Draft Specific Safety Guide "DS490, Seismic Design of Nuclear Installations",
Status: STEP 11, Comments by SSCs

COMMENTS BY REVIEWER				RESOLUTION			
NO/Country	**Para. No.**	**Comment & Proposed new text**	**Reason**	**Accepted**	**Accepted, but modified as follows**	**Re-jected**	**Reason for modifica-tion/rejection**
1 Czech Republic	3.6-h	assessing that the process above results in adequate margins. This safety assessment is performed using procedures which are different from the ones used for design purposes, as utilized in the previous steps in that they emphasize the use of realistic and best estimate assessments.	Assessment / verification of margins should be done using another approach than that one used for design. The last sentence of para 3.6 is part of requirements given in item h) thus it should be included directly into item h) to avoid misinterpreting of the text.	O.K.	(the paragraph is now 3.5 – after technical editorial review)		
2 Germany	3.6-h	h) assessing that the process above results in adequate margins. This safety assessment is performed using procedures which are different from the ones used for design purposes, as utilized in the previous steps in that they emphasize the use of realistic and best estimate assessments	Clarification The last sentence / paragraph of Para. 3.6 is only linked to list item h). Therefore, it should be incorporated into this list item (instead of being a separate paragraph).	O.K.	(the paragraph is now 3.5 – after technical editorial review) The para was also modified by another MS.		
3 USA	3.9	If a deterministic approach was used for determining the site-specific vibratory ground motion, seismic parameters such as ~~(e.g.~~ peak ground acceleration and spectral representation~~)~~, should be selected.	Clarification	O.K.	(the paragraph is now 3.8 – after technical editorial review)		

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4 USA	3.10 Line 2	… of the level of a relevant parameter, such as the peak ground acceleration …	Clarification	O.K.	(the paragraph is now 3.9 – after technical editorial review)		
5 Germany	3.19-5)	[…] 5) Develop the uniform hazard response spectra (UHRS) at the identified locations of interest for the nuclear installation site and for the annual frequencies of exceedance selected for defining the seismic design basis (e.g. 10-4 and 10-5 per year). Note that the final design ground motion could be developed with seismic margins beyond this level ~~to ensure that sufficient from~~, e.g., account for uncertainties ~~have been considered~~.	The last sentence is incomplete and thus not understandable. We made a suggestion.	O.K.	After technical editorial review the paragraph is now 3.17.(4) 3.17.(4) was re-worded: "…The final design vibratory ground motion could be developed with margins (sufficient conservatism) to ensure that uncertainties have been properly considered".		
6 Japan	3.22 Footnote 10	SL-1 earthquake level corresponds to an earthquake level often denoted as Operating Basis ~~Basic~~ Earthquake (OBE) in some States.	Typo.	O.K.	Please note that after technical editorial review footnote 10 is now footnote 7.		
7 Czech Republic	3.24 and Definition of SL-2 in chapter	„…of being exceeded in the range of 10^{-3} to 10^{-5}, with typical exceedance frequency of 10^{-4}"	Definition of SL-2 is slightly different there. In para 3.24 is frequency defined using range 10^{-3} to 10^{-5}, but in Definitions is written only: "…vibratory ground motion (with typical			X	(Paragraph numbers correspond to the technical edited version) In the technical edited version, some definitions have

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	"Definitions"		exceedance frequency of 10^{-4}) " It is necessary to have only one definition for one term.				been removed including the one for SL-2 (it was for NPP only) SL-2 is well defined in paragraphs 3.19, 3.21 and 3.22. In 3.22 the frequency range between 10-3 to 10-5 is given to cover other nuclear installations.
8 France	3.29	…an earthquake level exceeding the ones considered for design ~~purposes~~, derived from the hazard evaluation for the site, should be considered as required in Refs. [1, 10, and 11] … … …should: a) Provide adequate seismic margin for those SSCs ultimately required for preventing core damage and ~~mitigating~~ preventing an early radioactive release or a large radioactive release; b) Be consistent with mitigation measures for SSCs supporting Level 4 of the defence in depth concept and;	3.29 general: The expression "BDBEE" is not very ambitious. "design extension earthquake" or "earthquake within DEC" would be better. France can live with this expression if it is not possible to change it. Nevertheless, it should be clear that the consideration of "BDBE" is part of the design consistently with requirements from SSR-2/1, 3 and 4. Thus the proposed wording comes from SSR-2/1. 3.29a) Early releases and large releases cannot be mitigated by nature. Moreover, the guidance shall be consistent with SSR-2/1 5.21a "…*items ultimately necessary to prevent an early radioactive release or a large*	O.K.	Accepted. The draft was technical edited so is slightly changed: 3.29 is now 3.27. 3.27 BDBE is not used for design. It is used for assessment of the design margins. In IAEA documents we do not use DEC earthquake. 3.27a was changed according to the comment and SSR 2/1 5.21A.		

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		c) Demonstrate that cliff edge effects are avoided ~~and mitigated~~ within the uncertainty associated with the definition of SL-2.	*radioactive release in the event of levels of natural hazards exceeding those considered for design, derived from the hazard evaluation for the site*" 3.29c) if an effect is avoided, it is not anymore necessary to mitigate it. Here, the goal is avoidance according to SSR-2/1		3.27 c) modified according to the comment (mitigated was deleted)		
9 France	3.31	A new nuclear installation should, first, be designed against a DBE level in accordance with specific design performance criteria and, second, it should be verified that the safety requirements indicated in paragraph 3.29 are achieved in case of occurrence of a BDBE earthquake level, specific evaluation performance criterion would also be fulfilled	BDBE is part of the design: the concept of verification versus design is not clear. The proposed modification is consistent with 3.30	O.K.	O.K. – reference to 3.29 was changed to paragraph 2.3. After technical editorial review the paragraph 3.31 is now 3.28. Appropriate reference talking about applicable safety requirements is 2.3 (quoted from SSR 2/1). BDBE is not part of the design process.		

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					It is considered in assessment of the design margins since different criteria are used for seismic margin assessment. As is now paragraph 3.28 (old was 3.31) is fully consistent with SSR 2/1 para 5.21		
10 Japan	3.32	The determination of the BDBE and the associated loading conditions can be done by: a) Defining the BDBE earthquake level by a factor times the SL-2 earthquake level[12]. b) Defining the BDBE earthquake level based on considerations derived from the probabilistic seismic hazard assessment (PSHA)[13]. c) Defining the BDBE earthquake level based on the maximum credible seismic hazard severity.	To keep a consistency with para. 3.25 in DS498 "External Events Excluding Earthquakes in the Design of Nuclear Installations".	O.K.	Para 3.32 after technical editorial review is now 3.29.		
11	3.44	The items of nuclear installations included in Seismic Category 3 should be designed as a			(Now the paragraph is 3.38)	x	The actual text says the same thing as the proposed text.

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Czech Republic		minimum in accordance with national practice for seismic design of non-nuclear applications corresponding to high risk conventional facilities. In order to minimize the need for plant shutdown, inspection and restart, and thus allowing the installation to continue to operate after an earthquake occurrence, it may be reasonable to select a more severe seismic loading, and more stringent acceptance criteria than the ones for conventional facilities in national practice, based only on operational needs. Assessment of loading corresponding to SL-1 could provide such benefit.					Adding more detail on this issue would be inconsistent with the level of detail applied to other relatively minor issues elsewhere. Proposed to keep text as is.
12 USA	5.4 Line 1	… ~~linear~~ equivalent linear static analysis	Clarification	O.K.			
13 Ukraine	6.30	Add to para 6.30: Potential seismic-induced interactions with other SSCs should be analysed to exclude or sufficiently minimize such interactions.	Analysis of potential interactions is a very important item in the process of seismic qualification of equipment by indirect methods			x	The main scope of DS490 is design. Seismic Interactions should reflect the as-built and as-operating conditions and cannot be fully address at the design stage. At design stage this is done by including non-safety

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							classified items that may interact with safety classified items in Seismic Category 2.
14 Japan	7.6 Footnote 33	~~The adequate seismic margin (at facility level) is typically defined by a factor of 1.4, 1.5 or 1.67 based on PGA corresponding to SL-2.~~	The explanation of adequate seismic margin is already mentioned in para. 7.5 and 7.6, so it should be deleted.		Now is footnote 30	x	Footnote is called in paragraph 7.6. Footnote is useful since it reflects the practice in many MS practice (the footnote is not part of the safety guide body).
15 Germany	7.6 footnote 31	[31] ~~The~~ To demonstrate adequate seismic margin (at facility level) the reference level earthquake in seismic margin assessments is typically defined by a factor of 1.4, 1.5 or 1.67 based on PGA corresponding to SL-2.	As correctly stated in Paragraph 7.1, seismic margin refers to "the capability of a nuclear installation to achieve certain performance for seismic loading exceeding those corresponding to the site-specific seismic hazard." Thus, defining an "adequate seismic margin" relative to SL-2 (i.e. a design level that might already exceed the site-specific seismic hazard) is inconsistent. Nevertheless, it is common practice to use the factors (relative to SL-2) given in the footnote for seismic margin assessments. The proposed new text tries to avoid the contradiction and nevertheless account for the common practice.	O.K.	It is now footnote 30 Was slightly reworded: To demonstrate adequate seismic margin (for NPPs) the reference review level earthquake in seismic margin assessments is typically defined by a factor of 1.4, 1.5 or 1.67 based on PGA corresponding to SL-2		

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16 Germany	7.11	The facility level seismic margin (HCLPF) should be compared with the adequate seismic margin defined in paragraphs 7.~~5~~4 and 7.6 or established by the national regulatory body.	Clarification	O.K.	Was reworded based on technical editorial review.		
17 Japan	9.3 g	The need for active safety systems and/or operator actions to cope with prevention and mitigation of postulated accidents; characteristics of engineered safety features for preventing accidents and for mitigating the consequences of accidents;	To keep a consistency with the second half of the sentence. As an alternative, use of the same sentence as Para 6.4 in DS498.	O.K.	9.3.g) was also modified by the technical editorial review.		
18 France	Definition	Beyond Design Basis Earthquake BDBE – is the seismic ground motion (represented by acceleration time history or ground motion response spectra) corresponding to an earthquake severity higher than the one used for design derived from the hazard evaluation for the site. It is notably used in seismic margin assessment or seismic PSA ~~(not for design)~~.	See comment 1: to be consistent with SSR-2/1. Note that BDBE is not very useful for PSA, but we can live with that sentence.	O.K.	Definition was slightly changed after technical editorial review.		