TITLE

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Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
Finland-1	General	Reference 8, Seismic Design and Qualification for Nuclear Power Plants,» Safety Guide NS-G-1.6, IAEA, Vienna, 2003 should be replaced with the new revision of the safety guide NS-G-1.6 in the whole document. DS490 has been endorsed by CSS and it is waiting for the publications. Any necessary changes should be checked due to the update.		OK			
Japan-1	General	DPP-DS522 was approved with the title "Evaluation of Seismic Safety for Existing Nuclear Installations", however the title was reviced in this draft document to "Evaluation of Seismic Safety for Existing Nuclear Installations" Please clarify why new nuclear installations are covered by this revised draft publication and describe this fact in "SCOPE" with stating that the scope of this publication is expanded to new installation.			The scope was extended to new and existing nuclear installations. This is why the title was changed. The scope explain clearly that nuclear installations are included: "Scope 1.11. This Safety Guide addresses an		

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					extended range of new and existing nuclear installation …"		
Japan-2	1.1	The ~~present~~ previous publication "NS-G-2.13" provides guidance and procedures for the evaluation of seismic safety of existing nuclear installations against the effects generated by earthquakes.	Correction.				The paragraph talks about the present publication not about the previous one.
Japan-3	1.2	Add "GSR Part 2".	GSR part 2 should be referred in Sec. 8.	O.K.	It is already referenced in Para 8.1 see Ref [22]		
CORDEL-1	General	Seismic assessment for nuclear installations	somehow inconsistent: - title: INSTALLATIONS - this paragraph: Section 5 is CORE, focused on NPP				There is no inconsistency Chapter 5 provide the full methodologies typically used for NPPs (with high complexity). Nuclear Installations other than NPP are addressed in Chapter 6 where a graded approach is described based on the hazard category of the installation.

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							Same structure is common to other Safety Guides
CORDEL-2	1.13	Typically, a 'new' nuclear installation, as understood in this Safety Guide, is not constructed or construction is at a very early stage	it should be explicitly stated that the term "new" installations may include a standard design, for which the site has not been specified	O.K.	A foot note was introduced to explicitly mention that new installations may include a standard design, for which the site has not been specified.		
France-1	1.x	Additional article: The methodologies presented in the current guidance should be considered as complementary technical support within the context of adequate engineering design rules expected according to requirement 17 of SSR-2/1 and SSR-4 or requirement 13 of SSR-3. Solely used, they should not be considered as adequate to comply with these requirement	The role of the methodologies presented in the guidance is not sufficiently clear: notably, regarding the expectations to achieve an adequate design against seismic hazard and the expectations to achieve an adequate safety demonstration. France would not support the use of such methodologies for more than a complementary support to the above mentioned expectations.				This is explained in para 1.3 already: "…At the design stage of a new nuclear installation, it is required to be checked that the design provides for an adequate margin to protect items important to safety against levels of external hazards more severe than those selected for the design basis…. Hence, seismic safety assessments described in this

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							Safety Guide can be either a part of the design process or a completely separate procedure from the design stage" The Objective - Para 1.9 clearly states this Safety Guide provide recommendations in relation to seismic safety evaluation in relation to applicable requirements. There is nothing saying that this safety Guide provide recommendations for "achieving an adequate seismic design". It talks only about the need to demonstrate that safety margins above the design basis earthquake are sufficient to avoid cliff edge effects. In IAEA publications "complementary" is

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							not used in association to demonstration of compliance with applicable safety requirements from SSR 2/1, SSR-3 and SSR-4 regarding sufficient margins to avoid cliff edge effect.
Japan-4	2.1	As established in the GSR Part 4 (Rev. 1) [1], the following requirements should be applied for seismic safety evaluation ~~design robustness and periodic review of seismic safety~~:	As shown in the heading, the para. 2.1 take up the general safety requirements applicable to seismic safety assessment. The word 'seismic design robustness and periodic review of seismic safety' limits the scope of the requirements. The word 'seismic safety evaluation' should be preferred to express comprehensive meaning.				There is no scope limitation associated with the words you suggest deleting. Contrary "Robustness" is quite often used in relation to the DiD attributes and Periodic Safety review provides assurance that safety is maintained over the entire lifetime of the nuclear installations.
Ukraine-1	2.4, footnote 5	"5Paragraph 1.3 of SSR-2/1 (Rev. 1) [3] acknowledges that "it might not be	Editorial remark (to exclude double "to apply")	O.K.			There is nothing saying that all safety

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		practicable to apply all the requirements of this Safety Requirements publication to nuclear power plants that are already in operation or under construction". Hence, for the purposes of the present Safety Guide, the requirements here may be considered applicable only to new nuclear power plants".					requirements referenced in Para 1.3 are applicable to existing nuclear installations. Moreover Para 1.9 (Objectives) talks about "applicable requirements from Ref 1 to 6. Applicable does not mean all. See also footnote 6: "Paragraph 1.3 of SSR-2/1 (Rev. 1) [3] acknowledges that "it might not be practicable to apply to apply all the requirements of this Safety Requirements publication to nuclear power plants that are already in operation or under construction". Hence, for the purposes of the present Safety Guide, the requirements here may be considered

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							"applicable only to new nuclear power plants.
Korea-1	2.4/2 2.6/2 2.7/6	Replace 'nuclear plants' with 'nuclear power plants.'	Use a unified expression	o.k.			
Korea-2	Footnote 5 / Line 1	--- to apply to apply all ---	Delete duplicate words	o.k.			
Ukraine-2	2.7, footnote 6	"[6]The existence of margins has been demonstrated not only through the implementation of SMA or SPSA methodologies for existing nuclear power plants in several Member States, but also by the performance of some plants in large earthquakes. Those plants have experienced large earthquakes, which exceeded their design basis, and have survived the earthquakes with little or no damage. **For such cases new assessing the seismic hazard at the site of course should be performed with respect to paras. 2.15 (a), 2.22 of this Safety Guide".**	Clarification and connection with other paras of Safety Guide				There is no need to such clarification in this paragraph. FN 6 provides some clarifications based on OPEX and connection with relevant paragraphs is already included which are talking about reasons to perform seismic safety evaluation (2.15 (a) and 2.22).
Japan-5	2.8. footnote 7	7 One of the main reasons for this variation, as mentioned in para. 2.7, is the fact that nuclear installations are designed for a wide range of internal and external extreme loads, for example, pressure and other environmental loads due to accident	Clarification for the reason to use "envelope-type response spectra".				FN 7 (now is 8) is pretty clear – I do not see the need for additional clarifications regarding the use of envelope-type FRS (which is a well-

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		conditions, aircraft crash, tornado or pipe break. Therefore, seismic loads may not be the governing loads for some SSCs. Another reason is the method of equipment qualification in which envelope-type response spectra are generally used.					established international practice) for seismic qualification that may increase the size to the FN with such details.
Germany-1	2.11, L-6	… Numerous field observations and research and development programmes have demonstrated that a high seismic capacityies seismic results when the ductile behaviour of SSCs is able to accommodate large strains.	Clarification		Clarification: Ductile failure modes contribute to seismic margins since limited inelastic absorption factors are credited in calculation of seismic margin capacity.		There is no need to modify the paragraph
Korea-3	2.11/7-8	... that *a high seismic capacity seismic results* when the ductile behaviour of SSCs is able to accommodate large strains.	The underlined part seems to be an incomplete expression. It should be corrected	o.k.	Edited: …demonstrated a high seismic capacity results…		
Ukraine-3	2.13	"In accordance with the requirements established in GSR Part 4 [1], **SSR-2/1** (Rev. 1) …"	Editorial correction (to clarify the document designation)	O.K.			
Germany-2	2.14, L-2	… (a) Adequate seismic margin for items important to safety to provide	Protection against seismic hazards is provided by the	O.K.	This formulation		

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		protection against seismic hazards including those exceeding seismic hazards considered in the design basis and to avoid cliff edge effects (see para. 5.21 of SSR-2/1 (Rev. 1) [3]); and …	design (design basis events). The aim here is to demonstrate also that there are margins beyond the design basis level.		is similar with SSR 2/1 5.21A: ",,,Including hazards levels exceeding those considered for design…		
CORDEL-3	2.14	The seismic margin to meet (b) applies to a reduced set of SSCs and it normally will be selected larger than the seismic margin to meet (a).	is this really the intention? it implies that the plant HCLPF for LER should be larger than the plant HCLPF for CD if: the SSC for preventing LER (e.g. containment, CHRS, venting...) have the SAME HCLPF as the SSC preventing CD, AND the failure modes of the SSC for LER-prevention do not have a high correlation with the SSC for CD-prevention THEN the seismic LERF will be significantly lower than CDF, even if the plant HCLPF for CD and LER are the same (because of the additional basic event in the minimum cutsets for LER)				Seismic design basis and seismic margin are strongly corelated with the performance target s CDF and/or LERF. Typical performance target for CDF for a new design is 1E-5 since for LERF is 1E-6. Therefore mathematically the Margin for items controlling the LERF should be higher than those controlling the CDF. Since the list if SSCs is different this is not difficult to achieve. The margins associated to the containment system are higher than the

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							one associated to CDF (limited active systems are involved).
Ukraine-4	2.15 (a), (e)	Propose to combine paras 2.15 (a) and (e) into one para 2.15 (a) as following: "Evidence of a significant increase in the seismic hazard at the site, arising from new or additional data (e.g. newly discovered seismogenic structures, newly installed seismological networks or new paleo-seismological evidence), new methods of seismic hazard assessment, and/or the occurrence of actual earthquakes that affect the installation **(e.g. better recorded ground motion data and the observed performance of SSCs).** In this case propose to eliminate item (e)	Requirement 2.15 (e) is a part of more wide requirement 2.15 (a)				2.15 (a) and (e) are different. 2.15(a) refers to seismic hazard only since 2.15 (e) refers to performance of SSCs that experienced strong earthquakes.
Germany-3	2.16	(g) To assess installation capacity metrics (e.g. systems-level and installation-level fragilities or ~~High-Confidence-of-Low-Probability-of-Failure,~~ HCLPF [9] capacities) against regulatory expectations.	Mentioning both 'High-Confidence-of-Low-Probability-of-Failure' and the abbreviation 'HCLPF' (with explanation in the footnote) seems to imply that two different things are meant. To avoid this possible misunderstanding, the text should be modified.	o.k.			
Finland-2	2.16	(h) To develop instructions for safe	Post-earthquake procedures				I agree that the results

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		shutdown, inspections and other actions after an earthquake. (i) To review safety classification and seismic categorization.	etc. are mentioned in para 7.1. and safety classification in para 3.8. (d) but mentioning them already in section 2 could be considered.				can be used to inform seismic categorization and pre and post-earthquake actions and procedures but this is not the primary goal of seismic safety evaluation.
Japan-6	2.16 (g) 3.5 (d) 3.8 (a) 3.11 (a)	2.16. If, for the reasons listed in para. 2.15 or for other reasons, a seismic safety evaluation of an existing nuclear installation is required, the purposes of the evaluation should be clearly established before the evaluation process is initiated. This is because there are significant differences among the available evaluation procedures and acceptance criteria, depending on the purpose of the evaluation. In this regard, the objectives of the seismic safety evaluation may include one or more of the following: …… (g) installation capacity metrics (e.g. ... HCLPF9 capacities) against <u>regulatory expectations</u>.	Please clarify "regulatory expectations." It is difficult to understand what is sought through "expectation", as regulatory practices should be explicit ones.		It is well-known that the minimum seismic margins (expressed by HCLPF) needs to be accepted by the regulatory authority (or in other words to meet the regulatory expectation). An explicit one cannot be prescribed in an IAEA Safety Guide since different countries may have different targets (e.g. US NRC HCLPF 1,67 x design basis countries uses 1.5 or 1.4)		There is no need for modification of the paragraph.
CORDEL-4	2.16	a) To demonstrate the seismic safety	the objectives formulated in				2.14 is for new

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		margin beyond the original design basis earthquake and to confirm that there are no cliff edge effects.	2.16 for EXISTING installations also apply for NEW installations (for sub-items c) and e) a slightly different formulation would apply for new plants) the objectives in 2.16 are more detailed than the requirements in 2.14 and it would be useful to: either have a similarly detailed formulation of the objectives for NEW installations, or to modify 2.16, so that it applies also for NEW plants				nuclear installation in design is for generic hazards (no site was selected and no site specific hazards are known) and only design information is available so the objectives of seismic safety evaluations are limited as described in para 2.14. 2.16 is for existing nuclear installations as build and as operating conditions are known, walkdowns can be conducted, site specific hazards are known. So more detailed objectives can be formulated.
CORDEL-5	2.18	be consistent with the established purpose of the evaluation programme	add a reference to §8.6	O.K.	8.6 Talks about documentation and		

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					provide the minimum contents of the Seismic Safety Evaluation Report from the Management System perspective since 2.18 mention the principal end products from the technical perspective.		
CORDEL-6	2.18(f)	Identification of interactions with equipment and piping, including fire protection systems, high enthalpy lines and utilities	what is meant by this?		Clarification: Seismic interactions are identified during Seismic walkdowns. Many elements of the fire protection systems are not seismically qualified and therefore their failure (e.g. spraying water on a safety related electrical cabinet) could interact with seismic category 1 items. Same for some High Energy Lines (High		No modification of the paragraph is needed.

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					Enthalpy Lines)		
Korea-4	2.22/6-7	On the other hand, it ~~should not~~ doesn't need to be considered a prerequisite when ---	The underlined part seems to be an incomplete expression. It should be corrected				Should is the verb used in the IAEA Safety Guides type document. The paragraph look clear - there is no need for such modification.
Germany-4	2.24 Footnote 13	In this context, a seismic 'weak link' is a non-redundant SSC or a group of identical redundant SSCs which has a smaller capacity than the majority of the other SSCs and, as such, it could be controlling the installation-level seismic capacity.	If a group of redundant SSCs (e.g. pumps in different trains fulfilling the same function) has the same seismic capacity, they will fail at the same seismic load level. Thus, the whole group is the 'weak link' and controls the installation-level seismic capacity.	O.K.	Slightly re-worded: …or identical redundant SSCs (affected by common cause failure)…		
Korea-5	2.24/2~3	~~In general,~~ the reference level earthquake should not be understood as a new design earthquake.	It seems that 'should not' does not match 'in general'	o.k.			
Korea-6	2.24/7~9	In general, the seismic input for a seismic safety evaluation ~~should not be~~ is not less than a peak ground acceleration of 0.1 g at the foundation level.	It seems that 'should not' does not match 'in general.' If 'should not' is used, it is recommended to delete 'in general'				Should is the verb used in the IAEA Safety Guides type document.
CORDEL-7	2.24	It should be understood as a tool to	it should be mentioned,		Ref to Para 5.5 was		

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		determine the seismic margin of the installation and its seismic 'weak links'13	why it is important that the reference level EQ should be high enough: 1. because it defines the response level, which in turn affects various parameters (damping level, strain-compatible soil parameters, cracking of concrete) that are important for the fragility / margin of SSC 2. it defines the screening level at least a reference to §5.5 in this regard would be good		provided Why RLE should be large enough is well explained in 2.24: "The reference level earthquake should be sufficiently larger than the design basis earthquake to ensure that it challenges the seismic capacity of the SSCs so that an installation-level HCLPF can be determined and the 'weak links' (if any) can be identified" No further details are needed.		
Ukraine-5	2.24, footnote	"[12]In the literature on SMA methodology, this 'reference level earthquake' is sometimes known as the 'review level earthquake' or the 'seismic margin earthquake".	Increasing the quality of the document				Paragraphs 2.22 and 2.23 talks about assessing site specific seismic hazard. 2.24 talks about SMA and

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		Propose that this footnote is moved to para 2.22 where it appears for the first time in this Safety Guide					SPSA where the reference level earthquake is an important technical element. So I suggest to leave the FN 13 where it is.
Finland-3	2.27	At the design stage, methodologies are limited to information available in the design phases and ~~should not~~ cannot rely on an as-built and as-operated installation.	"Cannot" would be more appropriate because the as-built and as-operated information are not yet available.	O.K.			
Korea-7	2.27/2~4	At the design stage, methodologies are limited to information available in the design phases and ~~should not~~ could not rely on an as-built and as-operated installation.	It seems that 'could not' is more adequate than 'should not' contextually	O.K.	Already addressed by other comment from Finland.		
Korea-8	2.27/5~6	Instead of as-built and as-operated information, ~~at~~ the design stage methodologies use as-designed information.	Typo.	o.k.			
ENISS-1	2.27	Seismic walkdowns cannot be conducted at the design stage, but virtual reviews can be conducted.	Virtual reviews are mentioned in para 5.19, 5.21, 5.23 (For a new nuclear installation, the walkdown may be replaced with a virtual review followed by a				Chapter 2 presents general considerations for evaluation of seismic safety for nuclear installations. As you already identify more details are addressed

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			confirmatory walkdown after construction of the installation is finished.)				in Chapter 5. There is no need for addition details in 2,27.
Korea-9	Footnote 16 / Lines 1~2	High Confidence of Low Probability of Failure (HCLPF)	Use unabbreviated terminology of HCPLF in footnote 9.	o.k.			
Korea-10	3.11(a)/2	~~larger~~ large early release frequency	Use correct terminology	o.k.			
CORDEL-8	3.4	The end product of an SMA is an installation-level HCLPF capacity, which should be equal to the higher HCLPF capacity among two (or more) independent success paths[18]	to be checked; the US guidance documents require that one success-path should be able to mitigate a small LOCA the statement "equal to the higher..." is in contradiction with the fact that the plant HCLPF cannot be higher than the HCLPF of the small-LOCA success-path, because typically the small LOCA cannot be excluded -> the statement is only correct of the small-LOCA success path has a higher HCLPF (which is not				There is no contradiction. The statement is correct since the two success paths must be independent.

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			necessarily the case)				
Germany-5	3.5	~~(c) Demonstration of sufficient safety margin to restart operation following the occurrence of a beyond design basis earthquake that may have shut down the nuclear installation and/or changed the conditions of some SSCs [19];~~	In case of a beyond design basis earthquake (BDBE), extensive inspections and assessments are necessary to verify that all SSCs still conform to the pertinent design requirements. Furthermore, the fact that a BDBE happened calls the performed seismic hazard assessments into question. Considering these facts, a SMA seems not appropriate to ensure a safe restart of the installation. Therefore, item (c) should be deleted.	O.K.	Sufficient seismic margin is only one of the restart conditions. 3.5 (c) was slightly modified for clarity: … in addition to other actions defined in Ref. [19];		
ENISS-2	3.5	(j) Demonstration that regulatory seismic requirements are met for plants which were designed without seismic requirements.	For some sites (e.g. in Sweden), plants were designed without seismic requirements. However such requirements have been issued by regulators after NPP construction and the SMA has been used by the licensees to demonstrate compliance.				This is implicitly included see (b),(d), (f). There is no need to add the new line.
Germany-6	3.7 Page 25 Footnote 19	A 'minimal cut-set' is a combination of events (failures) whose sequence causes the accident to occur. Occurrence of all events in the cut-set ~~need~~ is necessary	Editorial	O.K.			

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		and sufficient for the accident to take place.					
Finland-4	3.9	The installation-level fragility should be constructed by explicitly solving the installation accident sequence Boolean logic trees using failure probabilities obtained by quantifying the individual SSC seismic fragilities at each initiating event. Non-seismic failure rates of SSC and human error probabilities are also taken into consideration in SPSA.	Including non-seismic failures and human errors in SPSA is mentioned in para 5.65 but it could be pointed out already in the description of SPSA in section 3.	O.K.			
CORDEL-9	3.9	Boolean logic trees using failure probabilities obtained by quantifying the individual SSC seismic fragilities at **each initiating event**	better: acceleration level?				To get installation level fragility is necessary to consider all Seismic IEs. So the formulation is appropriate as is.
CORDEL-10	4.2	e) and f)	items e) and f) seem already part of "Specific documentation"				Yes – Some overlaps exists. But 4.2 (e) and (f) are more general and 4.3 talks more specific about data to be collected
Ukraine-6	4.2	"All available general and specific documentation used at the design **and operational (for existing installations)** stage of the installation should be compiled, including the following …":	Para 4.2 also includes requirements for data collection of existing nuclear installations (see 4.2 (e), (f))	o.k.	Modified for clarity: 4.2 All available general and specific documentation for		Additional data and investigations for existing nuclear installations is covered starting with para 4.6.

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					new and existing installations should be compiled, including the following		
Ukraine-7	4.2(e)	"For existing installations, data and information on results and reports of seismic qualification tests for SSCs performed during the pre-operational **and operational** period, **results of seismic qualification of equipment using methods of analysis and operating experience,** including any information available on inspection, maintenance, and non-conformance reports and corrective action reports. For new installations, specifications for seismic qualification tests (e.g. required response spectra), **reports with results of seismic resistance analyses for structures, equipment, and distribution systems** may be sufficient"	1) Qualification tests could be also performed in the operational period of an installation (in case of modification, replacement of SSC during the operation) 2) For existing installations, seismic qualification of equipment could be performed also using methods of analysis (seismic calculations) or experience (for instance using Generic Implementation Procedure). Results and reports of such analyses can be useful for evaluation of seismic safety for existing nuclear installations For new installations, not only qualification test results but also results of seismic resistance analyses for structures, equipment, and distribution systems				Para 4.2 talk in general about type of information to be collected. More specific documentation is described in para 4.3 and more specific information for existing installations including inspection reports, condition assessment, etc. are covered already in Para 4.8-4.9.

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			using special software could be useful				
Ukraine-8	4.3 (e)	Propose to add (vi) Stress analysis reports	Results for stress analyses of distribution systems including supports could be useful for evaluation of seismic safety of an installation.	o.k.			
Germany-7	4.6 L-3	… The collection of as-is data should cover those selected SSCs that will be considered within the scope of the programme for seismic safety evaluation and that have either a direct effect on system performance or an indirect effect such as by transmitting earthquake motion from one location to another or by affecting safety related SSCs in in case of a seismically induced failure.	SSCs that could adversely affect safety related SSCs in case of their failure (e.g. the stack that might collapse due to an earthquake and damage relevant SSCs) should be mentioned, too. The failure of such SSCs might significantly contribute to the overall seismic fragility of the plant.	o.k.			
Korea-11	4.11(b)	ratio)	typo	o.k.			
CORDEL-11	4.11	dynamic properties and material damping ratio) should be available.	parentheses in excess	o.k.			
Japan-7	5.4.	The dominant seismic sources in a DSHA should be identified by careful review of the seismotectonic model, as recommended in SSG-9 [7], in the absence of deaggregation data from a PSHA. Dominant sources may not be the same for the different ground motion parameters	The proposed caution should be considered in the case where the sites located in a region of low to moderate seismicity. On the other hand, in a region of high seismicity like Japan, these ground	o.k.			

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		and other seismic hazards (see para. 2.19). For sites located in a region of low to moderate seismicity, l~~L~~ow-frequency ground motion accelerations can be dominated by distant high-magnitude sources while high-frequency ground accelerations are often dominated by diffuse seismicity, that is, nearby moderate magnitude sources. Geological failures are primarily caused by low-frequency ground motions, while the dominant sources for concomitant phenomena hazards are phenomenon specific.	motion accelerations are often dominated by identified near-site sources.				
Japan-8	5.4./L8	The dominant seismic sources in a DSHA should be identified by careful review of the seismotectonic model, as recommended in SSG-9 [7], in the absence of deaggregation data from a PSHA. Dominant sources may not be the same for the different ground motion parameters and other seismic hazards (see para. 2.19). Low-frequency ground motion accelerations can be dominated by distant high-magnitude sources while high-frequency ground accelerations are	Please add typical examples at the underline.				The paragraph is already too big and includes too many details already. Additional details are not appropriate for a Safety Guide (Such details can be addressed in TECDOCs or Safety Reports)

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		often dominated by diffuse seismicity, that is, nearby moderate magnitude sources. Geological failures are primarily caused by low-frequency ground motions, <u>while the dominant sources for concomitant phenomena hazards are phenomenon specific.</u>					
CORDEL-12	5.8	of the resulting seismic safety margin of the installation in a site specific context	what to do in case of SMA for standard design (covering various site categories) proposal: "If the evaluation is not site specific (e.g. in the context of standard design certification), the reference level EQ should be compared to hazard spectra that are representative of various site classes (e.g. rock and soil site)."				Para 5.8 basically is saying that in a site specific context the Generic RLE (or reference level earthquake) provides additional contribution to the margin and should be used to understand the seismic margin. If the evaluation is not site specific as mentioned ion 5.7(c).
Finland-5	5.9	Comment: The recommended procedure for determining the reference level earthquake spectrum for SPSA requires posterior checking if the spectrum satisfies the requirements. More information on the selection of the initial spectrum, or a reference, would be			5.9 (b) provide an initial check based on known similar designs and past SPSA results for similar technologies. In any case the final check if the RLE		

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		helpful.			shape is not deficient in a specific frequency range that may have significant contribution to seismic risk. Additional level of detail is not appropriate for a Safety Guide – can be addressed in supporting documents such as Safety Reports and/or TECDOCs.		
Japan-9	5.13.	For non-vibratory hazards that cannot be screened out, the reference earthquake parameters for SPSA evaluations should be determined using a probabilistic hazard assessment approach (see para. 5.2). The determination of ground motion parameters in the range of annual exceedance frequencies of interest may be performed by direct prediction (e.g. see para 5.12 (b)) or indirect prediction (e.g. see para. 5.12 (c)). In any case, the epistemic uncertainty and aleatory variability	Clarification. Why "multiple earthquake levels, especially above the reference level" should be used in developing the fragility functions? More concrete explanation is needed.		Additional details cannot be provided in a Safety Guide (these details are provided in supporting documents e.g. Safety Report 103 and TECDOC - 1937). It is a common practice in quality SPSA – fragility analysis to use the earthquake level		

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		in the assessment approach for each hazard should be incorporated. The reference level parameters should correspond at a minimum to annual probabilities of exceedance similar to those of the reference level earthquake spectrum. However, due to typically strong nonlinearities associated with geotechnical failure modes, and their potential to cause site-wide cliff edge effects, multiple earthquake levels, especially above the reference level, should be explicitly used in developing the fragility functions associated with the corresponding SSC failures.			relevant for the failure modes of the fragility evaluated (e.g. 1E-4 or 1E-5 exceedance frequency and the shape of GMRS could be different due to non-linear effects associated to each earthquake severity)		
CORDEL-13	5.17 b)	focus to include systems and functions whose failure might lead to the progression of an accident to an unacceptable end state.	this statement does not clarify in what the increased scope consists (because the stated criterion "systems/functions whose failure might lead to unacceptable end state" also applies to systems/functions on the success paths)				SMA uses success path approach – is looking to the margin capacity to the elements included in the success paths. SMA does not consider all combinations of failures. The SPSA is looking to both combinations of failures and success paths.

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							Because of that SPSA provide much more seismic risk insides e.g. significant accident sequences, significant contribution to seismic risk also include Human Errors and combination of random failures with seismic failures , etc. So the scope and results of SPSA is much broader than SMA. In conclusion the statement is correct.
Ukraine-9	5.19 and 5.21	"5.19. … For a new nuclear installation, the walkdown may be replaced with a virtual review **(to the extent practical)** followed by a confirmatory walkdown after construction of the installation is finished". Respectively propose to delete requirement of para 5.21: "For new installations, a virtual review should be performed of the available design"	In order to avoid discrepancies in the requirements.	o.k.			
Japan-10	5.19./L3	The final step in determining the scope should be to perform a	Clarification.	O.K.	Modified since virtual review		

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		seismic evaluation walkdown. Paragraphs 5.23–5.33 provide recommendations on this process. For a new nuclear installation, the walkdown may be replaced with a virtual review* followed by a confirmatory walkdown after construction of the installation is finished. *(footnote) A Virtual review is such that the 3D data of the installations is displayed directly in the VR space, and multiple persons in charge, including reviewers in remote areas, confirm the walkdown while communicating in the VR space.	The term "virtual review" is not defined and ambiguous. It would be better to define what that term means.		cannot be a substitute for seismic walkdowns: New FN: "A virtual review is such that the 3D model of the installations is displayed directly in the VR space, and some elements of the seismic walkdowns can be observed in this way."		
CORDEL-14	5.20 g)	(e.g. credible and consequential concomitant phenomena	add "e.g. SSC related to the credible..."	o.k.			
CORDEL-15	5.21		a separate systems walkdown (besides the seismic evaluation walkdown) seems a disproportionate additional effort the purposes listed in §5.25 for the seismic evaluation walkdown include those listed here; so why introduce the "systems walkdown" as a separate action in this paragraph? in §4.9 there is another type of				No it is not disproportional – it helps reducing the effort for the Seismic Capability Walkdowns and also for confirmation of completion of the seismic equipment list. Selected SSC list should be checked for

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			walkdown mentioned, the "screening walkdown", where screening has the meaning to compare as-built with as-is				completeness by so called Systems walkdowns. Also such walkdowns support screening of seismically rugged items. Some items can be screened out and new items can be screened if seismic interactions cannot be ruled out.
Finland-6	5.23	Use of some other expression instead of "disposiotioned" is recommended in the sentence "It is important that all design features used for the seismic assessment be verified in the as-built installation or dispositioned in order for the safety assessment to be valid."	Use of "disposition" as a verb seems to be rare and the meaning is not quite evident here. Perhaps: … removed from the model?	o.k.			
CORDEL-16	5.25 d)		perhaps anchorage should be explicitly listed, since it is one of the main things to look at	o.k.			
CORDEL-17	5.25 g)	(paras. 5.20(c), 5.20(d),	5.20(b) should also be listed (-> flooding)	o.k.			Seismic-induced fire, flood, or spray is addressed in 5.31
Korea-12	5.25(g)/1	paras. 5.20(~~c~~b), 5.20(~~d~~c)	typo	o.k.	Addressed by other comments also.		
Korea-13	5.26/2	a walkdown plan;plan,	typo	o.k.			
CORDEL-18	5.28	The objective of the preliminary	a preliminary walkthrough is often not practical (plant staff will not be				It is practical and

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		walkthrough is to gain familiarity	willing to open rooms more than once)				represent the common practice. Rooms with special access requirements will not be opened. This is useful for planning and detail preparation of the subsequent walkdowns and to establish the need for access requirements – needed for planning the main walkdowns.
Korea-14	5.33(1)/1	paras. 5.2~~6~~9(a)–5.2~~6~~9(d))	Ty6po	o.k.			
Germany-8	5.35 L-4	… For instance, the list should include the items for protection of the containment system, for installations with ~~a~~ such a system, or for protection of the last confinement barrier against large releases, for other installations.	Editorial	o.k.			
Korea-15	5.35/5	with ~~a~~ such a system	Typo	o.k.			
Korea-16	5.40/5	para. 5.22~~(b)~~	'para. 5.22(b)' doesn't exist. This should be corrected	o.k.			
Germany-9	5.42	(b) For vibratory ground motion input, response spectrum analysis methods may be sufficient for structures without significant soil-structure-interaction (SSI) effects. Response history methods (also called time history methods) should be used otherwise. Equivalent	NS-G1.6 / DS490 and many other documents on seismic analyses use the term 'time history'. To avoid confusion, it should be clarified that 'response history method' refers to	o.k.			

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		linear or explicitly nonlinear methods may be used.	the same approach.				
Finland-7	5.42	(a) New response analysis for the reference level earthquake ground motions using current mathematical models of the structure is recommended. Scaling of previous response analysis results (e.g. design-basis analyses) based on the ratios of reference-level to design-basis earthquake ground motions may be justifiable. Scaling is most appropriate for rock sites where the design-basis models of the structures are considered unbiased (i.e. median centred).	Words "structures" and "unbiased" are not clear in the sentence. Is the actual goal to tell that: … Scaling is most appropriate for rock sites where the design-basis models of the rock structures are considered linear…?	o.k.	Linear is appropriate.		
CORDEL-19	5.41	determined with a high confidence level	provide quantitative value (80%, as specified in EPRI 1019200)?	o.k.	Precise reference has been added.		In Safety Guides we avoid using quantitative values
CORDEL-20	5.43 a)	component/system,	add "(e.g. the spectral accelerations at the fundamental frequency)"?				Appropriate wording: System or component supports There is no need for additional details in a Safety Guide.
CORDEL-21	5.44	of an SSC corresponds to the scale factor	the scale factor is to be multiplied by the PGA of the RLE, in order to get the HCLPF	o.k.			
Korea-17	5.45/4	--- or screening-based capacity evaluations ~~HCLPF calculations~~	Deletion of 'HCLPF calculations' match the last sentence	o.k.			

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		may ---					
CORDEL-22	5.46	SSC with the lowest HCLPF capacity	this is correct if the SSC correspond to a "minimal" success-path (i.e. any redundancies have been eliminated) it is however conceivable to keep some of the redundancies (e.g. EDG and SBO-DG) in the success-path definition; in that case the success-path HCLPF would involve a min-max-process analogous to the one in the PSA-based SMA. This seems to be not uncommon, unless I am misinterpreting the commentary to the supporting requirement SM-G1 in ASME/ANS RA-Sa-2009, which mentions the use of the min-max concept for determining the plant HCLPF in the success-path based SMA.	o.k.	The paragraph was modified for clarity. Redundancy is considered in the alternative success paths.		
CORDEL-23	5.46	equal to that of the success path with the highest HCLPF capacity	see comment at §3.4	o.k.	Addressed already.		
CORDEL-24	5.49	ensuring that **a** success path	if "a" is replaced by "any", then the statements in §3.4 and §5.46 are correct	o.k.			
CORDEL-25	5.53 a)		extending the HCLPF to get a fragility curve is needed for the explicit quantification approach in 5.54 (b) or are there other reasons to derive a fragility curve in the PSA-based SMA?		If the effort for developing PSA based SMA model was done – to develop Seismic fragility based on HLPF values		FN 37 (now is 40) is correct – in the simplified approach smaller estimated Bet-c leads to conservative quantification results.

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			is the statement in footnote 37 verified in the context of the explicit quantification approach? it does not seem obvious to me (it is obvious that a low variability is conservative if the resulting fragility is used in a convolution with a hazard curve, but that is not what is done in the explicit quantification approach)		(using Kennedy Hybrid Method) and assumed beta values is very small and the benefit will be more seismic risk insight (and potentially less conservatism).		
CORDEL-26	5.54	The installation-level HCLPF capacity should be determined by incorporating all minimal cut-sets that can lead to an unacceptable end state.	the formulation is not entirely clear/accurate In my opinion, the PSA quantification is performed for a specific end state (e.g. core damage -> "consequence analysis"), to begin with. So there is no need to incorporate anything. Rather, it should first be mentioned that the PSA model (->§5.51) is used to produce the minimal cutsets.				This is equivalent saying that the installation Level HCLPF should be based on all minimal cutsets (a cutset is an unacceptable end-state). So formulation is pretty clear.
CORDEL-27	5.54 b)	latter fragility curve	this approach has the advantage that it is more straightforward to deal with mixed cutsets (seismic+random+operator)		Perfectly correct. This is most used today instead of Min-Max approach in quantification of PSA based SMA results.		
CORDEL-28	5.55	installation-level and **all** cut-set HCLPF	unnecessary and impractical; typically, the PSA quantification software produces ten-thousands of MCS (depending on the cut-off value)	o.k.	…all significant cut-sets… Actually typically		

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			propose replace "all" by "a reasonable subset of the"		quality the PSA produces many millions of cutsets. Depending on truncation (typically 1E-10 to 1E-12) quantify tens of thousands of them. For interpretation of results much less cutsets are selected base on importance analysis results and their contribution to the risk metrics of interest. The button lines you cannot truncate more in the first run without demonstrating that different truncation limits will not significantly change the results		
Germany-10	5.56	The SPSA methodology comprises most of the same steps of the SMA methodology (see para. 5.38), with the following ~~substitutions~~ <u>modifications</u>: …	As item (b) on the following list is not a substitute but an addition to the SMA steps, it might be more appropriate to talk	o.k.			

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			about 'modifications'.				
CORDEL-29	5.56 b)		this item should be added also in §5.50 (one of the major advantages of PSA-based SMA over success-path-SMA, as mentioned in NRC-SECY-93-087)	o.k.			
Japan-11	5.57.	The accident sequence logic model should include the analysis of potential seismically induced initiating events, and installation response considering the impact of the seismic event on SSCs, and operator actions. For example, the most popular approach in the Member States is to use seismic event trees to model accident sequences and fault trees to model basic seismic events. If the nuclear installation has an existing internal events PSA logic model, which is typically a regulatory requirement for nuclear power plants, the seismic accident sequence logic model should be developed by modifying the internal events logic model to account for seismicinduced failures and initiating events that are not included in the internal events PSA. For example:	Clarification. What is "a spectrum of failure probabilities that range from near zero to certain failure"? More concrete explanation is needed.	o.k.	Reformulated for clarity: The resulting probabilistic distributions of seismic demands at the plant level led to distribution of the core damage frequency, large or early release frequency or other risk metric of interest function of the hazard parameter.		

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		(a) …… (b) The range of seismic ground motions represented by the seismic hazard curve range from moderate to very large earthquakes. The resulting probabilistic distributions of seismic demands on most SSCs lead to a spectrum of failure probabilities that range from near zero to certain failure with increasing earthquake intensity.					
CORDEL-30	5.58	The system logic model40	this terminology is unfamiliar to me; is "system logic model" the same as the "system reliability model" mentioned below? if "system logic model" includes both event trees and fault trees, then the terminology that I am familiar with is: PSA model		Clarification: This is the PSA terminology for the logical model ET+ FTs Model. Each system is modelled by one or more Fault trees linked by Event Trees to get accident sequences at the plant level. JCNRM standard uses Plant Response Model - it is the same thing as system logic model (expressed by BOOLEAN equations) since represents a logic model for propagation of		

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					failures		
CORDEL-31	5.58	that map basic failures (e.g. SSCs) to initiating events should	in my opinion, the fault trees do not map directly to the initiating events but rather to the "function events" (branches in the event trees) in my opinion this subsentence might as well be omitted	o.k.	Clarification: The subsentence was deleted however it is correct but could add too many details in an already crowd paragraph. For calculating the frequency associated to the ETs you need to define a FT that model (map) the failures (quite frequent there is not only single failure) that initiate an accident sequence.		
CORDEL-32	5.64	the annual probability	replace with "annual frequency" (to be consistent with §5.65 (a)?	o.k.			
Germany-11	6.2	Seismic safety evaluation of nuclear installations other than nuclear power plants should be based on a	In other IAEA Safety Guides (e.g. SSG-9, DS 490 etc.) the term 'graded	o.k.	O.K. however the graded approach described in this		

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		~~performance-based~~ graded approach, as recommended in the following paragraphs.	approach' is used (without "performance-based"). For consistency and considering that the addition of "performance-based" does not provide additional insights here, it is recommended to stay with the usual term.		section is using a performance based approach.		
Korea-18	6.3/5	--- prevent ~~a large or~~ a large early release.	typo	o.k.	This is true only if Seismic Level 1+ is performed) which is covered by the scope of this publication. If S-PSA Level 2 is performed that large or large early release is correct as well.		
France-2	6.6	An evaluation should be performed to state if, regarding the ~~If this screening demonstrates that there are no unacceptable~~ consequences for workers, the public, or the environment, and ~~no~~ other specific requirements ~~are~~ imposed by the regulatory body for such an installation, the installation may be screened out from the seismic safety evaluation.	Safety approach requires more than "no unacceptable" consequences				The conservative screening process described in this paragraph is for hazard categorization of the installation and is not equivalent to a Safety Evaluation. It is based on very conservative assumptions such as unmitigated release

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							(without crediting any barriers).
Korea-19	6.7/4~5	In general, the seismic input for the safety evaluations ~~should not be~~ is not less than a peak ground acceleration of 0.1 g at the foundation level. .	It seems that 'should not' does not match 'in general.' If 'should not' is used, it is recommended to delete 'in general'	o.k.	Should is the action verb for the IAEA Safety Guides and designate a recommendation. Reformulated for clarity: The seismic input for the safety evaluations should not be less than a peak ground acceleration of 0.1 g at the foundation level		
Korea-20	6.8/2~3	para. 6.~~1~~4~~4~~4	typo	ok			
Ukraine-10	6.8	"A 'performance target', expressed as a mean annual frequency of failure due to the earthquake hazard, should be assigned to each of the seismic design classes described in **Annex"**	Correction of the reference (para 6.14 is missing in the Safety Guide)	o.k.	Is 6.4		
Ukraine-11	6.8, footnote 43	"[43]A 'limit state' is the limiting acceptable condition of the SSC, so that its intended safety function is kept. For example, the failure limit state for a column that is supporting **a safety class pressure vessel** would be the loss of load carrying capacity through either buckling or collapse "	Editorial correction	o.k.			
Germany-12	6.13	(c) Explicit~~ly~~ computation of the annual	Clarification		Edited for clarity		

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		frequency of failure, following a SPSA.			"following": was replaced by "using" This is one alternative method for demonstrating compliance with the performance target. Selection of a) , b) or c) is done function of the installation hazard category and scope of the evaluation and regulatory requirements.		
Ukraine-12	6.13 (b)	"Showing adequate seismic margin beyond a site specific **design level earthquake.** The reference level earthquake should be selected based on an annual frequency of exceedance that is consistent with the performance target for the particular SSC."	Correction of the terminology				Seismic Margin is expressed function of Reference Level Earthquake not function of Design Level Earthquake.
Korea-21	6.13(c)/1	Explicit~~l~~y computation	typo	o.k.			
Germany-13	7.2	The programme for seismic safety evaluation of an existing nuclear installation may result in a subset of the selected SSCs that do not meet the established acceptance criteria ~~for a~~		o.k.			

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		~~newly defined seismic input~~.					
Germany-14	7.3	~~(b) Strengthening the facility to upgrade any SSCs that fail to meet the acceptance criteria;~~		o.k.	Reformulated: Upgrading the facility by strengthening any SSCs that limit the installation to meet the minimum seismic margin or are significant risk contributors;		
Germany-15	7.5 Line 3	… For options that are very costly and for which there is very little risk reduction, the ~~opereta8ng~~ operating organization of the nuclear installation should work with the regulatory body		o.k.			
Ukraine-13	7.5	"… For options that are very costly and for which there is very little risk reduction, the **operating** organization of the nuclear installation should work with the regulatory body to determine if the costs exceed the benefits from the small amount of risk reduction"	Editorial correction	o.k.			
Korea-22	7.5/4	~~opereta8ng~~ operating organization	typo	o.k.			
Korea-23	7.7/4	Upgrade concepts should: (i) accommodate~~: (i)~~ the existing configuration, ... and (ii) observe seismic interactions ...	'should' is an auxiliary verb for both 'accommodate' and 'observe'	o.k.			

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Germany-16	7.9 New issue	(d) Upgrading of critical components, to models with larger seismic capacity.		o.k.			
CORDEL-33	7.11		paragraph is not clear an example would help	o.k.	Clarification added		
Germany-17	8.4	The peer review should be conducted by experts in the areas of systems engineering, operations (including fire prevention and protection specialists), earthquake engineering and other specialists depending on the focus of the seismic evaluation. ~~electromechanical relay circuits (if a relay seismic capacity review is performed)~~.	Although rely chatter is an important failure mode in case of an earthquake, there are other topics that might be the focus of the assessment. Therefore, a more general formulation is recommended.	o.k.			
Korea-24	8.6/26-27	~~Specific plant procedures should be prepared for dealing with response actions required before, during and after an earthquake, covering those aspects indicated in para. 2.18.~~	It doesn't seem that the sentence is related to this paragraph (para. 8.6	o.k.			
Germany-18	A.1 Line 2	… These failure modes should be reviewed and used, if ~~as found~~ applicable, to inform the walkdown review and seismic capacity evaluations.	Clarification	o.k.			
Korea-25	A.4(c)/1	between buildings	typo	o.k.			
Germany-19	headline before A.22	OPERATOR TRAVEL PATHS ~~FOR SEISMIC FAILURE MODES IN~~	The current wording seems to imply that 'operator	o.k.			

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		~~NUCLEAR INSTALLATIONS~~	travel paths' affect seismic failure modes (of SSCs). But the following paragraphs are about the feasibility of (necessary) operator actions. To avoid misunderstandings, it is proposed to delete the last part of the headline or to reformulate it.				
Finland-8	Annex, Table A-1	Point 1: "play facility workfare at risk" should be "place facility workforce at risk" Point 4: "sours or" should be "source of"	Annex, Table A-1	o.k.			
Korea-26	Table A-1 / 'Seismic Design Class 1*' / 'Worker'/ Lines 3~6	... but failure of SSCs may ~~play~~ place facility ~~workfare~~ workers at risk of physical injury	typo (ref. ANSI/ANS 2.26-2004)	o.k.			
Korea-27	Table A-1 / 'Seismic Design Class 4' / 'Worker'/ Lines 6~7	the ~~sours~~ source or hazardous material	typo (ref. ANSI/ANS 2.26-2004)	o.k.			
CORDEL-34	A.2 c)		the footnote is not clear;	o.k.	Agree – the FN		

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			is this item meant to cover failures of major components of the load-carrying support system of the building, e.g. shear walls? if yes, the the footnote is confusing if no, which bullet is covering these failures?		was deleted. Bullet (c) is sufficient clear by itself.		
Japan-12	A.11.	The review of electrical cabinets should consider whether the internal instruments and components are positively and securely attached inside the enclosure and whether their mountings are stiff or flexible. In particular, if the internal instruments and components are on a structure that can be pulled out from the cabinet from the viewpoint of maintenance, the amplification of seismic motion due to this structure should be considered.	Amplification of seismic motion due to the structure that can be pulled out from the cabinet should be considered.	o.k.			
Ukraine-14	A.17 (c)	"Weak or brittle connections, **structural penetrations**, supports, or anchorage"	Places of intersections of structures by piping, cable conduits and ducting are also should be considered as seismically vulnerable conditions				All elements you proposed to add are covered already (b), (c), (e)
CORDEL-35	A.19	source should be determined by the systems engineer	or from previous internal fire assessment?		Clarification:		The fire area affected by each potential

COMMENTS BY REVIEWER Reviewer: NUSSC Members Page.... of.... Country/Organization: All Received Comments Date:				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
					The fire area affected by each potential ignition source should be determined by the systems engineer… This should be known by the system engineers (from Fire Hazard Analysis – mandatory for getting license for domestic fire protection authorities)		ignition source should be determined by the systems engineer… This should be known by the system engineers (from Fire Hazard Analysis)
CORDEL-36	A.26 e)	and SSCs straddling the	English word "straddling" might be unknown to most non-native English speakers (including myself...)	o.k.	Replaced by spanning		
Japan-13	Annex TABLE A-1 and A-2	Tables A-1 and A-2 seismic design class of DS522 is the reverse representation of the seismic design category of Table 2 of SSG-67/DS490.-This may lead to confuse among users, and therefore tables of DS522 and SSG-67/DS490 should be consistent in numbering of class and description of consequences. Similarly, target value should be	Annex TABLE A-1 and A-2				An Annex is not part of the Safety Standard. Presents relevant practice and approaches from MS(s). In this case Annex 1 shows Tables from USA, ANS 2.26 standard. SSG-67 proposed a simplified

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		consistent. Desirably, DS522 should use tables of DS490, as those tables are provided in ANNEX of DS522, while these tales are provided in main body of DS490.					Tables using 4 Hazard Categories instead of 5 but basically is using the same principles.
Korea-28	Table A-2 / Title	EXAMPLE OF PERFORMANCE TARGETS ~~[1 2]~~ [A-2]	typo	o.k.			
Korea-29	Table A-2 / Seismic Design Classes 1 and 2	~~1[a]~~ 1 ~~2[a]~~ 2	typo	o.k.			