate separation distance ~~(physical separation)~~	It seems that physical separation in this document addresses the aspect of separation by distance. However, IAEA glossary (and also WENRA) defines physical separation as wider scope as follows: *Separation by geometry (distance, orientation, etc.), by appropriate barriers, or by a combination thereof.* This definition of physical separation includes also protective structures. Therefore it is proposed to precise the expression to be used in this context in chapter 4.			x	Protective barriers are treated separately in this Safety Guide.
66.	5.169 Line 2	…. Generally, it suffices to combine with the aircraft crash loading only those loads expected to be present for a significant	The statement should be consistent with paragraph 5.186 (Actual live loads	x			

		duration, i.e., dead and actual live loads ~~(not including extreme snow or extreme wind)~~…..	should be considered rather than the generally assumed design live loading conditions). The brackets should be deleted as combination of independent extreme external hazards is anyhow not to be done.				
67.	5.170 Line 1	The characteristics of the primary missile (aircraft), the secondary missiles (e.g. engines) and the structure should be defined and explicitly include:	E.g. landing gear is also a stiff, compacted part. Cf. also 5.164.	x			
68.	5.170 Line 7 (fifth dash)	[...] - Consequences of an impact, e.g. fuel fires effects or debris and secondary missiles.	Clarification.	x			
69.	5.171 Line 1	The location of the impacted area and the impact angle depends on the topology of the surrounding landscape, the neighboring buildings and type of aircraft.	Dimensions of aircraft are also of important.	x			
70.	5.173 Line 1	The material properties for structural steel, steel reinforcement and concrete to be considered in such evaluations should represent the realistic ductility of the materials (defined by test) and should also include strain rate effects and time development (e.g. concrete strength).	Concrete strength changes with time.	x			
71.	5.175 Line 1	Load-time functions can be used to consider a DBEE. In this case ~~T~~ the engineering design rules should comply with the relevant national or international codes and standards and with proven engineering practice. Load-time functions also can be used to consider a BDBEE. In this case a best estimate approach can be used for the margin assessment.	There are no limitations to use load-time-function for BDBEE. Best estimate approach will be used to define structural behaviour of reinforced concrete structure. This approach was used for vulnerability analysis of NPP in Germany (“Verwundbarkeitsanalyse”)	x			
72.	5.178 Line 2 (second sentence)	[...] The nonlinear material behaviour of the concrete with its different values in tension and compression, strain rates and failure criteria should be defined.	Clarification	x			

73.	5.181 Line 1	"…(equal to global area in para. 5.173~~3~~2)…"	Local and global areas are described in para. 5.172	x			
74.	5.188 Line 1	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 with appropriate fuel load for a long distance flight~~.	According to 2.35 the single failure criterion applies for all design basis events. An exception from this approach seems not to be justified.	x			
75.	Headline before 5.195	~~FUEL~~ FIRE EFFECTS	The effects are from the fire, not the fuel and not only the fuel (kerosene) will burn.	x			
76.	5.195(a) Line 5	[...] (a) The fire load should be directly related to the amount of fuel carried by the reference aircraft at the target (corresponding to the assumed scenario of refuelling of aircraft for the route from the starting airport to the destination, fuel consumption from take-off and cruising) and the potential involvement of other flammable material inside the aircraft (hand baggage, luggage, payload, plastics sheeting, seats and flammable materials of the aircraft structures) and outside present at the site;	Aircraft structure consists of some flammable materials. Especially, they are wide used in new aircrafts e.g. Boeing B787.	x			
77.	5.196 Line 1	~~If for any reason beyond design basis aircraft crash is considered involving fully fueled commercial airplanes, acceptance criteria should be chosen such that as a minimum the safety related items of the nuclear installation that are involved in the fourth level of defence in depth remain functional.~~ Methods in the assessment for beyond design basis aircraft crash (BDBEE) should normally be the same as in the design for design basis aircraft crash (DBEE). The differences are in the acceptance criteria and the material properties used in the assessment (see Section 4).	Also for aircraft crash a BDBEE should be defined. From the current formulation this is not unambiguously clear. As it is not very helpful to limit the scenario to a fully fuelled airliner, a more general formulation in line with 5.133 seems advisable.			x	In many cases, the current MS practice is to consider a BDBEE airplane crash as a security related scenario. However, this should be the result of a threat analysis

78.	5.219, Line 1	Beyond design basis ~~releases~~ events (BDBEE) should be established by increasing the size of the floating body and/or the impact velocity with respect to the design values (DBEE).	Wrong word	x			
79.	5.225, Line 4	[...] The probability for a collision of large vessels in normal cruising can significantly be reduced ~~usually be ruled out~~ by the implementation of this kind of administrative measures.	Administrative measures are not suitable to rule something out. Credible is only a reduction of the probability of an accident.	x			
80.	5.232, Line 1	If blockage of an intake is possible to the extent that the necessary minimum heat transport system flow cannot be ensured, then either redundant means of access to the UHS or diverse means of fulfilling the design objective for the UHS should be provided. [...]	Missing word	x			
81.	5.233 Line 1	In the case of a significant hazard for ice, the static and dynamic action on the intakes derived from debris and ice should be considered. In addition, measures should be implemented to prevent ice accumulation in the intake structure [27]. Alternatively, a different method of providing cooling water to the plant should be provided ~~[27]~~, for example from a different source or by a closed loop air cooled system.	Besides the mechanical loads due to ice impact, the clogging effect needs to be mitigated. The measure mentioned in the footnote is one example how to do this; it is not a "different method of providing cooling water".	x			
82.	5.237 Line 1	In general, external hazards should not be combined with other extreme loads unless one of the following conditions ~~are~~ is present: [...]	One of the mentioned conditions is sufficient to necessitate the consideration of combinations.	x			
83.	6.5, after bullet point (i)	[...] (j) The characteristics of the structures of the nuclear installations and the means of confinement of radioactive material. (k) The characteristics of the site that are relevant to the consequences of the dispersion of radioactive material to the atmosphere and the hydrosphere (e.g. size, demographics	The chapters on the graded approach should be consistent between the new Safety Guides. Therefore, coordination with the authors of DS507 is recommended.	x			

		of the region).	To be consistent with DS507 at least two additional bullet points should be added. (Proposed text copied from DS507 (Step 8).)				
84.	7.4 Line 7	[...] Previously proven designs need ~~should~~ not be subject to verification unless they are intended for different applications or the performance criteria are different. [...]	The purpose of a safety standards is to promote safety. Therefore, it seems not advisable to state that a safety-oriented activity (such as verification of a design) "should not" be performed.	x			

COMMENTS BY REVIEWER Reviewer: András Gábor Siklósi Page.... of.... Country/Organization: Hungary/HAEA Date: 31.01.2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.2	*"An external event is an event that originates outside the site and whose effects on the nuclear installation should be considered. Such events could be of natural or human induced origin and are identified and selected for design purposes during the site evaluation process. Events originating on the site but outside the safety related buildings should be treated the same as offsite EEs."* I suggest to use the following definition instead: *"An external event is an event to which the licensee does not have both the authority and the possibility/means to reduce its occurrence frequency and whose effect on the nuclear installation should be considered. Such events could be of natural or human induced origin*	I believe the proposed definition is contradictory and hard to interpret or apply. The region defined by the third sentence is a subset of the zone defined by the first sentence ergo either the first sentence is unnecessary or the third sentence is in contradiction with the first one. Also in my experience, it is a better approach to define the difference between internal and external events based on whether the licensee has to authority and possibility to decrease the occurrence frequency of the event or not. This in practice could mean for example whether the			x	The definition of the present text is considered adequate. There is no contradiction in the definition. The third sentence simply recommends that events originating within the site but outside safety related buildings should be treated similarly as EE originating outside the site area.

		and are identified and selected for design purposes during the site evaluation process."	licensee is responsible for the design and maintenance of a specific SSC on the site and/or has to authority and possibility to implement safety improvements and develop technological and/or administrative barriers to reduce the occurrence frequency of events originating from the SSC. The problem with using the border of the site as the border between internal and external is that while in most cases the licensee has the authority to act within the site it's not always the case. A typical example of this is the transformer stations connecting the NPP to the grid, which is usually on the site and can induce an initiating event but do not owned and operated by the licensee but the grid operator instead. Since the licensee does not have the possibility and the authority to implement changes in the maintenance practice, design, etc. of this equipment any initiating event originating from this station should be considered an external event. In short, the grid operator may induce an initiating event (e.g.: through a mistake during the maintenance of the transformer station) and the				

			licensee cannot interfere or have the power to stop it from happening, therefore in my opinion it is an external event the same way as if the grid operator would execute an action that collapses the grid in the region and cause a LOOP. The proposed definition has several advantages compared to the original one: - The difference between external and internal is always clear and based on an objective (legal) standpoint that helps both the licensee and the authority. - Instead of spatial parameters which have limited meaning from a safety point of view, the proposed definition is based on who is responsible for the certain equipment or condition, ergo who can do something about it if it poses a threat to the facility. Since there are several member countries in which the screening criteria for DB is different for IIEs, IHs and EHs (and in many countries EHs, are				

			not even considered in the overall CDF/LERF values) the definition of DBEE is crucial to have an objectively justifiable value for the risk posed by these external hazards.				
2	1.10/ Human induced events	I suggest to add the following line into the list and extend the scope of the guide with this phenomena: *"Release of oil and/or fouling chemicals into seawater near the site due to oil pipeline breaks/ruptures and/or oil tanker accidents"*	As far as I know there is a special phenomenon in the Baltic Sea region that affects several member countries and may affect future NPPs as well, therefore I believe it should be included in this list. This phenomena is the release of large amount of oil into the very cold and shallow water of the Baltic Sea (or any other subzero "Arctic" water). Unlike with "normal" oil spills due to the salt density and temperature of the Baltic Sea the oil spill does not float on the surface of the water but instead a meter or so under it in a thick layer and forms a very viscous mixture with the seawater. The mixture is capable of clogging pumps, filters, armatures and pipes thus effectively blocking the water intake of the NPPs in the region for the layer forms at almost the same depth where the water intake junctions usually are.		Accepted. Bullet 5 can be modified as follows: - Release of corrosive and or hazardous gases and liquids from off-site or on-site storage or transport		The added words correspond to the proposed change.

			Since this phenomena can affect several member countries and NPPs (maybe even at the same time) I suggest to add it to the list as well as to extend the scope of the document and provide some recommendations on how to handle this phenomena during external event/hazard assessments in the fifth chapter.				
3	2.5	2.5. Two levels of external ~~event~~ hazards should be considered for the design and evaluation of those structures, systems, and components (SSCs) identified to be important for the safe performance of the nuclear installation ~~safety performance~~ ~~safe performance~~ or non-safety--related SSCs that may cause such safety related SSCs to fail when subjected to EEs. The second level should be selected to be higher than the design basis and used in the evaluation of the nuclear installation in order to evaluate the uncertainty in external hazard estimations and safety margins and ensure the avoidance of cliff--edge effect. This is called the BDBEE.	Since it is one of the main issues of external events that they can affect the whole site and many SSCs simultaneously the original scope in the recommendation should be extended to those non-safety-related equipment that if failed may cause safety related SSCs around them or in some other causal relation with them to fail as well. This is mentioned later on in the Guide so this addition in my opinion would not be in contradiction with the original text. I think it would be also beneficiary to highlight the avoidance of cliff-edge effect in this recommendation as well.			x	Safe performance of the nuclear installation would require that Category 2 to Category 1 interactions are considered. They are explicitly treated when categorization is discussed later in the text.
4	2.31	2.32. For the UHS, the need for make-up of heat transport fluids and the possibility of auxiliary junction/injection points for heat removal systems should be examined. Where a limited quantity of heat transport fluids is stored on site, the	Many countries considered the possibility to add junction points to the service water system in order to provide a mean to inject/redirect water through it from the fire	x			

		capability for make-up should be ensured by either (a) protecting the make-up system from EEs or (b) providing an adequate quantity of such fluids to allow time to repair the damaged part of the make-up system or (c) provide junction/injection points to the system through which additional heat transport fluid can be injected from other on-site sources while the repair takes place.	protection system or other on-site water sources. Since the recommendation does not specify whether if it refers to DBEE or BDBEE I suggest adding this possibility as well because it may be a mean to ensure the UHS function under BDBA conditions after a BDBEE.				
5	2.32	2.32. Credit for operator actions during or after the DBEE and the operator training to perform the necessary actions should be considered dependent on the specific EE and its anticipated effects on the site and SSCs. Impediments to operator actions include: lack of on-site communication ~~on site on site~~, lack of mobility due to site soil failures, lack of specialized technical support needed to safely perform a recovery function, and inability to perform action due to failures or malfunctions of SSCs, inaccessibility of areas relevant to perform recovery actions due to structural damages or changed environmental conditions. No credit for operator actions should be given for the correction of equipment failures, the repair of a damage or the suppression of induced events (e.g. bushfire) as a consequence of a DBEE or BDBEE, unless there is a clear demonstration that such an action can be safely and reliably accomplished within a time frame consistent with the complexity and difficulty of the necessary action. A considerable margin should be applied to account for uncertainties, time needed to diagnose the extent of failure and to develop or	I suggest rephrasing communication on-site to on-site communication, which for me seems to describe the issue better. It should be noted/highlighted that certain areas of the plant that are necessary to perform recovery actions may not be accessible for the operating personal and/or the probability of a successful intervention is highly reduced due to certain environmental conditions (e.g.: room filled up with steam, smoke, debris, dust, toxic/corrosive or radioactive chemicals in the air, etc.)	x			

		modify corrective procedures, and the possible unavailability of appropriate personnel or replacement parts.					
6	2.41	2.41. The following aspects should also be considered in a design to meet safety requirements: -In considering the occurrence of a BDBEE, the design should ensure accessibility to the main control room or the supplementary control room, and to the locations (compartments, rooms and facilities) necessary for meeting the requirements for response to the BDBEE. - The systems not protected against BDBEEs 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 - The systems not protected against DBEEs (items not important to safety) should be designed in a manner not to jeopardize safety related SSCs while failing due to DBEE. - On-site mobility of personnel and equipment after the occurrence of BDBEE should be verified if needed.	I think it should be emphasized to design the non-safety related SSCs in a manner that they do not damage safety related SSCs when failing due to DBEE. This issue came up earlier in the Guide and I think the document is more consistent if it is mentioned here as well.	x			
7	3.3	3.3 Screening is a part of the hazard analysis. For human-induced EEs, screening by physical distance/effect as well as severity or probability of occurrence should be used[11] or it could be based on whether administrative measures/barriers prevent their occurrence. When a Screening Probability Level (SPL) approach is used for screening purposes, the hazard analysis team should be informed in advance regarding appropriate level of	I think distance in itself does not define the screening criterion well enough and this distance value may differ from EE to EE. The right question is whether the effect of the EE is reduced to an irrelevant level or not, which can be assessed by an effect-distance function. In the case of human induced external events administrative			x	Administrative measures should not be part of the screening process.

		annual probability of exceedance to be considered.	barriers can have a major role and could be used as a basis for screening as well. A typical example of such external hazard screening is corrosive/explosive gas release during traffic accidents in the vicinity of the plant. This can be avoided and screened out if it is prohibited by law to transport such materials in a certain proximity to the site. Therefore in my opinion this third screening method should be added to the recommendation as well.				
8	3.3-3.4	3.X An external hazard could be screened out from detailed external hazard assessment if it can be justified that its occurrence frequency is significantly lower and its effects on the plant are significantly less severe than another hazard with the same kind of effect	I think such a recommendation could help the licensees and the national authorities to focus their efforts on the assessment of the relevant and significant hazards. A typical example where this recommendation could be used is the case of sand storms and salt storms. The two phenomena have the same effect on the NPP, while the amplitude/magnitude of a sand storm at the same occurrence frequency is usually significantly higher than for salt storms, so there is no need for a detailed DBEE salt storm hazard assessment for the justification of the design basis it is enough to perform it for sand storms.			x	This is a redundant recommendation. Screening out an EE on the basis of either SDV or SPL means exactly what is proposed.
9	3.3.-3.4	3.X. In some cases, the probabilistic screening criteria for human induced DBEEs could be defined at a lower occurrence frequency than for natural	I think there should be a recommendation emphasizing the fact the through administrative			x	This is not a recommendation.

		DBEEs because unlike in case of natural EEs the occurrence frequency of a human induced DBEE could be highly reduced by administrative restrictions and barriers.	restrictions/barriers (e.g.: no-fly zones around the NPP, prohibition on the transport of explosive and flammable materials, restriction on certain industrial activities in a specific proximity to the plant, etc.) the occurrence frequency of human induced external hazards could be highly reduced. Such recommendation could promote this approach and increase the safety of the NPPs. Such administrative barriers could increase the safety not just of new NPPs but of older ones as well without major costs on the licensees side.				
10	3.13	3.13. All ~~operational modes~~operational ~~modes~~plant operating states should be considered at the time of occurrence of any DBEE.~~, such as full power, hot shutdown, cold shutdown, refuelling outage, maintenance and repair.~~, ~~such as full power, hot shutdown, cold shutdown, refueling outage, maintenance and repair.~~	I suggest to use the term "plant operating states". I think listing the possible plant operating states is repetitive since "all plant operating states" already include all these operating states, such as POSs with open containment.		Accepted. 'Plant operational states' is inserted without deleting the examples.		Clarity.
11	3.28	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), Fuel damage frequency (FDF), Large Early Release Frequency (LERF), Large Release Frequency (LRF) [15] ,	In my opinion the scope of the document does not exclude spent fuel pools and in certain member countries (e.g. Czech Republic) there is no CDF criterion only FDF which sets requirements on the overall (reactor + SFP) level 1 PSA risk, so I suggest to add FDF as well.	x			

		- A ‘margins’ method that provides an EE magnitude at or below which the analyst has very high confidence that the CDF/FDF risk arising from the EE is acceptably low.					
13	3.29	3.29. It is expected that for many needs, the ‘margins’ method is likely to be sufficient to provide robust support to a decision-maker. In any case, the possibility of a cliff edge effect should be assessed for each EE of interest and their possible combinations.	Cliff edge effect may arise from a combined load of correlated hazards so I suggest adding combined hazards to the recommendation.	x			
14	4.24	4.24 EEs may be of a very infrequent nature. In these cases, statistically independent loadings from any single event are combined with normal operational loads using unity load factors for all loadings. Multiple external event loadings need not be combined. However, all effects from a single design basis external event should be properly combined, with due attention paid to the physical meaning of the combinations. Furthermore, when a causal relationship or correlations for simultaneous occurrence exists between events, the effects should be properly combined, as necessary. In the case of meteorological events and floods, causal relationships are discussed in SSG-18 [7].	I think it would be beneficial to highlight that not just causal relation but simple correlation may also exist between the events (e.g.: extreme cold and extreme snow; these phenomena are only in correlation but there is no causal relationship between them since the snow wont start to fall just because it’s a cold weather)	x			
15	4.24-4.25	4.X Some correlated/combined external hazards may have a mitigating effect on the effect/consequence of one-another. In such cases, the combined effect of the hazards may be less serious which can be taken into consideration in the design to avoid ultraconservative assumptions.	It should be highlighted that certain simultaneously occurring EEs have a mitigating effect on the consequences of on-another. Such an example is the extreme snow-extreme wind,			x	This is not a recommendation.

			during which there is no need to combine the snow load and wind load on the reactor hall/containment building for example, because the wind removes most of the snow from the rooftops.				
16	4.32	4.32 The finite element mesh should be validated for any specific load case to be analyzed. Analyses should be carried out on mash--independent models to minimize the uncertainties of the numerical approximations and the user effects. The discretization should be appropriate for the frequency content of the loading. Short duration loads (typical in explosions) may require dedicated models, different from the traditional dynamic models used for seismic analysis.	Mesh independence is a critical requirement to ensure the quality of such analyses and minimize the mentioned uncertainties in FEM models and codes.		Accepted. Change 'mash' to 'mesh'		Typo.
17	4.40	4.40 In the case of building structures designed against an external event, the design should address the following interaction effects to the nearby SSCs, caused by the event: (a) Failure and collapse of nearby structures; (b) Secondary missiles generated from nearby SSCs; (c) Flooding from failure of liquid retaining structures, not necessarily close to the building; (d) Chemical releases from failure of containers or deposits; (e) Secondary fires or explosions, as a result of failures in tanks containing flammable or explosive material; (f) Electromagnetic interference generated by electrical faults.	It would be beneficiary in my opinion to highlight that the EEs may collapse or otherwise degrade non-safety related SSCs in a manner that makes it impossible to access rooms/areas relevant for recovery actions for the operating personnel. As the suggested text says this also should be taken into consideration in the design to ensure that no non-safety related SSC can block the path to safety related SSCs if need for maintenance or other forms of recovery actions arise.			x	While the point made is important, the subject of the paragraph is different. This point is made elsewhere in the text.

		It also should be taken into consideration in the design that parts of the plant relevant to recovery actions may become inaccessible due to the listed effects.					
18	RIVER SITE Subchapter	5.X The temperature of the river may greatly vary during the different seasons and directly connected to extreme weather temperature if it occurs for a longer period of time (days-/weeks). Design considerations for river site plants should take into account that the effects of extremely high weather temperature is usually correlated with high river water temperature which follows the weather temperature with a relatively short delay and may affect the transient behaviour of the plant.	In our opinion high river temperature could be a major issue for riverside NPPs that is comparable to extreme weather temperatures type EEs. Since the temperature of the river is correlated with the temperature of the weather, following it with a few days of delay and heat waves usually occur for a longer periods of time (weeks) the combined effect of the two phenomena should be taken into consideration.	x			
19	RIVER SITE Subchapter	5.X+1 It should be taken into consideration in the design that high river temperature may induce initiating events on its own due to administrative restrictions or technological reactor protection measures that initiate a transient (shut down, power reduction, etc.).	Our experience is that an initiating event (such as an emergency shut down due to administrative restriction on the temperature of the river) has a significant occurrence frequency that needs to be taken into consideration in the design and therefore as a DBEE.	x			
20	5.43	5.43. Unless there is a clear evidence for a preferred direction of extreme winds, the wind at the design speed should normally be assumed to blow from any direction~~.~~ for BDBEE and from the most harmful/hazardous direction for DBEE to fulfil the required conservative approach.	It should be highlighted that the wind direction should be chosen on a conservative basis for the DBEE and a best estimate approach for BDBEE.		Accepted. Change 'harmful/hazardous' to 'unfavorable'		More accepted terminology.
21	5.73-5.74	5.X Lightning could cause various failure modes depending on lightning properties that cannot be characterised by a single	I suggest to add specific recommendations for lightning assessment as it is shown in the		Accepted. Change '…have to be…' to '…should be…'		To put into a recommendation form.

		parameter but with several physical properties (e.g. peak current, rising time, down time). Primary and secondary hazardous effects of a lightning strike have to be taken into consideration in the design. It is noted that high-current lightning strikes hit the primary lightning protection system with a high probability that conducts the current in a coordinated way to the ground. However, lightning strikes in the middle-range (with few times of 10 kA current) may miss the lightning rods with a higher probability and also have the capability to induce the failure of sensitive equipment by the secondary effects. Therefore, care should be taken not only to lightning strikes with high peak currents, but also to the ones with a moderate level of peak current too in the design.	proposed text. There are specific issues in assessing and designing against lightning strikes that are not trivial and should be highlighted. In my opinion there are two main issues that should be mentioned in the document: 1., The fact that lightning cannot be described and categorized based on a single concentrated parameter (e.g. current) but with several. 2., The "strongest" lightning strikes are usually not the most dangerous to the plant, because they tend to hit the lightning protection system with a very high probability. In our experience the most hazardous lightning strikes are in the "middle range" which have a high probability to miss the lightning protection system, but still have enough current to disrupt or destroy sensitive equipment, therefore specific protective provisions should be made to protect the facility against them.				
22	5.73-5.74	5.X+1 Special care should be taken to secondary effects of lightning (e.g. electromagnetic pulse), since it may pose even more severe threat to the nuclear safety than primary effects.	The secondary effects of lightning strikes should be highlighted.		Accepted. Combine with the previous paragraph.		Editorial.
23	5.237	5.14. COMBINATION OF HAZARDS 5.237 In general, external hazards should not be combined with other extreme loads unless the following conditions are present:	Hazards may have high correlation even without direct causal relation. I suggest adding this recommendation to the list as well.	Accepted.			

		- The external event triggers the occurrence of another external event, such as a tsunami is triggered by an earthquake or a submarine landslide. In this case, the effects of both EEs on the nuclear installation should be considered with due regard to the time difference between the events felt at the site; - The external event comprises several potential hazards which may all occur at the site. For example, a large airplane crash at the site has the potential to cause impact, vibration, explosion and fire at the site, all of which should be considered; - The external event causes a change in the plant state (from normal operation to accident conditions including DECs). This possibility should be evaluated and considered in the safety evaluation of the nuclear installation. - External hazards that have a high correlation of occurrence (e.g. extreme cold and extreme snow; extreme wind, lightning and extreme precipitation).					
24	After 5.237	5.238 Some correlated/combined external hazards may have a mitigating effect on the effect/consequence of one-another. In such cases, the combined effect of the hazards may be less serious which can be taken into consideration in the design to avoid ultraconservative assumptions.	I believe this phenomena should be mentioned either here or in chapter 4 (see: comment No 15). As I described I think certain simultaneously occurring EEs have a mitigating effect on the consequences of on-another. Such an example is the extreme snow-extreme wind, during which there is no need to combine the snow load and wind load on the reactor hall/containment building for			x	This is not a recommendation.

			example, because the wind removes most of the snow from the rooftops.				
25	7.6	7.6. Computer ~~programs~~ ~~programs~~ codes and models used in design should be verified and validated (V&V) in the required range for the assessment through quality assurance, benchmarking, testing or simulation prior to use, if they have not already been proven through previous use [20]. The documentation of assessments based on such models and codes should ensure and justify [21]: - Comprehensibility - Preciseness - Traceability and completeness - Consistency - Verifiability - Modifiability	V&V should be extended to the models as well, not just the codes themselves. I also suggest to highlight the minimal requirements on the documentation of V&V to provide a common ground for licensees/developers/regulators and refer to the IAEA document describing the issue in detail e.g: [21] INTERNATIONAL ATOMIC ENERGY AGENCY, Software for Computer Based Systems Important to Safety in Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-1.1, IAEA, Vienna (2000)		Accepted. Change 'preciseness' to 'precision' and separate to two bullets 'traceability' and 'completeness'.		IAEA Safety Standards Series No. NS-G-1.1 has been superseded by SSG-39.
26	General	I propose to change either the term "external event" to "external hazard" or vice versa but use only one consistently in the document.	The document uses these two terms alternately but does not define that the two terms are interchangeable or synonyms nor, in my opinion, should it use two different terms for the same phenomena.		x		External events occur in the region of the nuclear installations may create external hazards for the nuclear installation. External events and external hazards are used in this context.
27	General	I propose to add a subchapter about how to assess the effects of the time delay between the occurrences of correlated hazards.	In a previous IAEA workshop there was a presentation from the Ukrainian colleagues who developed a method on how to assess correlated hazards when they occur with a time delay, e.g.: An initiating event occur due to extreme cold and two days later extreme snowfall			x	This may be a suitable topic for a safety report or a TECDOC.

			happens. The importance of these assessments is that during the correlated event described in the example the facility already used its resources and reserves (e.g.: oil reserves for DGs, accumulators, etc.) when the second hazard hits the plant. I don't know if there is research carried out in this field right now, but the Ukrainian licensees, TSOs, and the RB body may provide a good input for the development of such methodology and recommendations.				

COMMENTS BY REVIEWER Reviewer: Meir Markovits Page1of Country/Organization: ISRAEL, IAEC Date: 30/4/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	Paras. 4.33 and 4.49	Remark: These two paragraphs (4.33 and 4.49) address the importance of Material Properties. We would like to suggest to consider to mentioning in these paragraphs **ageing properties** of the materials (being important when dealing with materials strength, for example).	Quality and clarity	x			
2	Para 6.4 footnote 30	Footnote 30 related to paragraph 6.4 does duly explain the specific importance of the use of graded approach for sites at which different types of nuclear installations are collocated. (For smaller and less dangerous nuclear installations compared to a high power NPP being operated at the same site, as a possible example). We would like suggest, for the	Completeness			x	Footnote 30 is not related to collocated installations.

		sake of completeness of this footnote, to consider to add to that footnote a sentence mentioning that at such collocated installations site the "downgraded" approach to the "small" and less dangerous installations – has to be applied carefully. That, when taking in consideration the proximity to the "high power NPP" for example, proximity which may result in case of an accident at the high power installation to significantly increased damage - and resulting hazards - to the "small installation", compared to a scenario in which the small nuclear installation is standing alone and not in vicinity to other installations.					
3	Para 6.2 footnote 29	A small remark/question related to the important subject of mission integrity not explicitly being an element of performance criteria for nuclear installations (footnote 29 mentioned in section 6.2): That important statement is indeed relevant to all nuclear installations – of course, and maybe primarily, to NPP's. So, the location of this footnote in section 6, which is named "Safety Design Provisions for Nuclear Installations **OTHER THAN NPP's** could be reconsidered. Or, alternately, to consider having a similar remark (footnote) being placed also in a previous section of that DS, where NPP's are dicussed.	Completeness	x			
4	Paras 1.10, , 2.15, 2.23, 2.24, 2.25, 2.37, 3.14, 4.24 and **5.237**	General remark regarding the issues of **Combination of EE Hazards** (for DBBE and BDBEE scenarios at various load conditions and combinations, and**,** probabilities for events combination**), Common Cause Failure, Secondary**	Clarity			x	The present text is considered to be adequate.

		Effects, Multiple external event loading… These issues are mentioned quite frequently in the present DS (see for example the paragraph numbers in the left column here). It seems to me (and I might be wrong), that that the user of this standard may find that the messages regarding the general issue of EE combinations are not clear enough, and mainly not consistent enough along those various paragraphs of the present document. Since it is not an exact mathematical matter as how to evaluate and consider hazards and events combination probabilities, it may very well be that there is no exact way for definitions and formulations on these matters**. Summarizing** (in an **appendix**?) the recommendations on these issues can be one way to help. **Paragraph 5.237** in section 5.14, is a very good example how to do that. However it seems that paragraph 5.237 does not cover all the issues raised above and it could be expanded.					

COMMENTS BY REVIEWER Reviewer: Country/Organization: ITALY			Page 1 of 1 Date: 29/04/2019	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	Parag. 1.10	1.10. This Safety Guide is applicable to the design and evaluation of nuclear installations in relation to the following EEs taken individually or in a combination of them.	An External Event can be a combination of a human induced events and a natural event (e.g. Extreme meteorological conditions can produce freezing of the structures and a simultaneously internal explosion can occur).			x	The point of the comment is not clear. Combinations of events are also considered in the SAFETY GUIDE.

2	Parag. 4.18	4.18 Another factor that should be considered in the plant layout is ignition of gas or vapor accumulated in confined external areas, such as courtyards or alleys. Detonations under these conditions might result in high local overpressures. To reduce the likelihood of such events, the design should, as far as practicable, provide a compact layout devoid of long alleys and inner courtyards, or provide adequate automatic/passive systems of expulsion in external environment so to prevent the development of an explosive concentration of gases.	We have to be sure that gases flow directly in the environment to prevent explosive concentrations of gases in other parts of the nuclear power plant. (Fukushima)			x	The point of the comment is not clear.

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 8 Country/Organization: Japan NRA Date: 23 April 2019				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason				
1.	1.8.	This Safety Guide provides methods and procedures for defining an appropriate design envelope* for a nuclear installation based on the site hazard evaluations carried out in the site characterization phase and on the specific layout of the plant. *: The initiating events, internal and external hazards and other conditions considered in the design of the nuclear installations.	Define “design envelope” here as a footnote as defined in TECDOC-1791.	x			
2.	2.5.	Two levels of external event hazards should be considered for the design and evaluation of those structures, systems, and components (SSCs) identified to be important for nuclear installation safe performance when subjected to EEs. The first level is the DBEE. The second level	To keep a consistency with SSR-2/1 (Rev. 1).	x			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 8 Country/Organization: Japan NRA Date: 23 April 2019				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason				
		should be selected to be ~~higher than the design basis~~ more severe than considered in design and used in the evaluation of the nuclear installation in order to evaluate the uncertainty in external hazard estimations and safety margins. This is called the BDBEE.					
3.	2.6. 3.1., 3.2.	Three terms is used for similar team. Unify the terms used, if there is no difference among these three. "hazard assessment organization" "hazard calculation teams" "hazard analysis team"	Completeness.		Partly accepted.		Para. 2.6 should remain the same. Hazard calculation team are changed to hazard evaluation team.
4.	After 2.12.	Add the following para after 2.12. 2.12A Taking into account a graded approach, the BDBEE should be considered only for those that have significant effects on prevention of an early radioactive release or a large radioactive release. In addition, in the case where the uncertainty associated with the hazard curve is large, it may be impracticable to define the BDBEE. In such a case, a method alternative to defining some external events may be applied, depending on the nature and characteristics of the hazard.	A graded approach for the BDBEE should be applied taking into account the nature and characteristics of the external hazards. Although it is understandable that defining two levels is ideal as a formulation, in practical, there are cases where it is difficult due to large uncertainty to define the Beyond Design Basis EE. Since Safety Guides provide recommendations and guidance on how to comply with the safety requirements, the case mentioned above should be described. In addition, some descriptions stated in subsection of			x	Paragraph 2.12 already includes the concept proposed as it refers ONLY to cliff edge effects. Furthermore, the proposed term 'graded approach' is different from the graded presented in the Safety Guide.

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 8 Country/Organization: Japan NRA Date: 23 April 2019				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason				
			"ASSESSMENT FOR BEYOND DESIGN CONDITIONS" for each external event in chapter 5 may be modified accordingly.				
5.	3.9./L	The objective of the design basis selection is to keep the radiological risk due to the EE acceptably low, i.e. as low as reasonably ~~practicable~~ achievable and ~~within~~ below the prescribed ~~regulatory~~ authorized limits.	Suggested to use identical expression described in SSR 2/1 (Rev. 1) in defining design basis.	x			
6.	3.26.	DBEE should ~~be based on~~ be derived from the hazard evaluation for the site. In order to assess the margins and evaluate cliff edge effects, alternatives to define the BDBEE and the associated loading conditions are:	To keep a consistency with SSR-2/1 (Rev. 1) para. 5.21.		x		First sentence is deleted. Please see comment of France on par 3.26.
7.	4.17. footnote 17	Some of the EEs can be considered as extreme events, which are more frequent than rare events. This is the case, for instance, of wind load when it does not include tornado or hurricane conditions[17]. [17] In some Member States, design wind speed is chosen with a 100-year return period (1% annual probability of exceedance), whereas rare design events are typically chosen with a much longer return period ~~of 10000 years~~.	To keep a consistent with footnote 20. As the return period of the rare events is chosen differently in each state, the specific values (10,000 years) should be deleted.	x			
8.	4.43.	For some external hazards, it may be possible to identify scenarios that are extremely unlikely yet still credible,	To keep a consistent with para.5.44.			x	The provided guidance is in line with practice and sufficiently flexible.

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 8 Country/Organization: Japan NRA Date: 23 April 2019				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason				
		which could be selected as the basis for the BDBEE. In these cases, the annual probability of exceedance of the BDBEE should correspond to appropriate value ~~about one order of magnitude~~ less than that of the DBEE.	It is not clear why the annual probability of exceedance of BDBEE is "about one order" less than that of the DBEE.				
9.	5.3.	The design should consider potential damage to ~~safety related~~ SSCs important to safety by the infiltration of water into internal areas of the installation resulting in water pressure on walls and foundations that may challenge their structural capacity or stability.	Better wording.	x			Pls note that SSCs important to safety is a much larger set than 'safety related' (TECDOC 1791 page 47)
10.	5.4.	The design should consider the dynamic and static effects of water that can be damaging to the structures and foundations of a nuclear installation as well as to the many systems and components located on the site. Moreover, there may be erosion at the site boundaries, scouring around structures or internal erosion of backfill due to the effects of groundwater.	Accumulation of water surrounding structures may cause water in-leak into structures with giving damage to some items important to safety.	x			
11.	5.48./L7	High winds have been known to cause collapse of cooling towers as a consequence of a 'group effect', even though they were individually designed to withstand an even higher wind speed. These effects should be considered in the design.	Clarification. "group effect" should be defined here as a footnote.	x			

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 8 Country/Organization: Japan NRA Date: 23 April 2019				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason				
12.	5.66.	Assessment for beyond design basis wind speed (BDBEE) should be performed for SSCs that are used for the containment of radioactive material or otherwise mitigation of the consequences of an accident caused by extreme winds or associated hazards.	To keep a consistency with other paras. Refer to para. 5.44, beyond design wind speed should be assessed.			x	BDB wind refers to more than the 'speed', e.g. wind borne missiles.
13.	5.84./L7	In such cases all uncertainties should be considered, and large safety factors should be used in the design of these protective structures. ~~In any case, solutions and measures should be discussed with the regulatory body on a case by case basis.~~	The last sentence should not be stated here as a Safety Guide, but it should be stated in a Safety Guide for a role of regulatory body and licensee.	x			
14.	5.89.	Non-exclusionary aspects related to volcanic hazards should be treated as DBEE loads. If any of the potentially exclusionary aspects cannot be adequately screened out with sufficient margins, these should~~, with the agreement of the regulatory body,~~ be treated in the framework of BDBEE.	Ditto.	x			
15.	5.132.	The protective measures that should be considered in design include adding supporting ~~members~~ measures to increase resistance and reduce unsupported spans, using strong backing walls for increased resistance, through bolting of walls to roofs, floors and intersecting walls to improve overall structural integrity, and replacing or reinforcing doors and windows with blast resistant elements. ~~Safety important air~~	The phrase of "should be provided" is more strict expression compared to other means in this para. Therefore, "should be considered" is preferable for this phrase. In addition, "shutters" should be revised to "measures", since		x		Major comment is accepted. For the first correction, instead of 'measures', 'structural members' will be used.

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 8 Country/Organization: Japan NRA Date: 23 April 2019				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason				
		~~intakes should be provided with a~~Automatic pressure wave protection ~~shutters~~ measures should be considered in design for safety important air intakes.	it is an example of protective measures.				
16.	5.164./4th bullet	- The effects of jet fuel initiated fires on SSCs.	To distinguish between nuclear fuel and jet fuel clearly.		x		"fuel" is changed with "crash". Please see comment of Germany on the same para.
17.	6.13.	~~As a result of this grading process, three or more categories of installation may be defined depending on State practice:~~ ~~(a) The least radiologically hazardous installations are similar to conventional facilities (essential facilities, such as hospitals); other non radiologically hazardous facilities, such as petrochemical plants, are outside the scope of this Safety Guide;~~ ~~(b) The highest grade of hazardous installation would be installations for which the risks involved to the environment and population are comparable to the risks from NPPs;~~ ~~(c) There is often one or more intermediate category of hazardous installation specified as being between those defined as equivalent to conventional facilities (essential facilities or~~	The scope of this guide is clearly stated only for nuclear installations. So it is not necessary here introducing other facilities.			x	All the installations mentioned in this paragraph are nuclear installations. This is a standard paragraph in several Safety Guides.

COMMENTS BY REVIEWER Reviewer: Japan NUSSC member Page of 8 Country/Organization: Japan NRA Date: 23 April 2019				RESOLUTION			
No.	Para/Line No.	Proposed new text	Reason				
		~~hazardous facilities) and the category for NPPs.~~					
18.	7.3.	Management of d~~D~~esign inputs, processes, requirements, outputs, changes and records should be established and controlled. The design outputs include specifications, drawings, procedures and instructions, including any information necessary to implement or install the designed SSCs or protective measures.	For clarification. It is not individual elements (design inputs, processes, requirements, outputs, changes and records) but management scheme that should be established and controlled.		x		These element need to be established in the design processes.

COMMENTS BY REVIEWER Reviewer: Poland Page 1 of 22 Country/Organization: Poland / PGE EJ1 Date:2019-03-xx				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/ Rejection
1.	1.1/2	1.1. This Safety Guide provides recommendations on the design of nuclear installation for External Events (EEs) excluding earthquakes and excluding intentional human actions to meet the requirements established in Rev [XX]…	Intentional human actions like sabotage, terrorist attack, military actions (war) should be analysed in this guide much more thoroughly or in other particular guide. Reference to it should be given. See para. 1.14. and introduced exception in para 5.201. It should be here (in para. 1.1) clearly explained.			x	This is considered in Para 1.15.

2.	1.1/5, 2.3/1, References	1.1. …"with reference to IAEA Safety Standard Series No. SSR-1 , Site Evaluation for Nuclear Installations [4], …" 2.3. SSR-1 [4] … [4] INTERNATIONAL ATOMIC ENERGY AGENCY, Site Evaluation for Nuclear Installations, IAEA Safety Standard Series No. SSR-1, Vienna ~~(2017~~ in preparation).	The SSR-1 (2017) reference seems to be wrong, as such document is not available in the IAEA website (as of 6th February 2019), and also it is not listed among recently issued documents (in particular in 2017). Instead the document No. NS-R-3 (Rev. 1), published in 2016, is still present in the IAEA website, and we are not aware of the issuance of the new SSR-1 document that would supersede NS-R-3 (Rev. 1). SSR-1 is probably the document "in preparation", as noted in Ref. [1] to DS507.		Accepted. The date will change to 2019.		Reference IAEA Safety Standards which are under revision were written as '(under revision)'.
3.	1.9/last sentence	To add at the end of that sentence: "… as well as to perform the comprehensive PSA studies covering severe accident conditions including conditions beyond DEC".	The PSA studies must include all severe accident sequences, also those beyond DEC (in fact this is a common practice in performing safety analyses).			x	Types of approaches are discussed later in the Safety Guide.
4.	1.10/3	*Human induced events (only unintentional)*	Clearly underlining the narrowing down the list of EE will avoid misunderstandings.			x	As this is a Safety Guide, security issues are not within the scope. Pls see para 1.15.
5.	1.10/17,18	− Electromagnetic interference from off the site (e.g. from communication centres and portable phone antennas, radars or directional radio lines) …	Potentially hazardous interferences especially may cause devices which emit concentrated directional electromagnetic beams, such as radars or radio lines with directional antennas.	x			

6.	1.10/20	− Flood as a result of ~~rupture~~ failure or malfunctioning of external ~~pipes~~ water retaining and control structures or devices	Not only pipe ruptures may cause potentially dangerous flooding. Any water retaining and control structures (such as dams, penstocks, gates, sluices, etc.) whose failure or malfunction may result in potentially dangerous flood should be included.			x	Dam failures are listed under the next heading.
7.	1.10/Human Induced Events	The list of human induced events should be complemented with the four following items: - External missiles - Mining, excavation, and search of mineral resources	- External missiles, arising from either mobile sources or stationary facilities, or being windblown debris, could impact the plant and potentially cause damage to its SSCs important to safety. - Activities such as mining, excavation, and search of mineral resources can result in unstable ground conditions on the plant site or in its vicinity. These unstable conditions could result in induced seismic hazards, flooding conditions or ground collapse, subsidence, ground settlement, sinkholes and leaching, what may pose significant hazards to a NPP.			x	Missiles are listed under events which can generate a missile (e.g. explosions, tornadoes, etc.)

8.	1.10/30	- Lightning, solar storms	The consequences of solar storms may be dangerous for a NPP in any location, especially for those located at high latitudes (extensive and prolonged loss of off-site power supply due to power grid failures). In recent years a number of studies have been performed in North America and Europe on the impact of solar storms on power grids. In particular, the report by the UK Royal Academy of Engineering "Extreme space weather: impacts on engineered systems and infrastructure" (2013): 1) Provides probability of extreme space whether events; 2) Defines the "one-in-100-year event": a rate of change of the Earth's magnetic field of 5000 nT/min (extreme scenario for the UK); 3) Discusses the "one-in-100-year event" impact on the UK electrical grid (which would be quite significant). As new NPPs are designed for 60 years of operation (which may be prolonged) this hazard should not be ignored.	x			

9.		1.14. External human induced events are defined as of accidental origin. These events may also include hazards posed by military facilities and activities, where relevant. Considerations of actions related to sabotage, terrorist attack, military activities related to the war, which are intentional, are outside the scope of this Safety Guide. Engineering and organizational safety aspects of the protection of nuclear power plants against these listed above EEs are discussed in other IAEA publications, for example in Ref. [15].	Potential hazards associated with malicious acts, and military facilities and activities should be clearly and properly addressed for example, taking into account the latest IAEA developments regarding the DBT such as: INFCIRC/225/Rev. 5 (2011), and Implementing Guide. IAEA Nuclear Security Series No. 10 (2009). Some military facilities (nearby bases, exercise grounds, etc.) and activities may cause significant hazards to a NPP and therefore such hazards should be also addressed here. Threats posed by the possible war actions should be also addressed somehow.			x	The present text is considered to be sufficiently clear. 'Sabotage' is defined in the security guidance of the IAEA as including all the other events. Acts of war are not considered as sabotage and nuclear installations are not designed against acts of war.
10.	2.4/2	The end products of hazard assessments should be hazard descriptors, expressed by information on the annual frequency of exceedance versus information on the severity levels of the hazards, including design basis load,…	The meaning of "Severity levels" is not enough informative as it remains unclear in which values it should be expressed. Usually severity levels are expressed by numerical or alphabetic symbols, but then it requires to provide a description of each level limits or boundaries. Meanwhile hazard design basis load, for example maximal and minimal extreme temperatures, flooding levels, wind speed, etc. will be the input information in the nuclear facility and SSC design.			x	Design basis derivation would be part of the present guide.

11.	2.15.b)/6	▪ Warning time in minutes or less – seismic ground motion (automatic seismic trip system); extreme wind (tornado). Suggestion: to modify accordingly the text highlighted in yellow (considering the reasons given in next column).	The text highlighted in yellow seems controversial, as: - Seismic shocks may occur without any advance warning, however the automatic reactor trip still would be triggered on the exceedance of a preset ground acceleration limit, - It is unclear what mitigating measures can be taken against extreme wind if the warning is received only few minutes in advance?			x	The present Safety Guide excludes seismic design. This part of the paragraph has been deleted. The point is that even if the warning time is small there may be time to scram the reactor.

12.	2.19 (entire) 2.20 (entire)	2.19. Unless national regulations require otherwise, the categorization for EEs should follow the principles of seismic categorization, which are described in NS-G-1.6 [12]. Items identified in accordance with para. 2.18 should be considered against para. 2.14 of NS-G-1.6 [12]. (…). 2.20. EE category 2 should be established for SSCs whose failure could jeopardize EE category 1 SSCs. (…). <u>Suggestion:</u> to modify accordingly sec. 2.19 & 2.20 (considering the reasons given in next column).	1.The concept of the SSCs "categorization for EEs" is new and is generally unclear, so its purpose should be explained first. 2. The idea to follow the principles of seismic categorization, instead of the safety categorization and classification principles (as described in SSG-30), seems controversial. The seismic events are just one of many EEs to be considered, and for NPPs located in low-seismicity areas the seismic hazard is insignificant, as standard plant designs provide large safety margins for seismic loads. The seismic categorization should be then regarded as secondary to the safety categorization and needs to consistent with it. Obviously the safety categorization and classification reflects the impact of specific SSC failures on performance of the main (fundamental) safety functions, and it provides the basis for proper grading the safety requirements to be set for particular SSCs.			x	Sufficient guidance is provided for the categorization in the paragraph so there is no need for referencing the Safety Guide on seismic design which itself is under revision. EE categorization was already introduced in the previous Safety Guide to a more detailed extent.

13.	3.1/2nd sentence	Adequate communications with the hazard ~~calculation~~ evaluation teams (?) should be maintained in order to ensure that the extent of the information and data is adequate to permit the design organization to develop the loading conditions (?) for the EE.	The division of responsibilities is unclear and requires clarification. It is unclear what is understood by the "hazard calculation teams" and of which organization they are the part – the design organization or the operator / stakeholder. Usually the operator/stakeholder is responsible to provide the site specific external hazards design basis loads as input information to the design organization. External hazards design basis load shall be calculated or evaluated by other applicable means before the design of nuclear facility and SSC's. External hazards design basis load <u>does not depend from nuclear facility design in any way</u> as it is either the environmental/nature phenomena, or my arose as a result of human induced event. Due to this it is also unclear what is "loading conditions for EE" which the design organization should develop. Design organization should design SSC's taking into account EE loading conditions, in particular external hazard design basis load. Paragraph 3.1 requires proper clarification or text revision.		x		"Calculation" is changed with "evaluation". The present text is considered to be adequate.

14.	3.2/1st sentence	The design organization should provide information to the hazard ~~analysis~~ evaluation team (?) regarding the requirements for the derivation of DBEE and BDBEE including the appropriate level of annual probability of exceedance to be considered.	As in the above comment and related to it, the division of responsibilities is unclear and requires clarification. 1). Are the "hazard analysis team" and "hazard calculation team" the same teams? If so one proper term should be used in the entire document. It was suggested to use the term "hazard evaluation team" with necessary clarification of the relationship of this team with design organization and operator / stakeholder. 2) It is not the design organization eligibility to require or provide requirements to the hazard evaluation team to perform external hazards derivation to the DBEE or BDBEE categories based on the offered nuclear facility design. The requirements to derivate external hazards to DBEE and BDBEE categories including the appropriate level of annual probability or hazard frequency arouses from national Regulatory requirements and/or international recommendations (see 3.9 and 3.10 paragraphs). The design organization shall adopt national Regulatory requirements and Operator / Stakeholders specifications and develop the nuclear facility design taking into account external events annual		x		"Calculation" is changed with "evaluation". The present text is considered to be adequate.

			probability, hazard frequency and loading conditions, provided by the hazard evaluation team as an input information. 3.2 chapters proper clarification or text revision is required.				
15.	3.2/2nd sentence	A feedback process between the hazard ~~development~~ evaluation organizations (?) and the design organizations should be implemented.	What is this "hazard development organizations"? 1) Nobody develops external hazards as it is either environmental/nature phenomena or arouses as a result of human activity or human induced external event. 2) A feedback process may be performed only between nuclear facility operator / stakeholder acting as an Owner and design organization acting as Plant Provider. Owner is responsible for the provision of all the external hazard evaluation information to the design organization, even if hazard evaluation team or organization is an external organization acting as Owners contractor. Usage of the term "hazard development organizations" shall be reviewed in the entire document or proper definition provided.		x		"development" is changed with "evaluation".

16.	3.4	In addition, Screening Distance Value (SDV) and SPL should be considered for screening of natural EEs (for instance for such EEs as …)	Using of SDV criteria for natural EEs screening is doubtful, as most (if not all) of the natural occurring external hazards does not depend from the nuclear facility site localization and may not be screened at all, or might be screened by SPL or other parameters, like height above the sea level, but not by the distance. Mentioning of few proper examples of natural EEs which may be screening by SDV would be useful for this guide.			x	For example, monogenetic volcano hazards may be screened out using a SDV and SPL.

17.	3.5	A feedback process for screened out hazards should be implemented, in the same manner (?) as the implementation of the feedback process between the hazard ~~development~~ evaluation organizations and the design organizations for the hazard parameters and loading conditions.	This paragraph is not enough informative. First of all, it is unclear in which "same manner" this feedback process shall be implemented as there was no description how such feedback should be organized and performed in the paragraph 3.2, except the recommendation to provide / implement such feedback. 2nd, it is unclear between which organization feedback process for screened out hazards should be implemented, as hazard evaluation and design organizations are mentioned here only as an example and from how it is written this organizations are not related to feedback process for screened out hazards. Feedback should be implemented only between Owner and design organization even if hazard evaluation organization acts as an external Owners contractor. Paragraph 3.5 requires text review and clarification.		x		"development" is changed with "evaluation". The present text is considered to be adequate.

18.	3.6	The general approach in the nuclear facility design process is to ~~establish~~ apply the design loading conditions including the hazard design basis load determined by a combination of deterministic and probabilistic methods and to proceed with the design in a deterministic manner.	Hardly understandable sentence. Design organization does not establish any hazard loading conditions in the design, but applies hazard loading conditions determined by a combination of deterministic and probabilistic methods as input information for the nuclear facility design. Paragraph 3.6 requires review and clarification			x	The present text is considered to be adequate.
19.	3.26/1st bullet	Define the BDBEE conditions by a factor times the DBEE loading conditions similar in concept to the requirements for Beyond Design Basis Earthquake loading conditions for new nuclear installation designs [Ref. XX]	This guide does not provide recommendations for and is not related to the earthquake external events and earthquake design basis load. Proper reference to the literature or IAEA Safety Guide is required.	x			

20.	5.41	Wind speeds should be averaged over definite time periods. Time averaging of wind speed should be done using time periods consistent with natural frequencies (?) found in SSCs[21]. In addition, corrections for local topographical effects (?), if any, should be considered. … [21] For structural design in nuclear installations, time averages over 1 to 3 seconds (gust speeds) are usually necessary.	This requirement is hardly understandable and requires additional clarification. All the issues mentioned below should be clarified and explained in the guide. 1st of all, it is unclear how this wind speeds averaging should be done. For winds speeds evaluation at the nuclear installation site and wind speed design basis load estimation, wind speed measurement data from meteorological measurement station at the site vicinity or nearby area might be the only source of data. This measurement data will have its own measurement frequency, which might be much less than 1 Hz, especially if dealing with historical measurement data. 2nd, it is unclear why there is a need to perform wind speed averaging as well as it is unclear what should be the prolongation of this "definite time periods". Wind speed design basis load should be estimated considering maximal, but not average wind speed within defined historical period of meteorological measurement time. 3rd, Owner/Operator will be responsible for the definition of the wind speed design basis load at the nuclear installation site and provision of this data			x	The present text is considered to be adequate.

			to the Designer. As of that, the Owner/Operator will not be able even to know, what might be the natural frequencies found in the SSCs designed by Designer. It should be noted one more time, that not the design basis loads are defined from the Designers provided design of nuclear installation and SSC's, but the nuclear installation and the SSC's shall be designed based on the defined design basis loads. The definition and clarification are required of what is understood as "SSCs' natural frequencies" and why this frequencies is so important (It is assumed that this might be related to the resonance effects). It will be the Designers responsibility to design SSC's in such a way, that they "natural frequencies" won't match wind speed frequencies. 4th. It is unclear who should consider corrections for local topographical effects and how it might be performed. Wind speed meteorological measurement data is as it is, measured at some fixed point at the nuclear installation site nearby area. Any attempt to "correct" wind speed at any other location based on this measurements will only				

			increase data uncertainties and errors probability. Also it, should be noted, that wind speed design basis load must be defined before the nuclear installation and SSC's design. At this point any wind speed "corrections" considering "topographical effects" is senseless, as 1st of all, the site topography will change during site preparation and development, 2nd – Owner will not be able to know the proposed nuclear installation layout, which might cause local "topographical effects" for wind speed in the future (see paragraph 5.48). Definition of "topographical effects" shall be provided.				

21.	5.51	In analysing the failure of equipment within the buildings, the design should conservatively assume that a failure in the enclosure causes the failure of all sensitive equipment protected by the failed portion of the enclosure.	This might be a recommendation for safety analysis and safety analysis report preparation, to show that any potential failure of equipment within the building due external event will not cause an initiating event leading to the failure of SSC's important to safety. But this guide objective is to provide recommendations how external events effects should be considered in the nuclear installation and SSC's design and how SSC's should be designed to comply with external events design basis loads. In other words, the equipment and all SSC"s should be designed in a such a way, that during DBEE no equipment failure would happen. For the design qualification, it should be demonstrated, that none of the DBEE will cause failure of the SSC's important to the safety. For BDBEE it might be demonstrated, that assumed failure of the equipment will not affect the nuclear safety functions, such as prevention of early release of radioactivity. Due to said above, it is proposed to reconsider or supplement and clarify the paragraph 5.51 and whole subsection "Design and			x	The point of the comment is not clear.

			Qualification Methods" in general, providing clear explanation of <u>what is the final objective of design qualification</u>, as well as who is responsible for design qualification – the Designer, or the Owner. Now it seems like everything is mixed: a) the identification of external event and EE design basis load (capacity) estimation – which should be performed by the Owner or his hazard evaluation team, and b) the analysis of nuclear installation buildings and equipment responses to EE design basis loads – which should be performed by the Designer.				

22.	5.67/2nd sentence	Methods in the assessment for beyond design basis wind speed (BDBEE) should normally be the same as in the design for design basis wind speed (DBEE). The differences should be reflected in the acceptance criteria (?) and the material properties (?) used in the assessment (see Section 4).	It is unclear, how external event related to wind speed or any other extreme wind behavior (tornado, hurricane) can be assigned to DBEE or BDBEE based on the acceptance criteria and the material properties? Also it is unclear, what are this "acceptance criteria" and which material and its properties is considered here. It should be noted, that external event assignment to the design basis external event, i.e. EE which consequences and/or initiating events shall be considered in the DBC (design basis conditions), or to the beyond design basis external event, i.e. EE which consequences and/or initiating events shall be considered in the DEC (design extension conditions) or beyond DEC, shall be bases on this EE occurrence probability and its annual frequency and is in no way related to any material properties. It is Designers responsibility to choose and use materials with such properties, that no equipment or SSC's failure would occur as a result of DBEE and early release of radioactive material would be prevented during BDBEE.			x	Design basis wind includes more than the speed, e.g. wind borne missiles.

23.	5.71	The entity responsible for the EE hazard analysis ~~team related to the above-mentioned EEs~~ should ~~be informed that the necessary definition of the environmental parameters follows~~ perform the evaluation of the extreme values for ~~the quantities~~ each meteorological event of interest and define the design basis load (design basis conditions) of each environmental parameter.	1. Hardly understandable sentence: "Definitions… follows… evaluation… quantities of interest." The recommendation needs to be clarified and reviewed. 2. It is unclear, who should inform "hazard analysis team" – the Owner/Operator, or the Designer? And how many such "hazard analysis teams" might be if each team is related only to particular EEs. It is understandable, what certain analysis will be performed by people who has the particular competency, but final responsibility for the EE hazard analysis results will have the entity as a whole. Due to this it is proposed hazard analysis team change with hazard analysis entity do not related to any particular EE. 3. Moreover, using such style of the recommendation then somebody should be informed about something, like in this case "hazard analysis team" should be informed about that "definitions follows evaluation" is not applicable. Just being informed does not put any obligation for hazard analysis team, requires any action from hazard analysis			x	The present text is considered to be adequate.

			team, or makes hazard analysis team responsible for whatever. All such kind recommendations "should be informed" **must be reviewed in the entire guidance** providing clear recommendations, what actions need to be done, or what should be done by hazard analysis team, or any other entity – Owner/Operator, Shareholder, Designer, etc. **Paragraphs which needs revision are: 3.3, 5.59, 5.71, 5.96.** In this particular case, the recommendation could be written: *"The entity responsible for the EE hazard analysis should perform the evaluation of the extreme values for each meteorological event of interest and define the design basis load (design basis conditions) of each environmental parameter."*				

24.	5.72	"… while equipment should be qualified in accordance with its safety and EE classification (?)."	It is unclear what it is "equipment EE classification" and how equipment shall be classified against external events. Also it is unclear, how SSC's safety classification will comply with EE classification. Proper definition of SSC's EE classification system should be provided and relation between SSC's safety and EE classifications should be explained.			x	The text explains the questions raised in the comment.
25.	5.122	Nuclear installation ~~Design~~ designing process should involve the following steps: (a) ~~Characterize~~ Characterization of the blast pressure and dynamic (wind) pressure acting on the structure... (b) ~~Obtain~~ Determination of the forces acting on the external surfaces of the structure; (c) ~~Determine~~ Determination of the structure's resistance to the pattern of forces,… Etc.	Ordering tone should be replaced by recommendations what should be done in such document as guide. Ordering tone might be acceptable only in "check list" of certain procedures when actions must be done in strict order.			x	The present text is considered to be adequate.

26.	5.8 Chapter	RADIATION HAZARDS FROM ON-SITE AND COLLOCATED INSTALLATIONS	This guide is dedicated exclusively for external events and hazard arousing from external natural and human induced events, which are beyond of control of operating organization. Such on-site events which are not related to meteorological events but related to radioactive material release due everyday operation of nuclear installation or nuclear material on-site transportation are internal events and should be out of scope of this guide. Nevertheless, there might be similar radiation hazard effects, arousing from nearby other nuclear installations, which might require similar analysis and protective measures put in the design of installation. This aspect should be either clarified in the document, why radiation on-site internal and external hazards are grouped together, or chapter 5.8 should provide recommendations exclusively only for external hazards consideration in the nuclear installation design.			x	Pls. see scope in Section 1.

27.	5.157	Nuclear installation should be designed considering all potential ~~Design against~~ radioactive external hazards and should aim at keeping the external and internal exposure of installation personnel within the prescribed regulatory requirements of the Member State. In addition, nuclear installation should be designed to ~~design should avoid~~ minimize (limit) further spreading of radioactive substances that reach the installation.	Recommendation needs to be clarified. Not the design should aim at or should avoid something, but nuclear installation should be designed in a proper way to keep the external and internal exposure of personnel within the prescribed regulatory requirements and to minimize and limit further spreading of radioactive substances, or should provide protection against further spreading of radioactive substances.	x			

28.	5.158	In the case of a cloud of radioactive gas, the gas concentration inside the installation should be calculated based on air exchange rates, with assumed meteorological conditions (excluding some portion of the most adverse historical data) taken into account, thus giving a time dependent concentration and doses. The extension and interaction time of the gas or vapour cloud should be determined on an installation specific basis. Special attention should be paid to releases of radioactive gases to air intakes for the control room and other locations where personnel are present.	Comments to the underlined sentence: 1. Once again, the goal of nuclear installation design process is mismatched in the guide. Calculation of radioactive gas concentrations inside the installation might be considered only as intermedia process of nuclear installation designing process. When external hazard arousing from any external natural or human induced potential event is defined and EE design basis load or design basis conditions are determined, nuclear installation should be designed to ensure protection for equipment, SSC's and personal against all DBEE and to ensure performance of safety functions during BDBEE. 2. It is unclear, why radioactive gas concentrations inside the installation should be calculated based only on air exchange rates and meteorological conditions and why air filtration factor is ignored. The determination of the necessary filtration efficiency and capacity as well as provision other protection design measures, like external radiation detection and			x	The point of the comment is unclear.

			automated shutdown of air exchangers should be the final result of nuclear installation design process against external radiation event to which guide should point. Proper clarification of the nuclear installation design process and explanation of the final goal of radioactive gas concentration calculations should be provided in the guide. Comment to the new wording in red: Considering all possible meteorological conditions seems to be too conservative approach. The exclusion of some percentage of the most adverse conditions is the common international practice (e.g. USA, Finland, Japan).				
29.	5.163	SSCs requiring a design for aircraft crash are defined by a safety analysis. ~~Iterations between the designers of the SSCs may occur before the final EE classification determined.~~ All SSCs classified as EE category l and EE category 2 (?) should be designed or evaluated for the aircraft crash event.	1. It is proposed to delete 2nd sentence as it does not provide any recommendation for the nuclear installation design process, but just points out to the inner communication of the Designer, which is out of the scope of nuclear installation design process. 2. As it was mentioned before in the comments for paragraphs 2.19 and 5.72, SSCs classification against EE and EE categorization should be explained and clarified in this guide.			x	It is not intended that each sentence of the Safety Guide is a recommendation. It is important that each paragraph has at least one recommendation. Explanatory sentences within paragraphs are intended to help the reader.

30.	5.169/2nd sentence		Meaning of the used term "dead and live loads" is not understandable. Does it actually means "passive / static load" like snow load and "active load" like wind speed? The meaning of the term "dead and live loads" should be clarified **or replaced here and in the paragraphs 5.186.**			x	Dead and live loads are common engineering terms.
31.	5.201/2	If the EMP sources are of malevolent origin, close cooperation with nuclear security specialists should be made to respond to EMPs of any origin with a single comprehensive design, but this problem (sabotage, terrorist attack, war) is outside of this guide (see 1.1, 1.10). See dedicated Ref. [XX].	Intentional human actions like sabotage, terrorist attack, military actions (war) couldn't be described in one sentence. References should be given.			x	Recommending cooperation with security specialists is not outside the scope.
32.	5.203/1st sentence	Within the nuclear installation, sources may be stationary or mobile.	Hazards from EMI/RFI sources within nuclear installation belongs to internal hazards which can be controlled by operator. It is supposed that this guide should be dedicated exclusively for external hazards, including EE related with EMI/RFI sources usage outside the nuclear installation site (see also comment for 5.8 chapter). Proper clarification, why hazards from internal EMI/RFI events are grouped together with external EMI/RFI events should be provided, or guide text should be revised.			x	These events are within the scope of the document as stated earlier.

COMMENTS BY REVIEWER Reviewer: V. N. Pogrebnyak, Page.... of.... Country/Organization: TC MPI JSC Atomstroyexport, Russian Federation Date:25/04/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	Clause 1.10 Natural phenomena 1st paragraph	I suggest the following revision: Floods caused by tides, tsunamis, seiches, storm surges, extreme rainfall, waterspouts, dam formation and destruction of the dam, melting of snow and of mountain glaciers, landslides into water bodies, changes in the river bed and work carried out in the riverbed; Floods such as due to tides, tsunamis, seiches, storm surges, extream rainfall, waterspouts, dam forming and dam failures, snow melt and mountain glaciers, landslides into water bodies, channel changes and work in the channel;	Some major factors of floods formation on rivers during the spring-summer flood (for example, on the rivers of the European part of Russia and Siberia) and floods on the rivers with a flood regime (for example, Primorsky Krai, the rivers of the Black Sea coast of the Caucasus), including all rivers subject to hydrological exposure to typhoons and hurricanes are missing. For a region, the likelihood of flooding caused by one or more natural causes, such as melting of snow and mountain glaciers, extreme precipitation (including combinations of a common cause or due to a relatively high frequency of occurrence) that may affect the safety of a nuclear installation, shall be assessed. For the sites located on the rivers below the water storage basins of the hydroelectric complex dam location, the probability of flooding from the wave of the waterfront pressure of the hydroelectric station during the passage of a maximum flood or flood shall be assessed.		Accepted, to include '…landslides involving glaciers…' to the list. As the comment is not clear, this seems to be the only item missing from the paragraph.		

2.	Clause 1.10 Natural phenomena 3d paragraph	I suggest the following revision: - Powerful tropical cyclones (hurricanes and typhoons), tornadoes and hurricanes winds; - Powerful tropical cyclones, tornadoes and hurricanes winds;	Cyclones are atmospheric disturbances with air subpressure, the position, characteristics and the trajectory of motion of which are displayed on the maps of the baric topography. Extra-tropical cyclones have a size across from a thousand kilometers at the beginning of development and up to several thousand kilometers in the case of the so-called central cyclone. These extra-tropical cyclones are characterized by maximum winds, which in the document are called "straight winds", and in the proposed new revision "hurricanes winds". Powerful cyclones that have arisen in tropical latitudes have smaller sizes, large pressure gradients and storm wind speeds which are very rare in extra-tropical cyclones. Powerful tropical cyclones with wind speeds of more than 32 m / s in the basin of the Atlantic Ocean are called hurricanes, in the Pacific Ocean they are called typhoons, and, for example, in the southern part of the Indian Ocean basin when entering Australia they have the name of Willie-Willi. By nature, tornadoes are not cyclones in the classical sense. They are powerful ascending vortex flows, which are formed during the development of		Text is modified as "- High wind hazards due to tropical cyclones (hurricanes and typhoons), extratropical cyclones, tornadoes and downbursts;"		Please see the comment of Finland' on para. 1.10

			powerful cumulus clouds characteristic of frontal zones.				
COMMENTS BY REVIEWER Reviewer: A. Sergeev, Page.... of.... Country/Organization: BKII JSC Atomstroyexport, Russian Federation Date:25/04/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	Clause 2.12	In the course of reviewing beyond design external events and observing the method of analysis based on the best option, the parameters values of the external event causing the cliff edge effect shall be established. In addition, an adequate degree of safety shall be demonstrated. For this purpose, the confirmation shall include determination of the event severity causing the cliff edge effect and calculations of the likelihood when the cliff edge effect may occur.	The characteristics/ parameters of external events taken into consideration in the design basis are set rather conservatively. For example, external events of technogenic origin are taken into consideration in the NP designt either as a deterministic event (that is, an event that is admittedly to be realized at the site / power unit), or with a frequency of implementation determined by the standardized frequency of the maximum permissible accidental release. Thus, in the Russian Federation, external events of technogenic origin are included in the design bases if their frequency of occurrence exceeds 10-6 per year. External events of natural origin are included in the design basis if their frequency of occurrence is equal to or greater than 1 time in 10 thousand years, since the rarer occurrence of natural events is devoid of physical meaning. So, the calculation of a cliff edge effect probability arising from beyond design external effects, recommended by paragraph 2.12 of the design "IAEA Safety			x	The proposed text does not bring a new idea and an added value to the present text.

			Guide" No. DS 498, implies work, the results of which are not used in the design any more. At the same time, in most cases the assessment of safety margins can be performed by simple analysis of the AS characteristics. The requirement to calculate the probability of the cliff edge effect is difficult of accomplishment, and the practical value of the calculation results is not obvious.				
COMMENTS BY REVIEWER Reviewer S.S. Polyushenko, Page.... of.... Country/Organization: ACS JSC ASE EC, Russian Federation Date:25/04/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	Clause 2.41 the first hyphen	After the occurrence of the beyond design external event the design shall provide access to the block control center or the Remote Shutdown Station and to other locations (boxes, rooms and technical facilities) that are necessary to maintain the beyond design external event response.	Bringing to the original. With beyond design external events the requirements are softer.			x	The proposed text does bring a new idea and an added value to the present text.
2.	Clause 5.148	The modular control room and its emergency ventilation system (or emergency operation of the ventilation system) shall be a leaktight construction	In the original, the requirement is only for emergency operation of the ventilation system of the main control room.			x	In fact, the original text includes the leaktightness requirement of the control room as well. The proposed text does not bring a new idea and an added value to the present text.
3.	Clause 5.150	A nuclear power plant shall have an emergency control room for shutting down the reactor and monitoring its condition, with a separate system for supplying air from the air supply, it is to be situated remotely from the main control panel. The	It more accurately expresses the sense of the original.			x	The proposed text does not bring a new idea and an added value to the present text.

		movement pattern from the main control room to the emergency control room shall be protected to ensure safe movement of the operators or, alternatively, provide for the personnel movement through the checkpoint where they can get a breathing apparatus.					
4.	Clause 5.196	If a non-design aircraft crash involves a commercial aircraft accident with a full tank of fuel, the acceptance criteria shall be chosen so that, at the very least, the safety-related facilities of the nuclear installations in the fourth defense in depth level remained capable of performing their functions.	It more accurately expresses the sense of the original.			x	The proposed text does not bring a new idea and an added value to the present text. Non-design is not an accepted term.
5.	Clause 5.199	The development of instrumentation and control (I & C) tools for nuclear installations includes a lot of digital equipment, which increases its vulnerability to electrical / radio interference. In addition, the development of potential sources of electrical / radio interference occurs at a very fast pace. Consequently, protection of the quality control system of a nuclear installation against electromagnetic and radio interference shall be analyzed more often than other types of hazards (dangers).	It more accurately expresses the sense of the original.			x	The proposed text does not bring a new idea and an added value to the present text.
6.	Clause 5.204	In such cases when protective measures cannot be provided for by the design, administrative controls shall be established, such as exclusion zones, and procedures to ensure compliance with these measures shall be developed.	It more accurately expresses the sense of the original.			x	The proposed text does not bring a new idea and an added value to the present text.
COMMENTS BY REVIEWER Reviewer V.A. Korotkov Page.... of.... Country/Organization: JSC «Atomenergoproekt»,, Russian Federation Date:25/04/2019				RESOLUTION			
1.	Section 2, subsection PROTECTIO	The following subsection should be included into this section:			Accepted with modification as follows:		

	N OF SYSTEMS, STRUCTURES AND COMPONENTS AGAINST EXTERNAL EVENTS	SEISMIC-ISOLATED STRUCTURES containing the paragraph: P1. Application of seismic isolation in order to reduce the seismic loads shall not result in increase of the response of structures in case of any external events if an external event is the determinative factor in comparison with an earthquake.			'If any SSC (including the complete nuclear island) is designed using seismic isolation, the response of these SSCs to other external hazards should be verified to demonstrate that they are not adversely affected by this design approach.'		
2.	Section 3, subsection "Assessment of beyond design basis external events: cliff edge effects", par. 3.29	It is not quite clear how to comply with the requirement specified in this paragraph due to rather general definition of the term "cliff edge effect". If this requirement is regulated only by the safety margin this margin is provided due to consideration of beyond design basis external events.				x	Requirements for dealing with cliff edge effects are originating in the Design Requirements document.
3.	Section 5, par. 122	This paragraph should be amended with the following sentence: "Besides the soils under the particular structure shall be taken into consideration".				x	The comment is correct, but the term 'design' includes the foundation soil conditions.
4.	Section 5, subsection "Loads and structures"	The following additional paragraph should be included into this subsection: "The required number of impacts defining both global response (including the response spectra) and the maximum local damage shall be taken into account for the structure under consideration".				x	The comment is not clear, and no explanation is provided on what is meant by 'number of impacts'.
5.	Section 5, par. 123	The following words should be added after the words "the particular structure response include": the load build-up time and its peak value,	x				
6.	Section 5, par. 181	This paragraph should be amended. The simplified model may be used in the analysis of "global effects" (calculation of the kinematic parameters in the building and stress-strain behavior of the building				x	The proposed idea is not precluded in the present text.

		outside the impact area) not only outside the local area but also within the local area provided that the impact is set as a function of load with respect to time.					
7.	Section 5, par. 182	Compliance with this paragraph means that in case of any beyond design basis impact the contact problem of interaction between the aircraft and the building should be solved where both objects are modelled geometrically similar with due regard for plastic deformations. The soil shall be also duly taken into consideration. This paragraph should be amended: "In case it is impossible to provide the particular aircraft model for the designer of finite elements analysis for the temporary load effect (dependence of force on time) may be performed".				x	The type of aircraft can never be predicted. However, the scenario to be considered needs to be enveloping and credible, which means that a type of aircraft suitable for such purpose should be identified for modeling purposes.
8.	Section 5, par. 185	The current wording should be replaced with the following text: "The soil is represented by the damped system of springs. For standard foundations and site conditions it is sufficient to consider the average value of the dynamic soil properties under the buildings as it is supposed that the effect of variability in the soil properties on this analysis will be negligible".				x	The proposed text does not bring a new idea and an added value to the present text.
COMMENTS BY REVIEWER Reviewer Reznikov Pavel Nikolaevich, Page.... of.... Country/Organization: Private institution of Rosatom State Corporation "Rosatom Capital Construction Division", Russian Federation Date:25/04/2019				RESOLUTION			
1.	Standard at large	It is recommended to specify (at least in minimum) requirements for the used mathematical models of hydrometeorological phenomena (hydrodynamic models, models of atmospheric circulation, models for predicting the trajectories of typhoons, models for calculating tsunamis, models for calculating sediment transportation, etc.) .	The absence of requirements for mathematical models of hydrometeorological phenomena does not allow us to estimate the accuracy, reliability, quality of the hydrometeorological characteristics (risks) obtained with their help.			x	DS 498 is a draft Safety Guide for design. The proposed subjects belong to Safety Guides on hazard evaluation.

		In particular, the requirements for validation, model verification, a clear definition (declaration) of the field of applicability.					
2.	Standard at large	It is recommended to include requirements for the fullness and quality of the hydrometeorological information used to determine hydrological, oceanographic and meteorological characteristics.	The lack of requirements for the fullness and quality of hydrometeorological information does not allow to assess the accuracy, reliability, quality of the hydrometeorological characteristics (risks) obtained on its basis.			x.	DS 498 is a draft Safety Guide for design. The proposed subjects belong to Safety Guides on hazard evaluation.
3.	Standard at large	It is recommended to include definitions of the terms (from the field of natural influences) or a compiled glossary for a monosemantic interpretation of the terms used in the standard. In particular, it is required to determine: Tsunami Storm surge Seiche Wind swell (wind wave) Sandstorm (tornado?) Blocking (ice) Erosion and sediment load accumulation Wave load Ice load Load from ships	The users of the standard do not have to be specialists in a broad range of Earth sciences (oceanology, geology, hydrology, meteorology). The terms shall be unambiguous and not to allow different interpretations.			x	DS 498 is a draft Safety Guide for design. The proposed subjects belong to Safety Guides on hazard evaluation.
4.	Section 3. Basics for the design of external events. Clause 3.12	The meaning of the phrase is not completely clear. Instead of “overflowing the protective structure from flooding”, it is recommended to use the translation “overflow of water over the flood control protective structure” or “overflow of water over the flood protecting structure”	«3.12.For each external event of interest, the possibility of the external event load mode (s) to create a threshold effect shall be assessed (see paragraph 5.21 of SSR-2/1 (Edition 1) [1]). The assessment shall include identification of the threshold effect, for example, overfilling of the protective structure from flooding, the likelihood of such an event, the consequences of the			x	It is considered that the present text is sufficiently clear.

			threshold effect on the systems, structures, components and the nuclear installation and methods for eliminating such effects. ”				
5.	Section 4. The plant layout and the approach to the design of construction. Clause 4.15	It is proposed to amend and paraphrase the last sentence in paragraph 4.15 “The layout shall include provisions that take into account accidental pluggage of engineering systems for the discharge of surface and drainage wastewater”	«4.15. The roof structure shall not allow accumulation of snow, rainwater or ice, exceeding the design loads provided for the roof. The layout shall include provisions that take account accidental pluggage of the drainage system.”		Second sentence is modified as “The layout should include provisions that account for accidental clogging of engineering systems for the discharge of surface and drainage wastewater.		
6.	Subsection 5.1. Outside flooding, including tsunami. Clause 5.1.	Instead of “waves caused by strong wind”, it is recommended to translate “wind waves” or “wind waves”	"Waves caused by strong wind"			x	The wording ‘wind generated waves’ is used in Safety Guide SSG-18.
7.	Subsection 5.1. Outside flooding, including tsunami. Clause 5.7	It is recommended to include general requirements into the models computation of tsunamis	«5.7.Flood analysis during a tsunami shall include the maximum water level, the duration of such an event, the height of the wave surge, horizontal flooding, the return water effect, the minimum water level and the duration of lowering the level below the water intake. The analysis of loading and unloading shall include hydrodynamic effects, static effects of loading, missiles carried by water, as well as erosion and sedimentation (deposition) and other relevant effects. The water level during design flooding can be determined in one place or several places in the open sea, where the theory of linear long wave is applied, and the wave			x	The point of the comment is not clear. If the recommendation is to include guidance on computation of tsunami model. This is scope of the Safety Guide SSG-18. The last sentence of this paragraph has been deleted as a consequence of a comment from Finland.

			reflected from the coast is insignificant."				
8.	Subsection 5.1. Outside flooding, including tsunami. Clause 5.34	It is recommended to speak not about the "river delta" (it is an isolated situation), but about the estuarine area. Not all rivers have a delta, and the tides may extend beyond the delta.	«5.34.For the sites located in the river delta and exposed to ocean tides, it is necessary to determine the range of tidal water levels."			x	The proposed text does not bring a new idea and an added value to the present text.
9.	Subsection 5.1. Outside flooding, including tsunami. Clause 5.34	It is recommended to speak not about "ocean tides" (it is a particular case), but about "sea tides" or simply "tides".	«5.34.For the sites located in the river delta and exposed to ocean tides, it is necessary to determine the range of tidal water levels."			x	Non-oceanic tides are considered to be insignificant when compared to other phenomena that will influence the water level at the site.
10.	Standard at large	It is recommended to include definitions of the terms (from the field of natural influences) or a compiled glossary for a monosemantic interpretation of the terms used in the standard. In particular, it is required to determine: Tsunami Storm surge Seiche Wind swell (wind wave) Sandstorm (tornado?) Blocking (ice) Erosion and sediment load accumulation Wave load Ice load Load from ships	The users of the standard do not have to be specialists in a broad range of Earth sciences (oceanology, geology, hydrology, meteorology). The terms shall be unambiguous and not to allow different interpretations.			x	Repetition of Comment 3 above.
11.	Section 3. Basics for the design of external events. Clause 3.12	The meaning of the phrase is not completely clear. Instead of "overflowing the protective structure from flooding", it is recommended to use the translation "overflow of water over the flood control protective structure" or "overflow of water over the flood protecting structure"	«3.12.For each external event of interest, the possibility of the external event load mode (s) to create a threshold effect shall be assessed (see paragraph 5.21 of SSR-2/1 (Edition 1) [1]). The assessment shall include identification of the threshold effect, for example, overfilling of the protective structure from			x	Repetition of Comment 4 above.

			flooding, the likelihood of such an event, the consequences of the threshold effect on the systems, structures, components and the nuclear installation and methods for eliminating such effects. ”				
12.	Section 4. The plant layout and the approach to the design of construction. Clause 4.15	It is proposed to amend and paraphrase the last sentence in paragraph 4.15 “The layout shall include provisions that take into account accidental pluggage of engineering systems for the discharge of surface and drainage wastewater”	«4.15.The roof structure shall not allow accumulation of snow, rainwater or ice, exceeding the design loads provided for the roof. The layout shall include provisions that take account accidental pluggage of the drainage system.”			x	Repetition of Comment 5 above.
13.	Subsection 5.1. Outside flooding, including tsunami. Clause 5.1.	Instead of “waves caused by strong wind”, it is recommended to translate “wind waves” or “wind waves”	"Waves caused by strong wind"			x	Repetition of Comment 6 above.
14.	Subsection 5.1. Outside flooding, including tsunami. Clause 5.7	It is recommended to include general requirements into the models computation of tsunamis	«5.7.Flood analysis during a tsunami shall include the maximum water level, the duration of such an event, the height of the wave surge, horizontal flooding, the return water effect, the minimum water level and the duration of lowering the level below the water intake. The analysis of loading and unloading shall include hydrodynamic effects, static effects of loading, missiles carried by water, as well as erosion and sedimentation (deposition) and other relevant effects. The water level during design flooding can be determined in one place or several places in the open sea, where the theory of linear long			x	Repetition of Comment 7 above.

			wave is applied, and the wave reflected from the coast is insignificant."				
15.	Subsection 5.1. Outside flooding, including tsunami. Clause 5.34	It is recommended to speak not about the "river delta" (it is an isolated situation), but about the estuarine area. Not all rivers have a delta, and the tides may extend beyond the delta.	«5.34.For the sites located in the river delta and exposed to ocean tides, it is necessary to determine the range of tidal water levels."			x	Repetition of Comment 8 above.
16.	Subsection 5.1. Outside flooding, including tsunami. Clause 5.34	It is recommended to speak not about "ocean tides" (it is a particular case), but about "sea tides" or simply "tides".	«5.34.For the sites located in the river delta and exposed to ocean tides, it is necessary to determine the range of tidal water levels."			x	Repetition of Comment 9 above.

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: Tanya MacLeod Page.... of....							
Country/Organization: UK/ONR Date: 2 Nov 2018							
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.11	Accidental aircraft crash	It isn't made clear until paragraph 1.15 that malicious events are excluded, therefore it's a little confusing that it isn't specified that the hazard referred to is accidental aircraft crash	x			
2	1.11	Floods - include bores and waves, and clarify what is meant by "channel changes and work in the channel"	For clarity and consistency with paragraph 34	x			
3	1.11	Move combinations below both categories of hazards	At the moment it appears that combinations only apply to manmade hazards	x			
4	2.15 (a)	State "more severe or less certain"	Not all of the factors listed would make a hazard more severe		Accepted. Change to 'more severe and more uncertain'		Certainty is an absolute concept and should not be graded.
5	2.15(b)	Mention that the shutdown state still requires evaluation - also remove seismic	The way the text is written it could be taken to mean that	x			

			shutting down = making safe, also seismic is out of scope				
6	2.20	Refer to paragraph 2.19	2.20 refers to paragraph 2.18 twice but both references should be to 2.19			x	No reference to Para. 2.20. References are made in Para 2.19 to Para. 2.18.
7	5.22	State that a dry site is preferred over a site protected by permanent external barriers	Alignment with the IAEA director general's report post-Fukushima	x			
8	5.238	Expand the text to ensure that all credible combinations of events are considered. Please consider the text in ONR TAG 13 (rev 7) paragraph 150 for an explanation of the combinations of hazards that we think need to be taken into account. Not all of these are included in the text.	The text the way it is written could lead to screening out combinations of hazards prematurely		x		Please see the comment of Hungary on para. 5.239.
9	5.77	The predicted implications of climate change must be taken into account beyond the design basis for any external hazards directly or indirectly affected by meteorological events	There are only two mentions of climate change in the entire document. The main definition is given in para 5.77: "Beyond design basis for other meteorological events should be considered taking into account predictions of climate change that may affect the design basis parameters already considered We acknowledge this is a catch all statement, but can coastal flooding be considered a meteorological event? Reading this, there may be an argument to say that climate change doesn't need to be considered for coastal flooding. In reality, this is unlikely to happen in most countries, but we do feel like this is a weakness in the standard and suggest a revision to the wording	x			

COMMENTS BY REVIEWER Reviewer: US Nuclear Regulatory Commission Country/Organization: United States of America/US NRC Date: Apr 23, 2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	2.14/last	It is recommended that the following be added: "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 their upper bounds, which are by and large critical but uncertain, especially at low annual exceedance probability level."	This would be a more logical step to develop a probabilistic model.			x	There is no recommendation in the proposal.
2.	2.22/last	It is recommended that the following be added: "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."	The provision to use a combination of methods will move this process in line with current practice.			x	The paragraph already includes the concept. Proposed text does is not a recommendation.
3.	5.237/ first indented item	It is recommended that, right after the current text "between the events felt at the site.", the following two sentences be added: "This case also includes multiple dependent events occurring concurrently. Some examples include storm surge accompanied with heavy rainfalls, dam failures induced by heavy rainfall, serial upstream dam failures in a cascading manner, and others."	These are relevant cases that need to be considered.	x			

COMMENTS BY REVIEWER Reviewer: ENISS Page 1 of 5 Country/Organization: ENISS Date: 30/04/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.14	External human induced events are defined as of accidental origin. Considerations of actions related to sabotage are outside the scope of this Safety Guide. Engineering safety aspects of the protection of nuclear power plants against sabotage are discussed in Ref. [15]. ~~However, the methods described in this Safety Guide might also be applied to sabotage protection of a nuclear installation.~~	The guide is not intended to provide guidance on methods for protection against "sabotage". The statement that "the methods herein also have certain application to sabotage protection" is vague and adds ambiguity. The guide includes no further discussion on the subject and, thus there is no added value of making this statement.			x	This is not claimed in the Safety Guide.
2	2.8	…The analysis should consider, as far as reasonable, all applicable epistemic and aleatory uncertainties.…	The analysis shall be proportionate to the stakes and the field of uncertainties must be limited			x	**All applicable** uncertainties imply already reasonableness.
3	2.12	~~In consideration of the BDBEE and following a best estimate approach, values of external event parameters causing cliff edge effects should be established.~~ Adequate margins to avoid cliff-edge effect should be demonstrated by means of a best-estimate approach. ~~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.~~	The way the paragraph is formulated it gives the impression that BDBEE analysis should determine the maximum severity of the event causing a cliff-edge. This is not in line with SSR-2/1. According to para. 5.73 of the SSR-2/1 safety analysis shall provide assurance that adequate that adequate margins are available to avoid cliff edge effects. The important message in this paragraph is to point out that best estimate approaches are appropriate for demonstrating			x	The margins can only be known if the severity of the hazard that causes the cliff edge effect is known.

			sufficient margins to avoid cliff edge effects. This was also pointed out by the IAEA in the comments resolution table belonging to review step (step 7). It is sufficient to keep only a minor part of the paragraph.				
4	3.12	For each EE of interest, the possibility of the EE loading condition(s) creating a cliff edge effect ~~is required~~ should be assessed	Syntax error ?	x			The existing sentence includes “should”. There is no “is required” in the sentence.
5	4.8	The principle of physical separation cannot be used for the containment building structure, since there is no redundant building. For example, the following layout approaches should be considered by the designer:	Technical solutions should not be imposed, so this list is not exhaustive.	x			The existing sentence includes “For example”.
6	5.67, 5.133, 5.153, 5.234	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.	The paragraphs 5.67, 5.133, 5.153, and 5.234 give the wrong impression that the methods for assessment of BDBEE should be the same as assessment of DBEE. Please modify according to ENISS proposal. There are a number of clear and basic differences regarding the treatment of DBEE and BDBEE and this ought to be reflected in the guide. 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			x	The difference in the ‘conservative’ versus ‘realistic’ approaches for DBEE and BDBEE is reflected in the acceptance criteria. The methods that is the subject matter of the paragraph refer to engineering approaches, computer software.

			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).				
7	5.73	Special protection from lightning should be designed and implemented, with periodic assessment of the dedicated protection means following international industrial standards, special national codes and standards or qualified modelling. Sufficient protection should be provided against both conductive and radiative effects of lightning. ~~In general, a comprehensive Faraday cage should be put in place by means of narrow mesh thin reinforcing bars in the outer skin of the building walls. Moreover, special care should be taken in the protection of conductors at short distances from each other and/or protruding from the cage protected volume.~~	Avoid imposing technical solutions in the guide. The paragraph is too prescriptive in terms of how lightning protection should be carried out on design level.	x			
8	5.86	If hazard ~~from this missile effect~~ related to gases and aerosols from volcanic eruption has been identified and a design basis has been derived, then design features and procedural measures should be provided.	Proposal of clarification	x			
9	5.132	…. Safety important air intakes should be provided with automatic pressure wave	Shutters have not to be systematically installed if it can be established that maximum	x			

		protection shutters, depending on the maximum overpressure of the air intake.	overpressure will not deteriorate equipments.				
10	5.219	Beyond design basis releases (BDBEE) should be established by increasing the size of the floating body and/or the impact velocity with respect to the design values (DBEE). ~~The approach should be based on the potential maximum size or weight 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. It is appropriate to revise paragraph 5.219 for the same reason that 5.113 (transportation of explosive substances) and 5.136 (transportation of asphyxiant and toxic gases) were revised in step 7.			x	For HIEE, both the size and frequency of the events are non-stationary and increasing with time. Therefore, looking at maximal values at a certain point in time is a plausible method.