Resolutions of the NUSSC comments to the

DS523 – Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants

Country	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
ENISS	1	Whole document	(…) end points states (…)	‘End states’ is the commonly agreed wording in PSA area. ‘End points’ should be replaced with ‘End states’.	X			
UK	1	Whole document	Review the use of “mitigating systems” and any remaining uses of “safety systems” to ensure it is as the guide authors intend it to be.	It is noted that the term mitigating systems has been defined and adopted widely through the guide. However, the switch from “safety systems” to “mitigating systems” is not comprehensive or consistent. It is not clear if remaining uses of “safety systems” is deliberate or an oversight.		X The mitigating systems were used to indicate the systems credited and modeled in PSA. These are not only safety systems, could be also non-safety systems performing certain functions which could be credited and modeled in PSA. In the meantime, it is true that the word ‘mitigating’ is confusing and is used in other contexts. Therefore, the term ‘systems credited in PSA’ was used with relevant explanation provided in the footnote (see para 5.4).		

ENISS	2	Whole document		The document uses many wordings to describe systems that may be credited in PSA analysis: “mitigating systems”, “safety or non-safety systems”, “ safety systems”, “mitigating systems (including the systems with supporting functions), “support systems”, “frontline systems and support systems”, “mitigating systems including support systems”. Check has to be done to define and retain homogeneous wording throughout the document.		X The wording was changed to assure consistency throughout the document. But sometimes the specific terms were used to reflect certain context (e.g. safety and non-safety systems). In this cases the definition from IAEA Safety Glossary is applicable. (see also response to the UK comment #1)		
ENISS	3	Whole document		It appears that references to requirements from other IAEA documents have not been changed from previous revision of this document, although some of these other IAEA documents have been revised. Please check that referencing single requirements is still correct.	X The consistency was once again checked.			

ENISS	4	Whole document		As far as internal or external hazards are concerned, singular should be used instead of plural (i.e. internal fires → internal fire, internal floods → internal flooding, etc.)			X	The document uses both plural and singular forms. Sometimes it requires use of plural form depending on context. If there are specific examples, where it was found to be wrong we are ready to discuss case by case basis.
Russian Federation	Whole document	1	The IAEA Safety Glossary 2018 edition does not contain definitions of the specified terms that are used in the IAEA document: Core damage, core damage frequency (fuel damage frequency), probabilistic safety goals, accident sequence, success criteria, plant damage state, human reliability analysis (human error), importance analysis, conditional core damage probability, plant damage states, multi-unit PSA, risk metrics, plant operating states, risk informed approach etc.	The IAEA Safety Glossary should be updated to harmonize terminology used in the IAEA document.		N/A The comments is more to the IAEA Safety Glossary than to the SSG-3 (DS523). At this stage the IAEA Safety Glossary is under revision.		
Germany	4.	1.4 Item (3)	In Level 3 PSA, public health and other societal consequences are estimated, such as the contamination of land or food from the accident sequences that lead to a release of radioactivity to the environment <u>[NN]</u>. <u>[NN] Procedures for Conducting Probabilistic Safety Assessments of Nuclear Power Plants (Level 3), IAEA Safety Series No. 50-P-12, 1996</u>	Add reference regarding Level 3 PSA for consistency.		X 50-P-12 document is considered to be obsolete and therefore is not references here. Currently there is a TECDOC under development aimed to elaborate on Level 3 PSA methodology (in an early stage of		

						development). In addition, there are plans to propose initiation of a Safety Guide on Level 3 PSA. It is planned to update the reference list Depending on the further developments in this area		
Germany	3.	1.4 Item (2)	In Level 2 PSA, the chronological progression of core and/or fuel damage sequences identified in Level 1 PSA is are evaluated, including a quantitative assessment of phenomena arising from severe damage to reactor fuel. Level 2 PSA identifies ways in which associated releases of radioactive material from fuel can result in releases to the environment. It also estimates the frequency ies, categories and amounts magnitude and as well as other relevant characteristics of the releases of radionuclides active material to the environment. …	According to the state-of-the-art, the scope needs to cover both, core and fuel damage. Precision is also needed on the releases. In addition, editorial additions are given.	X			
Germany	2.	1.4 Item (1)	In Level 1 PSA, the design and operation of the plant are analysed in order to identify the sequences of events that can lead to core and/or fuel damage and the corresponding core and/or fuel damage frequencies are estimated (or fuel damage and fuel damage	According to the state-of-the-art, the scope needs to cover both, core and fuel damage, in addition editorial additions are given.	X			

			~~frequency, when spent fuel pool is also considered~~ —see Sections 10 and 12).1 Level 1 PSA provides insights into the strengths and weaknesses of structures systems and components (SSC)~~s~~ important to safety and procedures in place or envisaged as preventing core and/or fuel damage.					
Germany	1.	1.4 Line 2	… PSA provides a methodological approach ~~to~~ for identifying accident sequences that can follow from a broad range of initiating events …	Editorial (grammar)	X			
Germany	5.	1.5 Line 2	… Level 1 PSA provides insights into design weaknesses and into ways of preventing accidents leading to core and/or fuel damage, which might be the precursor of accidents leading to major releases of radioactive material with potential consequences for human health and the environment. Level 2 PSA provides additional insights into the relative importance of accident sequences leading to core and/or fuel damage in terms of the severity of the releases of radioactive material they might cause, and insights into weaknesses in measures for the mitigation and management of severe accidents and ways of improving them [4]. …	According to the state-of-the-art, the scope needs to cover both, core and fuel damage.	X			

Germany	6.	1.7	This Safety Guide replaces IAEA Safety Standards Series No. SSG-3, Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants[2].~~, which it supersedes.~~	Clarification on duplication	X			
Japan	1.	1.11.	This Safety Guide addresses the necessary technical features of a Level 1 PSA and applications for nuclear power plants (both operating and new plants), on the basis of internationally recognized good practices. Level 1 PSAs have now been carried out for most nuclear power plants worldwide. ~~In recent years, a trend has emerged for Level 2 PSAs or limited Level 2 PSAs for nuclear power plants (e.g. Level 2 PSAs in which the large early release frequency is estimated) [4], as well as in some Member States it is extended to limited assessment of the doses (e.g. limited Level 3 PSA). In addition, Level 3 PSAs have been carried out in several States.~~ The scope of a Level 1 PSA addressed in this Safety Guide includes all ~~operating states~~ operational states of the plant (i.e. at power and shutdown) and all potential initiating events and potential hazards, namely:	i) This description is not relevant to the scope of this Guides publication, rather it is information of three type of PSAs, and then suggested to move back to "BACKGROUND." ii) Use of terminology defined in IAEA SAFETY GLOSSARY. This usage of the term "operational states" is applied through this draft publication.		X The sentence was deleted. The BACKGROUND already includes discussion on PSA levels.		

Germany	7.	1.11 Line 8	… The scope of a Level 1 PSA addressed in this Safety Guide includes all plant operationalng states (POS) of the plant (i.e. at power and shutdown) and all potential initiating events and potential hazards, namely: (a) internal initiating events caused by random component failures and human error, (b) internal hazards (e.g., internal fires, and floods, explosions, turbine missiles) and (c) external hazards, both natural (e.g. earthquake, external flooding, high winds, external floods) and of human-induced ones (e.g., aircraftplane crash, explosion pressure wave, accidents at nearby industrial facilities).	Clarification, completeness of examples representing good practice	X			
Germany	8.	1.12	This Safety Guide ~~is focused on the reactor core and the fuel in the spent fuel pool; it does not cover other sources of radioactive material on the site, e.g. the interim fuel storage facilities. The reactor core is in the main focus of this Safety Guide; however, the specifics of the spent fuel pool analysis are addressed.~~ focusses on the assessment of nuclear power plant respective spent fuel pools. An assessment of other sources of radioactive material on the site, such as interim dry fuel storage	The text is misleading and inconsistent and not in line with discussions had with IAEA.		X The second part of the proposed revision is not really related to the scope. It is still incorporated in the document but down in the text of the document.		

			facilities or nuclear waste treatment facilities is not in the scope of the Safety Guide. However, the consideration of any adverse effects of such facilities to the reactor(s) and spent fuel pool(s), e.g. in case of external hazards impairing the whole site, in the assessment are addressed.					
Japan	2.	1.12.	This Safety Guide is focused on the reactor core and the fuel in the spent fuel pool; it does not cover other sources of radioactive material on the site, e.g. the interim fuel storage facilities. The reactor core is in the main focus of this Safety Guide; however, the specifics of the spent fuel pool analysis are addressed. The scope of addressed in this Safety Guide is expanded to cover Level 1 multi-unit PSA which aims to quantify multi-unit risk metrics.	It should be explicitly stated that the scope of this guide is expanded.	X			
Netherlands	1	1.12	This Safety Guide is focused on the reactor core and the fuel in the spent fuel pool; it does not cover other sources of radioactive material on the site, e.g. the interim fuel storage facilities. The reactor core is in the main focus of this Safety Guide; however, the specifics of the spent fuel pool analysis are addressed.	The text is not clear and not consistent about the focus of the SG (see yellow marks). Please consider rephrasing the paragraph, to clarify the text, and avoid inconsistencies.	X			

Finland	1	1.13.	The consideration of hazards arising from malicious actions is not within the scope of this Safety Guide. However, PSA applications section discuss the use of PSA for assessment of safety-security interface and enhancements of safety and security.	However, PSA is an effective tool for the analysis of the safety security interface and further enhance the safety and security of the nuclear power plant and spent fuel pool.				X According to the DPP reviewed and agreed by NUSSC, NSGC and CSS the use of PSA for security purposes is out of the scope of this document. IAEA recently launched another activity aimed to investigate the topic of Use of PSA for security purposes and develop a corresponding Agency publication.
Germany	9.	1.14 Line 2	… plant operational ~~operating~~ states ...	Clarification for consistency				X Plant operating state is used throughout the document
Germany	10.	1.16 Line 13	… Section 11 provides recommendations on recommendations on Level 1 multi-unit PSA …	Editorial (duplication removed)	X			
ENISS	5	1.16	Section 11 provides recommendations ~~on recommendations~~ on Level 1 multi-unit PSA aimed to quantify multi-unit risk metrics	Typographical error .	X			
ENISS	6	2.2	The scope of the PSA to be undertaken should be correlated with the ~~national~~ probabilistic	The term “*national* is not clear. Consistency with para 2.21 that states:				

			safety goals or criteria, if they ~~latter~~ have been ~~set~~ specified in national regulations or guidelines.	*"..the results of the PSA should be compared with the probabilistic safety goals or criteria if these have been specified in national regulations or guidelines*				
Germany	11.	2.3 Line 3	… The scope of the Level 1 PSA ~~might~~ should also include consideration of the fuel in the spent fuel pool, …	SFP PSA represents state-of-the art, see e.g. OECD/NEA WGRISK reports on Use and Development of PSA	X			
ENISS	7	2.3	The scope of the Level 1 PSA ~~might~~ should also include consideration of the fuel in spent fuel pool, for which recommendations are provided in Section 10.	The requirement for a Spent Fuel Pool PSA appears too weak with *"might"*. "Should" is usually used in guides.	X			
Japan	3.	2.5.	Paragraphs 2.5 and 2.6 provide recommendations on meeting Requirement 18 of GSR Part 4 [3] on the use and validation of computer codes for a PSA and Requirement 21 of GSR Part 4 [3] on the independent verification of PSA. PSA involves a number of analytical methods. These include the analysis of accident sequences and the associated systems, typically through the development of event tree and fault tree logic models, the methods for solution of the logic models, the models of phenomena that could occur, for	It must be human health and environment to be determined on effect from the transport of radionuclides.	X			

			instance, within the containment of a nuclear power plant following core damage, and the models for the transport of radionuclides in the environment to determine their effects on health and the ~~economy~~ environment, depending on the scope of the analysis (Level 1, 2 or 3). Prior to their application, ...t					
Germany	12.	2.11/ (d)	… The occurrence frequency of occurrence of specific health effects to members of the public or the frequency of occurrence of particular environmental consequences (Level 3 PSA [NN]).	Wording + please add reference [NN] regarding Level 3 PSA for consistency, see comment above	2	X See response to the comment #4 from Germany		
Japan	4.	2.12.	~~The available frameworks and examples for the definition of probabilistic safety criteria are discussed in Ref. [11].~~ In the Member States the probabilistic safety criteria are typically identified as targets, goals, objectives, guidelines or reference values for orientation. In addition, the numerical values for the levels of risk, which correspond to the threshold of tolerability and the design targets, differ from State to State[nn2]. (footnote nn2) The available frameworks and examples for the definition of probabilistic safety criteria are	Ref.[11] is TECDOC publication, which is not a consensus document reviewed by Member States and related SSCs. Therefore, move it to the footnote.	X			

			discussed in Ref. [11] IAEA-TECDOC-1804 “Attributes of Full Scope Level 1 Probabilistic Safety Assessment (PSA) for Applications in Nuclear Power Plants”..					
ENISS	8	2.14	For example, INSAG (see Ref. [9]) has proposed the objectives for core damage frequency separately for existing plants and future plants.	Should be Ref.[8] rather of Ref. [9]. See also comment 10 with respect to a more appropriate location for Ref.[9].				
Germany	13.	2.14 Line 4	For example, INSAG (see Ref. [~~9~~8]) …	Wrong reference	X			
ENISS	9	2.15	Core or fuel damage frequency for a single unit are the most common measures of risk used in Level 1 PSA.	Additional precision that is considered important as far as the document addresses both single unit and multi-units perspectives.				X Before that it is specifically noted that the MU considerations are focused in Section 11. For consistency it is proposed not to mention everywhere that we are talking about the single unit.
Germany	14.	2.17	PSA can provide useful insights and inputs for various interested parties, such as plant staff (management and engineering, operations and maintenance personnel), regulatory bodies, technical support organisations (TSOs), designers and vendors, …	TSOs review PSAs (sometimes with PSA modelling in parallel to the model being reviewed) and contribute to the development of PSA methodologies.	X			
Japan	5.	2.17.	PSA can provide useful insights and inputs for various interested parties, such as ~~plant staff~~	Better categorization into operation-related entity and regulator.		X		

			operating organizations (management and engineering, operations and maintenance personnel), ~~regulatory bodies,~~ designers and vendors and also regulatory bodies,			We propose to keep the regulatory bodies in the beginning of the list right after operating organisation as one of the main users of PSA techniques.		
ENISS	10	2.18	2.18. Where the results of the PSA are to be used in support of the decision making process, a formal framework for doing so should be established (see Ref. [9]).	Reference to Ref. [9] (i.e. INSAG 25) may be inserted.	X			
Germany	15.	2.19	The PSA should address the actual design or, in the case of a plant under construction or when modifications are being undertaken, the intended design or operation of the plant, which should be clearly identified as the basis for the analysis.	Clarification	X			
ENISS	11	2.21	This should be done for all probabilistic criteria defined for the plant, including those that address system reliability, core or fuel damage frequency, frequencies of releases of radioactive material, health effects for workers, (…)	English correction	X			
Japan	6.	2.22	The PSA should set out to identify ~~all~~ accident sequences that contribute to risk and to determine weaknesses and potential improvements in the design or operation of the plant. If the	Clarification. Delete "all", because it is not feasible to identify all accident sequences that contribute to risk. There		X The comment is accepted (not all sequences should be identified). Just the		

			analysis does not address <u>dominant contributors</u> ~~all the contributions~~ to risk (for example, if it omits external hazards or shutdown states), then conclusions drawn from the PSA about the level of risk from the plant, the balance of the safety systems provided and the need for changes to be made to the design or operation to reduce the risk may be biased.	is no consistency with the second sentence of 5.14 also. It is also not feasible to address all contributors to risk including all external event risk.		resolution of the comment is modified in a way to keep the recommendation to identify all sequences, which contribution to the risk is not negligible. We believe that the completeness of the list should be assured for all non-negligible contributors.		
Netherlands	2	2.22	Rephrase the last sentences in 2.22 ("If the analysis… may be biased")	This sentence describes that a partial PSA may introduce a bias. This is surely true, and this concept should be retained, but it is not clear what is the "guidance" given here: what should be done in case you have a PSA not addressing "all the contributions to risk"? Should such a "partial" PSA be allowed at all? Please clarify.	X			
Netherlands	3	2.22 – 2.23	Please merge these paragraphs.	Avoid duplications.		X The paras are not merged, but the overlaps between the statements in these paras are eliminated.		

Germany	16.	3.1 Line 12	… and all plant operationalng states …	Clarification	X			
Germany	17.	3.1 Line 13	… In addition, other sources of radiation, particularly (e.g. the fuel in the spent fuel pool,) should be analysed, depending on the formulation of the probabilistic safety goals.	Precision, strengthening low power and shutdown PSA	X			
Japan	7.	3.2. / Line 9	As another example, if it is planned to use the PSA model as a basis for a risk monitor, the PSA model should be 'symmetrical' in terms of the modelling of initiating events.	Clarification. A word, "symmetrical," should be defined here. The explanation of relationship between "risk monitor" and "symmetrical" is also needed here.		X The connection between symmetrical and risk monitor has been highlighted. The idea of the model being symmetrical is already explained right after the text.		
ENISS	13	3.2	An extension ~~of~~ to Level 2 or even Level 3 PSA	English correction	X			
Japan	8.	3.4./ under the bullets	If PSA is performed for the specific plant, ~~In any case,~~ the operating organization should always participate as a source of operational knowledge, as well as being a beneficiary from the insights obtained. If generic PSA is performed as the reference, the participation of operating organization may be preferred to support the knowledge from their operating experiences.	Because the necessity of participation of operating organization is up to the purpose of PSA. If PSA for the specific plant is performed, the operating organization should participate. If generic PSA is performed, the participation of the operating organization is not necessarily required.		X This clarification is added in addition to a footnote		
Belgium	1	3.10	3.10. ~~A~~ The members of the team that perform the PSA …	Typographical correction	X			

ENISS	12	3.10	~~A~~ The members of the team that perform the PSA can be characterized by the organization they represent and the technical expertise they provide.	Typographical error .	X			
ENISS	14	3.14	General requirements for control of documents are established in section 2 of Ref. [7].	Reference to Ref. [7] does not appear appropriate (it has not been changed when updating the document). Please check.	X			
Germany	18.	3.16 Line 2	The documentation of PSA should be complete, well structured, clear and easy to follow, <u>also regarding</u> review and update.	Clarification	X			
ENISS	15	4.3	Currently, in many <u>Member</u> States, performance of a PSA is required as part of the safety analysis report.	Editorial to be consistent with rest of the document.	X			
ENISS	16	5.2	Fig.1	'Human errors probabilities' and 'Reliability and CCF parameters' are numerical data that are needed for quantification step. Associated arrows should be re-directed to 'Quantification and Interpretation of results' instead of 'Accident Sequence analysis'.				X X We agree that all the relevant inputs are eventually used in quantification. The idea of the figure is to demonstrate what kind of inputs are used from one task to another (in this case to highlight the input is in the event trees and FTs from HRA or CCF analysis) So, we believe

								that putting arrows with inputs towards the quantification will make the Figure less informative.
ENISS	17	5.2	Fig.1 ~~Human failure events' probabilities~~ Human error probabilities	Consistency text and rest of figure.	X			
ENISS	18	5.4	One widely practised approach is to use a combination of small event trees and large fault trees often referred to as the fault tree linking approach.	Suggestion to mirror wording retained in para. 5.5 "*Another approach that is widely used is to carry out the analysis using large event trees and small fault trees.*"	X			
Finland	2	5.4. and wherever the term is used	the term "mitigating systems" is misleading	Mitigation commonly refers to the mitigation of the consequences of a severe accident	X (see also response to the UK comment #1 and ENISS comment #2)			
Germany	19.	5.4	One widely practised approach is to use a combination of event trees and fault trees often referred to as the fault tree linking approach. The event trees outline the broad characteristics of the accident sequences that start from the initiating event and, depending on the success or failure of the	In Level 1 PSA safety systems are modelled not accident mitigation; the use of the term "mitigation systems" needs to be checked throughout the document		X See the response to the UK comment #1 and ENISS comment #2. Regarding the fuel damage, as it is described in Footnote 1		

			required safety ~~mitigating~~ systems, lead to a successful outcome or to ~~the~~ core or fuel damage (see paras 5.42 and 5.43), or to one of the plant damage states (used in the Level 2 PSA). The fault trees are used to model the failure of safety ~~the mitigating~~ systems to carry out their ~~safety~~ required functions.			Sections 5 to 9 focuses only on the reactor core and the fuel damage is described in more detail separately in Section 10.		
Netherlands	4	5.4 (and in several other places in the draft)	The consequent use of “mitigating” systems in place of “safety” systems is confusing and not in line with the Safety Glossary (2018). It should be avoided. Please reinstate the use of “safety systems” in place of “mitigating systems”.	The expression “mitigation” is used in the Defense in Depth concept, to describe actions aiming at mitigating the consequences of a severe accident. It should not be applied at the design levels for systems designed to prevent the progress of an accident.		X (see also response to the UK comment #1 and ENISS comment #2)		
Germany	20.	5.6	The overall aim should be to calculate a best estimate of the core or fuel damage frequency while avoiding the introduction of excessive conservatisms wherever possible, since this may unduly bias the results. ...	According to the state-of-the-art, both need to be covered, core and fuel damage.		X Both core and fuel damage are covered in the document. As it is described in the very beginning of the document both core and fuel damages are covered. Sections 5 to 9		

						focuses only on the reactor core. Then the fuel damage is described in more detail separately in Section 10. Thus the Section 10 starts with the following statement "…Level 1 PSA for the spent fuel pool is based on the same methodology as Level 1 PSA for the reactor core outlined in Sections 5-9. Accordingly, the general process for conducting Level 1 PSA for the reactor core should be adapted for the spent fuel pool, considering the specific aspects addressed in this section".		
Germany	21.	5.7	For plants with multiple units, the ~~interactions~~ interdependencies between the units (both positive and negative from risk point of view) should be considered in Level 1 PSA from the perspective of the unit under consideration, whereas the unit under consideration~~, whereas the~~. The	We suggest to use "interdependencies" here, "interactions" are not precise enough		X We would propose to keep the word "interactions", since the "dependencies" are used later in Section 11 to describe inter-unit dependencies. Whereas		

			recommendations on multi-unit PSA …			“interactions” is more global term describing the impact of one unit to another.		
Germany	22.	5.8	The Level 1 PSA model ~~produced~~ developed should be capable of being used for the intended applications and of being updated for possible future applications.	Clarification (well-accepted terminology)	X			
Germany	23.	5.9 (b)	… *timescale.*	Wording: should be better time frame or period of time	X			
Germany	24.	5.9 (c)	… leading to core or fuel damage …	According to the state-of-the-art, both need to be covered, core and fuel damage.		X (see response to comment #20 from Germany)		
Japan	9.	5.9.	(c) It should be capable of providing the information necessary to interpret the Level 1 PSA, such as the core damage frequency, dominant minimal cutsets, frequencies of minimal cutsets (combinations of initiating events and failures and/or human errors leading to core damage), importance measures and results of uncertainty and sensitivity analyses.	Add “dominant minimal cutsets,” because it is also important to identify dominant minimal cutsets. Add “minimal,” because cutsets should be minimal cutsets.	X			
Germany	25.	5.10	The development ~~production~~ of ~~the~~ a Level 1 PSA …	Clarification	X			
Germany	26.	5.11 Line 2	… lead directly to core or fuel damage …	Essential for a broad scope, see comments above		X		

						(see response to comment #20 from Germany)		
ENISS	19	5.12	Recommendations on issues specific to the identification of initiating events that could arise in shutdown states are provided in Section 9. Recommendations on issues specific to the identification of initiating events to consider for the spent fuel pool are provided in Section 10. Recommendations on issues specific to the identification of initiating events to consider for Multi-unit PSA are provided in Section 11.	For clarification	X			
Finland	3	5.13.	A systematic process should be used to identify the set of initiating events to be addressed in the Level 1 PSA. This should involve a number of different approaches including: (a) Analytical methods such as hazard and operability studies or failure mode and effects analysis or other relevant methods for all safety systems to determine whether their failures, either partial or complete, could lead to an initiating event; (b) Deductive analyses such as master logic diagrams to determine	Please align with GSR Part 4 and SSR-2/1 and DEC analysis as well plant design basis. (e) Review of the deterministic design basis accident analysis, design extension conditions analysis and beyond plant design basis accident analysis and the safety analysis report.		X DBA and DEC are mentioned in accordance with SSR-2/1 (Rev.1)		

			the elementary failures or combinations of elementary failures that would challenge normal operation and lead to an initiating event; (c) Comparison with the lists of initiating events developed for the Level 1 PSAs for similar plants and with existing safety standards and guidelines; (d) Identification of initiating events on the basis of the analysis of operating experience from the plant under investigation and from similar plants; (e) Review of the deterministic design basis accident analysis, <u>design extension conditions analysis</u> and beyond <u>plant</u> design basis accident analysis and the safety analysis report.					
Japan	10.	5.13.	(b) Deductive analyses such as master logic diagrams to determine the elementary failures or combinations of elementary failures that would challenge normal operation and lead to an initiating event~~;~~. <u>These are not the systematic process to identify initiating events, however alternative approaches including;</u>	Clarification Systematic process to identify initiated events are (a) and (b) only. Other alternative processes are (c), (d) and (e). Add the sentence as shown on the left.				X Actually when mentioning the systematic process we have meant consideration of all 5 inputs (a)-(e). Consideration of lists from similar plants and analysis of operational experiences is considered to be an integral part of the systematic process.

			(c) Comparison with the lists of initiating events developed for the Level 1 PSAs for similar plants and with existing safety standards and guidelines;					
Japan	11.	5.41. and 5.42. (between the paras)	Safe Stable State 5.XX A criterion (or criteria, if appropriate) should be developed for what constitutes safe stable state.* (footnote) * Several safe stable state can be specified, depending on the purpose of PSA. (i.e. for PWRs, the hot standby is used as one of the safe stable states. However, the cold shutdown is sometimes used for the detailed PSA.)	Before or after defining the core damage, the safe stable state is needed to be defined to model event trees.		X		
Belgium	2	5.43	For example, for a pressurized water reactor, core damage is assumed to occur following prolonged <u>uncovery</u> ~~exposure~~ of the top of the core or if a maximum specified cladding temperature is exceeded. If a significantly long time interval is required to cause core damage after <u>uncovery</u> ~~exposure~~ of the top of the core, then …	Suggestion to replace “exposure” by “uncovery”	X			
ENISS	20	5.47	The mitigating systems and actions by operating personnel that will need to be available to perform each of these safety functions	Success criteria not only applies to systems but also to human actions.	X			

			should be identified, along with associated ~~the~~ success criteria ~~for the mitigating systems used in performing these safety functions~~.					
ENISS	21	5.49	Where ~~diverse~~ multiple mitigating systems are involved, the success criteria should take into account the performance needed from each of the ~~diverse~~ different systems.	It appears that the wording “diverse” is used here to describe multiple systems instead of diverse (i.e. systems that show diversification features) systems. Please check.	X			
Germany	27.	5.49 Line 4	… Where redundant trains of the mitigating safety system are involved, the success criteria should be defined as the number of trains that are needed to remain operable operate. Where diverse mitigating systems are involved, …	Precision and clarification	X			
Germany	28.	5.50	The success criterion for each action by operating personnel should consider the time between the moment when based on available information the action can be initiated and the last moment ~~when~~ the action even correctly performed is able to lead to the successful system function required ~~is no longer effective in terms of accident progression~~ (considering the time required for diagnosis and for action performance).	Correction	X			

ENISS	22	5.52	The success criteria should specify the system mission time so that the reactor reaches a safe, stable state and that will allow for long term measures to be put in place to maintain this state. In many cases, this has been taken to be 24 or 48 h for most initiating events. For new designs that ~~provide the features to delay core damage~~ rely on passive features, consideration of a longer mission time may be necessary. ~~The mission time should be defined adequately for capturing possible cliff-edge effects and assuring that the residual risk accrued after the mission time is negligible.~~	The adoption of longer mission time only applies to design that rely on passive features whose failure probability is much less dependent of time than for active systems. (M) The sequence mission time, defined in para. 5.45, should *"be defined adequately for capturing possible cliff-edge effects and assuring that the residual risk accrued after the mission time is negligible"*. Once this is done, there is no need to put such requirement on the definition of system mission time. (E)		X Accepted with some revisions.		
Japan	12.	5.52.	The success criteria should specify the system mission time so that the reactor reaches a safe, stable state and that will allow for long term measures to be put in place to maintain this state, based on the sequence mission time defined in 5.45. In many cases, this has been taken to be 24 or 48 h for most initiating events. For new designs	Clarification According to the description in paragraph 5.45. and 5.52., system mission time is seemed to be almost identical with the sequence mission time. Then suggested to add that system mission time can	X			

			that provide the features to delay core damage, consideration of a longer mission time may be necessary. ~~The mission time should be defined adequately for capturing possible cliff-edge effects and assuring that the residual risk accrued after the mission time is negligible.~~	be defined based on the sequence mission time, and the last sentence to be deleted.				
Netherlands	5	5.52	…For ~~new~~ designs that provide the features to delay core damage, consideration of a longer mission time may be necessary.	Features to delay the core damage could be in place also in existing plants that had extended backfitting. We propose to delete the word “new” in order to make the applicability of the sentence broader.	X			
Germany	29.	5.52 Line 3	… For new designs …	We suggest to keep it more general	X			
Germany	30.	5.53	The Level 1 PSA documentation should include a list of the safety functions, ~~mitigating~~ safety systems, support systems and actions …	In Level 1 PSA safety systems are modelled not accident mitigation; the use of the term “mitigation systems” needs to be checked throughout the document	X (see also response to the UK comment #1 and ENISS comment #2)			
ENISS	23	5.56	Wherever possible, realistic success criteria that are based on best estimate supporting analysis	SSG-2 Rev.1 should be added to the list of references.	X			

			should be defined and used in the Level 1 PSA (see Ref. [SSG-2 Rev1]).					
ENISS	24	5.58	Best estimate input data and assumptions that avoid unnecessary conservatisms should be used whenever possible (see Ref. [SSG-2 Rev1]).	SSG-2 Rev.1 should be added to the list of references.	X			
Ukraine	1	5.58A	The input data (input model) for a computer code that is used for supporting analysis should be based on the plant specific data (whenever possible), should conform to the best practice guidelines for using the computer code (e.g., in the user manual) and should be independently checked. As a good practice, it is recommended to perform simulation of representative incidents that had occurred at the plant being analyzed or at the similar plant, and compare calculation results with the measured data to verify the input model capabilities to reproduce adequately the actual plant response	To reflect the need for thermal-hydraulic (or other code) input model qualification in order to ensure validity of the results (ref. to para.5.40 of SSG-2 (Rev.1))		X Paras 5.55 and 5.56 have been amended to reflect the relevant idea.		
Germany	31.	5.59 Line 3	… the success or failure of the mitigating safety systems, support systems and human actions …	In Level 1 PSA safety systems are modelled not accident mitigation; the use of the term “mitigation systems”	X (see also response to the UK commen			

				needs to be checked throughout the document	t #1 and ENISS commen t #2)			
Germany	32.	5.66 Line 19	… The list above is appropriate only for a PSA for power operation;. Ffor shutdown states, a different set of characteristics will be appropriate is provided in Section 9.	It is essential that suitable characteristics will be provided for shutdown states and can be found in the corresponding Section 9.	X			
ENISS	25	5.66	The list above is appropriate only for a PSA for power operation; for shutdown states, a different set of characteristics will be more appropriate.	English correction		X Reference to the characteristics applicable for shutdown states has been added.		
Netherlands	6	5.66	The characteristics specified for the plant damage state are generally left to the discretion of the analyst, but would typically include: (a)… … (j)… The list above is appropriate ~~only~~ for a PSA for power operation; for shutdown states, a ~~different~~ set of characteristics ~~will be appropriate.~~ should be compiled, using items from this list as applicable and completed with characteristics more specific for shutdown.	The last sentence about shutdown states is confusing. The words “only” and “different” suggest that none of the items listed above would apply to shutdown states. Also reference should made to chapter 9 and develop a similar list for shutdown specifically. It is important for MS to have that additional guidance.	X			

ENISS	26	5.72	The scope of the fault trees that need to be drawn depends on the size and complexity of the event tree; the fault tree will be less complex the more detailed the event tree is.	English correction	X			
ENISS	27	5.78	It should also include passive components whose failure could ~~lead to failure of the system~~ affect the operation of the system, for example, undetected filter blockages and pipe leaks.	Passive component failures affecting a single train of a system should also be included.	X			
Japan	13.	5.78.	The fault tree model should include all the mitigating system components that are required to be operational, including support system components. It should also include passive components whose failure could lead to failure of the system, for example, undetected filter blockages ~~and pipe leaks~~.	Some failure modes may be neglected sometimes such as pipe leaks.				X Pipe leaks are mentioned in general. Some pipe leaks could affect the system significantly, so it is proposed to keep the formulation.
Belgium	3	5.82	The way that the unavailability of systems due to testing and maintenance is modelled should be consistent with plant technical specifications11 and testing and maintenance practices in the plant.	Proposal to add “testing”	X			
ENISS	28	5.84	The development of a symmetrical model will allow the importance measures (see para. 5.178 for examples of importance measures) calculated by the Level 1 PSA	Editorial proposal	X			

			code to be used in a straightforward manner.					
Belgium	4	5.95 till 5.98	Replace “common cause failures” by “common mode failures”	The articles 5.95 till 5.98 are typically applied to identical redundant components, failing by the same failure mode. Therefore, the term “common mode failure” as defined in the IAEA Glossary 2018 seems more appropriate than “common cause failures” (the latter being wider).				X CCF is a commonly used term in the PSA community, so in the context of this guideline the applicability of common cause failure is found to be more appropriate. In addition, in general CCF could be modeled for the components that are not fully identical (only partially).
Japan	14.	5.107. /Line 1 Line- 4-5	A systematic review <u>of plant procedures</u> should be carried out to determine potential human failure events that could lead to an initiating event (Type B human failure events). As a minimum, a check should be carried out to ensure that human failure events that could cause initiating events are taken into account in the evaluation of frequencies of initiating events used in the <u>PSA</u> analysis.	Clarification i) In order to make clear what should be reviewed. ii) In order to make clear what type of analysis is “the analysis”.		X Accepted, except the adding PSA. It is considered that the PSA will be a duplication of the analysis.		
ENISS	29	5.109	Significant errors of commission, i.e. incorrectly performing a required task or action, or	Editorial proposal The last part of para. 5.109 rather applies to		X		

			performing an extraneous task that is not required and might lead to worsening the accident progression or cause an initiating event should be considered. ~~Errors of commission~~ This consideration can lead to the creation of additional accident sequences. However, ~~While~~ it is not yet general practice to include errors of commission in the base PSA.~~, it is advantageous to use information on the general causes of errors of commission (see for example, Ref. [14]) to reduce the potential for introducing changes that could increase the likelihood of, or create conditions conducive to, errors of commission.~~	optimization of plant operation with respect to human interaction than PSA area. We suggest suppressing.		We would suggest to keep the part related to the advantages of EOC systematic analysis as a logical continuation of the 'should' statement. The text was reduced.		
Japan	15.	5.109. /Line 3	Significant errors of commission, i.e. incorrectly performing a required task or action, or performing an extraneous task that is not required and might lead to worsening the accident progression or cause an initiating event should be is considered as a good practice.	Identifications and modeling of errors of commission are still under discussions, and there is no consensus method to identify and model the commission errors. It is better to be as a good practice.		X There are methods aimed to systematically identify EOCs (e.g. CESA) and there is a practice available in this regard, and therefore we believe that at least for significant EOCs the statement should be kept. However, the disclaimer about the good practice and		

						statement that it is still not the general practice is incorporated as commented.		
ENISS	30	5.110	Repair~~s~~ actions (e.g. the replacement of a motor on a valve so that it can be operated) should be credited in PSA only if there is strong justification for their feasibility. Human Reliability Analysis (HRA) techniques cannot be always (…)	Editorial proposal	X			
ENISS	31	5.111	Actions that are "heroic" (e.g. ~~if~~ operating personnel	English correction	X			
ENISS	32	5.116	For newly designed NPPs most of the sources for qualitative information listed in para. 5.115 might not be available. In ~~these~~ such cases, the information for similar plants should be used~~, if available~~. If this is not ~~available~~ possible, then the expert judgement should be used for items listed above. In any case, later the correspondence of qualitative information to plant actual status should be verified and PSA should be updated, ~~if~~ as needed.	English correction	X			
ENISS	33	5.120	~~The risk importance of HFEs should be evaluated to identify the need to perform a more detailed analysis of HFEs.~~ Quantification of HFEs is often performed in two stages: 1) screening assessment	It is proposed to suppress the first sentence because it has no added value				X This is the 'should' statement, which underlies the paragraph. The rest of the paragraph is informative to support the

			applying a simple quantification model and 2) detailed assessment where more factors and a more detailed context characterisation is taken into account, mostly for the most risk-significant actions by operating personnel. In this approach, it should be ensured that the risk importance of HFEs are accurately characterized after the screening phase so that the critical HFEs needing more detailed assessments can be identified.					should statement. Therefore we propose to keep it.
ENISS	34	5.121	(a) HFEs that are included in the Level 1 PSA for internal initiating events, but are also relevant for the internal or external hazard scenario. In this case, it should be checked whether there is a need to revise the assessment of performance shaping factors ~~due to the fact that~~ to consider it might be ~~harder~~ more difficult for operating personnel to implement actions than in the base case scenario (e.g. due to a higher stress level associated ~~with controlling the equipment remotely~~ to the hazard context).	Editorial proposal. In case of internal or external hazards, the context in itself may render more difficult operators actions and not only the ones that have to be accomplished remotely.	X			
ENISS	35	5.121	(c) Undesired responses by operating personnel to spurious alarms and indications. ~~For the third case, m~~More information on identification and assessment of	Editorial proposal	X			

			undesired actions by operating personnel can be found in Ref. [15].					
ENISS	36	5.122	Such interdependencies could arise from the use of a common cue or procedural step, incorrect procedures, an incorrect diagnosis or an incorrect plan of action in carrying out response actions.	Editorial proposal	X			
Japan	16.	5.123./ Line 2	The set of HFEs that are combined in the same minimal cutset or scenario should be reviewed to determine the degree of dependency between them;	Wording. Add "minimal," because cutsets should be minimal cutsets. Cutsets on other paragraphs should also be modified such as 5.171.(c), 5.174, 5.175, 5.176 and 5.177.	X			
US	7	5.123	All ~~measurable~~ cutsets or scenarios involving multiple human failure events should be identified[1]. The set of HFEs that are …… cutset or scenario should be reviewed to determine the degree of dependency between them; the human error probabilities used in the quantification of the model should reflect this degree of dependency.	What are "measurable cutsets?' Unless there is a clear meaning to "measurable" suggest deleting this word. Also added the words "the degree of dependency" to enhance technical accuracy.	X			

[1] Such cutsets can be identified by setting the human error probabilities to a high value (e.g. 0.9) and recalculating the core damage frequency; the cutsets involving multiple human failure events will then appear at the top of the list of cutsets

Japan	17.	5.124. /Line 4	The integration step should include a thorough examination of minimal cut sets to verify that HFEs have been incorporated correctly.	Typo Cut sets -> cutsets	X			
ENISS	37	5.124	The impact of critical HFEs should be either incorporated as basic events in fault trees or used as event tree headings.	The wording "critical HFEs" is used without prior definition. It is suggested to include definition before use.	X			
ENISS	38	5.125	Functional reliability assessment of passive systems being part of the safety functions (i.e., assessment of the failure probability of passive systems for performing satisfactorily their safety functions) should be considered in PSA.	The term "Reliability assessment of passive system" is not defined. It is important to characterize the reliability assessment of passive systems as "functional".	X			
Finland	5	5.127	Assessment of reliability of passive systems should carefully consider failure mechanisms and events potentially affecting the environmental and other boundary conditions for system operation, such as the conditions that influence natural laws ~~(e.g. natural circulation)~~. to effectively mitigate accident conditions, mechanical or structural degradation, including ageing effects, unique to passive systems. ~~since passive safety is not synonymous with inherent safety or absolute reliability.~~ For example, natural circulation may be impaired or prevented by non-	Please clarify. (New additions in yellow). The original text is too general.	X			

			condensable gases, blockage, wrong valve positions, impurities, corrosion, algae in tanks, maintenance errors or foreign objects in the system.					
ENISS	39	5.128	Assessment of reliability of passive systems should also consider the periodic testing and maintenance practices or planned procedures since such practices or procedures may have a significant influence on passive systems reliability. For instance, if it exists, the feedback from the periodic testing and maintenance may reveal any age-related material degradations or may demonstrate need to modify testing strategies.	For new design, the testing and maintenance practices and feedback do not exist.	X			
ENISS	40	5.129	The specific emphasis should be in gaining confidence that the system failure modes relevant to PSA ~~of the system~~ have been defined properly (…).	Editorial proposal	X			
Finland	4	5.132.	Reliability assessment of computer based systems being part of the safety functions should be considered in PSA. Computer-based systems in this context are assumed to consider various I&C equipment with programmable modules,	Please check the last sentence. Should it continue or should there be a point instead of coma?	X			
ENISS	41	5.132	Reliability assessment of computer based systems being part of the	Editorial proposal	X			

			SSCs credited to ensure safety functions should be considered in PSA.					
UK	8		Replace the term ‘computer based systems’ ‘digital systems’ throughout this guide. The use of the term ‘computer based systems’ has been superseded in IAEA SSG-39 by the term ‘digital systems’, which include computer based systems and systems programmed with hardware description languages.					X The term ‘computer based systems’ is still used in SSG-39, is used in the current version of SSG-3 and specifically described in the IAEA Safety Glossary which states: *The reliability of a computer based system, for example, includes the reliability of hardware, which is usually quantified, and the reliability of software, which is usually a qualitative measure as there are no generally recognized means of quantifying the reliability of software.* Based on this it is proposed to keep the term in the document.
ENISS	42	5.132 to 5.146	Reliability assessment of ….	This part of the guide provides recommendations, technical guidance,		X The topic of computer based systems		

			….It may be expected that the practices of Member States will evolve over time. Example of proposed rephrasing see comment 43.	references and examples that are deemed to be too detailed for a SSG document and, in addition, that do not reflect 'internationally recognized good practices' that should be described in a SSG document. Therefore, it is proposed to simplify this part adopting a level of detail consistent with a SSG document and to provide more structured recommendations. See example comment 43.		reliability is one of the main aspects agreed as amendment for current version of SSG-3. Therefore the discussion is detailed. Regarding the good practices available in Member States: the text is revised according to the comments received on this chapter. Further revision is expected after receiving a comprehensive feedback from the Member States.		
UK	7	5.132 to 5.146	These paragraphs need an editorial review as there are a number of mistakes and confusing sentences which will reduce the effectiveness of future MS reviews.			X The text is revised according to the comments received on this chapter. Further revision is expected after receiving a comprehensive feedback from the Member States.		
ENISS	43	5.133	The scope and the approach for the reliability assessment of computer based systems should follow the	1) The term "functional importance" is not defined. In terms of PSA,	X			

			~~functional~~ importance of the systems from the PSA point of view. For instance, it ~~can~~ could be expected that the reactor protection system and the reactor control systems would need a detailed analysis while the assessment of programmable components in other I&C systems ~~may~~ might be managed by treating the components in a more simplified manner. Other acceptable simplified approaches for assessing the reliability of computer-based systems could be adopted for modeling considering their architecture and their safety classification.	the term "importance" refers to contribution to the risk (e.g. RAW or FV factor). 2) The example is confusing and could be incorrect as global and simplified approaches for modeling the reliability of programmable I&C systems in PSA could be proposed whatever the role and the safety classification of the system.				
Finland	6	5.133.	The scope and the approach for the reliability assessment of computer based systems should follow the functional importance of the systems from the PSA point of view. For instance, it can be expected that the reactor protection system and the reactor control systems need a detailed analysis while the assessment of programmable components in other I&C systems may be managed by treating the components in a more simplified manner.	Please add examples of the more simplified methods for assessment of other I&C systems.		X The clarification is added referring to the risk significance and system classification. The description that for the concrete system simplified approaches could be used, might be misinterpreted. Therefore, we would prefer to keep the description general.		

UK	9	5.133	Replace 'functional importance' with 'risk importance'	The PSA results will provide risk importance information and this should guide the degree of scrutiny, not the functional importance of the system.	X			
UK	10	5.133	Suggest: "For instance, it can be expected that **if** the reactor protection system and the reactor control Systems **or other high-risk importance systems are controlled by a digital control system, they may** need a detailed analysis, while the assessment of programmable components in other **lower risk importance** I&C systems may **only require** ~~be managed by treating the components in a more~~ **analysis in a** simplified manner."	The example is not necessarily true. RPS may be hardwired, and as above comment says, there could be other digital systems with more risk importance than the RPS or reactor control systems. This is not to say a digital RPS or control system should not be scrutinised closely, but that it is not a given that these are the most risk important digital systems.	X			
Finland	7	5.134.	The need to assess the reliability of the operator interface systems should consider the dependencies with other I&C systems whose failures are relevant for the considered actions by operating personnel. In any case, for those programmable operator interface systems that treated in a simplified manner, a justification should be	Please add examples of the more simplified methods for assessment of other I&C systems.		X (see response to the comment #6 from Finalnd)		

			provided for the chosen limitation in the analysis.					
UK	11	5.134	Suggest: “~~The need to assess~~ ~~the~~ Reliability **assessments** of ~~the~~ operator interface systems ~~should~~ **usually will** consider ~~the~~ **other I&C system failure** dependencies **through normal PSA fault tree and event tree modelling, which cascade failures of systems credited earlier in a accident sequence routinely. It is also important to consider the operator and correlated operator interface system interdependencies between** ~~with other~~ different I&C systems ~~whose failures are relevant for the considered actions by operating personnel~~. ~~In any case~~, for those programmable operator interface systems that **are** ~~treated~~ **modelled** in a simplified manner, ~~a~~ justification should be provided for the ~~chosen~~ limitation**s** in the analysis.”	The paragraph is not clear and requires full review. It is unclear whether it is about operator error dependencies, or hardware dependencies. It would make more sense to be about intra-system operator errors, because hardware errors that contain dependencies on other hardware errors should be modelled in the I&C fault tree. The second sentence does not follow from the first.	X			
Belgium	5	5.135	In any case, for those programmable operator interface systems that <u>**are**</u> treated in a simplified manner, a justification	Add missing word	X			

			should be provided for the chosen limitation in the analysis.					
UK	12	5.135	The first challenge is not a real challenge and should be removed. Suggest: “Reliability assessment of computer based systems should cover both hardware and software components of those systems. **Modelling the reliability of computer-based systems is a challenge to be addressed in PSA**~~.~~ ~~Firstly, the functional complexity of I&C systems poses challenges in defining to what extent and which level of details failures should be analysed and modelled in PSA. Secondly~~, A justifiable way to assess the reliability of the software modules for which standard statistical approaches have limited applicability needs to be found.”	The degree of complexity of a digital I&C system is not a challenge for modern PSA models. Detailed fault trees of I&C systems are routinely created and used in modern PSAs.		X Further simplified.		
ENISS	44	5.137	(…) the ~~principle~~ major failure modes (…)	English correction	X			
UK	13	5.137	Further text should be added to discuss why a simplified approach is better for ‘failure to actuate’ failure modes compared to ‘spuriously operate failure modes’.	The statement ‘*Typically, with regard to the failure mode “failure to actuate certain I&C function”, a simplified approach may be sufficient while for the assessment and modelling of spurious*		X Actually the intention of the paragraph was not to claim that simplified approach is better for ‘failure to actuate’ failure modes compared to		

				actuations quite detailed analysis may be required' is not explained.		'spuriously operate failure modes'. The intention isto state that it can be easier to perform screening for 'failure to actuate' failure modes compared to 'spuriously operate failure modes', i.e., the likelihood and the impact of the former failure mode is easier to assess. The sentence paragraph was revised		
UK	14	5.139	Remove text 'Before a hardware or software modelling technique is chosen'	This paragraph appears to be discussing dynamic interaction expectations. The choice of hardware or software modelling technique is not related to these expectations.	X			
US	5	5.141 last three lines	……..all methods have limitations to produce a well-justifiable number as ideally expected in PSA. Significant uncertainty in identification of failure modes, modelling dynamic interactions and data have been noted [19]. This should be taken into account in	Suggest adding the highlighted sentence to note importance on treating uncertainties.		X The paragraph requires some simplification. The 'informative part' was moved to the footnote.		

			the use of PSA in risk-informed applications.					
ENISS	45	5.142	Use of expert judgement may be used ~~become necessary~~ to (…)	Editorial proposal	X			
UK	15	5.142	This paragraph should be reconsidered.	The paragraph appears to be suggesting that using ‘expert judgement’ is the primary acceptable way of deriving software reliability. This does not meet current expectations as the industry develops for digital I&C software reliability. It can be acceptable to use expert judgement when deriving reliability figures in PSA, but it is not ideal. Why are no other methods explained as acceptable, except for expert judgement? This paragraph is arguably the most important paragraph in the entire section, as most of the rest of this section contains already established PSA approaches. It is disappointing that this paragraph was not expanded more		X This paragraph should be read together with the previous paragraph 5.141. It is thus an incorrect interpretation that the paragraph suggests expert judgements as the primary acceptable way to assess software reliability. On the contrary, the paragraph acknowledges the fact that expert judgements are practically always needed to some extent when assessing software reliability. Thus, the decision was made to remove the paragraph, since the available approaches are discussed in the previous paragraph.		

				discussing the various proposed methods with pros and cons for each.				
US	6	5.145 last sentences	………than other systems, because of the lack of knowledge of detailed failure modes, system interactions and/or hardware software interactions. Software failure data (or lack of failures) should be carefully reviewed. Even minor changes in software can significantly change system behaviour, and aggregation of data from similar, but not identical software should be carefully considered. These modelling uncertainties should be identified and at least qualitatively addressed. Data uncertainty should also be addressed.	It is important to add this caution since number of manufacturers sometimes aggregating operating hours of software that are not identical.				X Given other Member States comments to this part of the document, it is proposed to keep the paragraph simple, with the ‘should’ statement regarding the uncertainty.
ENISS	46	5.146	~~It may be expected that the practices of Member States will evolve over time.~~	It is reminded that the SSG should reflect ‘internationally recognized good practices’. The document should not drive evolution of practices.	X			
UK	16	5.146	Re-word this paragraph to contain less conservative design engineering and more best-estimate PSA language. Suggest:	There is a phrase in this paragraph that is not appropriate in a PSA guide: “should be within justifiable limits”. In the context of modelling digital I&C in	X			

			"As stated in Ref. [20], insights gained from PSA should be considered in the design of I&C systems. ~~Any~~ **Derivation of** ~~reliability~~ ~~claims~~ ~~for~~ I&C system~~s~~ **reliability** should be substantiated **and use internationally recognised approaches. Assumptions should be documented and justified.** ~~and and should be within justifiable limits.~~ In this respect, IAEA Safety Guide SSG-39 on Design of Instrumentation and Control Systems for Nuclear Power Plants points out that practices differ in Member States. Some Member States expect quantitative estimates of probability of I&C systems due to hardware and software failures. For other Member States, design errors (including software errors) and their consequences are adequately treated only by qualitative analyses of the architecture and of the design. Some Member States, that apply numerical reliability to software, have established numerical limits to software reliability claims. ~~It may be expected that the practices of Member States will evolve over~~	PSA, a justifiable limit is not how reliability data should be obtained. The best estimate figure should be used, even if this figure is less than that which design engineering is comfortable, as long as the figure is justifiable within best-estimate approaches.				

			~~time.”~~**This is an evolving area of PSA modelling and it is expected that approaches and methods will continue to change.**					
Germany	33.	5.147 Line 5	…on use of operating experience data are also provided in paras 5.147–5.167166.	Clarification - wrong number	X			
ENISS	47	5.150	~~If the available operating data do not indicate the occurrence of failures, the initiating event frequencies and component failure probabilities assigned should be justified.~~	Redundant with para. 5.153	X (5.153 removed)			
ENISS	48	5.152	This can be done using a Bayesian approach or by engineering judgement.	Editorial proposal	X			
Germany	34.	5.154 and 5.157	5.154. A frequency should be assigned to each initiating event group modelled in the Level 1 PSA. In determining this frequency, account should be taken of all the causes identified for the initiating event. 5.157. The frequency should be calculated for the initiating event groups. The frequency for the initiating event group should be the sum of the frequencies for all the individual initiating events assigned to that group.	5.154 and 5.157 should be merged together, since they duplicate some information.	X (5.157 removed)			
ENISS	49	5.155	It should be checked that the predictions yielded by the fault tree are consistent with operating experience. If the results obtained	The document should provide recommendations in case fault tree predictions are	X			

			from the fault tree analysis are inconsistent with operating experience, these results should be reconsidered in light of the intended applications of the level 1 PSA.	not consistent with operating experience.				
ENISS	50	5.156	The frequencies assigned for frequent initiating events should be consistent with the operating experience from the plant under consideration and, if relevant, from similar plants.	The consistency of initiating event frequencies from one plant with the ones from similar plants should only be recommended when relevant. Indeed, different operation practices on similar plants may generate differences, e.g. internal fire frequencies.	X			
ENISS	51	5.168	For the approach using a combination of ~~small~~ event trees and ~~a large~~ fault trees (the fault tree linking approach, see para. 5.5 and 5.4), (…)	This para. should be applicable to both approaches described in paras. 5.4 and 5.5.	X			
ENISS	52	5.169	A number of sophisticated Level 1 PSA computer codes that can be used to carry out this analysis are available commercially or have been developed in various Member States.	Editorial proposal	X			
ENISS	53	5.178	The importance values should be used to identify the components ~~and~~, systems and actions from operating personnel that significantly contribute to risk and	Importance measures are also helpful for operator actions.	X			

			should be considered carefully at the design level or during the operation of the plant.					
Germany	35.	5.180	Consideration needs to be given as to how to use the uncertainty information in the design evaluation and decision making process. However, probabilistic safety goals or criteria for core or fuel damage frequency often relate to point estimates …	Please add issue of fuel damage as well		X (see response to comment #20 from Germany)		
ENISS	54	5.187	These uncertainty distributions should be propagated through the analysis to determine the uncertainties ~~in frequencies of occurrence of initiating event groups, and~~ in the core damage frequency.	Initiating event frequency is a PSA input parameter whose distribution should be estimated, it is not an output parameter as core damage frequency whose uncertainty distribution require uncertainty propagation from input parameters.	X			
Germany	36.	5.188 New issue	To address the correlation of the component data which have been derived from the same source failure rate coupling should be considered in uncertainty analysis. This can be done by means of parameter sampling.	Missing aspect of uncertainty analysis was added.	X	The recomendation was added. It would be interesting to get the feedback from the Member States in terms of available practices.		
ENISS	55	6.NEW	Because of increasing uncertainties associated with natural external hazards characterization as the hazard magnitude increases, External Hazards Level 1 PSA risk	It is proposed to highlight the potential larger uncertainties associated with Level 1 External hazards PSA, with respect				X This topic was specifically discussed within the Technical Meeting on

			estimates should be considered with caution when used to support industrial or regulatory applications.	to Level 1 Internal Events PSA. These uncertainties are mainly driven by the hazards characterization and increases as the hazard magnitude increases. This has to be recognized when using Level 1 PSA to support industrial/regulatory applications that are presented in chapter 12. See also 6.23 below. It is suggested to introduce a new para. 6.NEW.				Aggregation of various risk contributors (held in Vienna in March 2018). The conclusion from thorough discussions in this field was that some risk contributors from internal events and internal hazards could have comparable uncertainty characteristics with external hazards (e.g. Large LOCA, RPV rupture, fire modelling aspects, etc.). Therefore, the overall risk profile should be taken into account and the estimated uncertainty should be considered in the decision making. How to consider uncertainties in the risk-informed decision making is a challenge in general (not only applicable for external hazards). We have tried to elaborate on that in the IAEA TECDOC-1909 and in the IAEA TECDOC on Risk Aggregation (in the process of publication).
Germany	40.	6.1 Line 14	~~Such~~ ~~h~~Hazards including combined ones can damage plant systems, structures and	Text must be systematic and complete	X			

			components (SSCs) and thus generate accident sequences that might lead to core and/or fuel damage (or to other undesired end states as appropriate, if these are to be considered in the Level 1 PSA). Often, ~~these~~ hazards have the potential to affect many different ~~pieces of equipment~~ SSCs simultaneously and adversely impact plant personnel. Both internal and external hazards including their combinations should be included in the Level 1 PSA.					
Germany	41.	6.1 Line 16	… frequency of hazards combinations …	Editorial (grammar)	X			
ENISS	56	6.1	(…) e.g. a severe storm ~~causes~~ may cause important precipitation ~~and~~ together with simultaneous dam failure ~~simultaneously~~ resulting in ~~extremely~~ high water level on the plant platform.	Editorial proposal	X			
Finland	8	6.1	6.1. Apart from random component failures and human errors (as discussed in Section 5) that may lead to internal initiating events, fault sequences may be caused by the damage imposed by other hazards. This section provides recommendations on meeting Requirements 6–13 of GSR Part 4 [3] for Level 1 PSA for	It would be good if IAEA makes definition for internal and external hazards. Now DS503 is at MS comments. In that safety guide draft para. 2.1 defines internal and	X			

			other hazards, which can be categorized as follows: (a) **Internal hazards** originating from sources located on the site of the nuclear power plant, both inside and outside plant buildings. Examples of internal hazards are internal fires, internal floods, turbine missiles, on-site transportation accidents and releases of toxic substances from on-site storage facilities. (b) **External hazards** originating from sources located outside the site of the nuclear power plant. Examples of external hazards are seismic hazards, external fires (e.g. fires affecting the site and originating from nearby forest fires), external floods, high winds and wind induced missiles, off-site transportation accidents, releases of toxic substances from off-site storage facilities and severe weather conditions. …	externa hazards in a little pit different manner. 2.1. Internal hazards are those hazards to the safety of the nuclear power plant that originate from within the site boundary and are associated with failures of facilities and activities that are under the control of the operating organization. External hazards include natural or human induced events that originate outside the site boundary and outside the activities that are under the control of the operating organization, for which the operating organization has very little or no control. Such events are not connected to the operation of the site or conduct of an activity on the site, but could have an adverse effect on the safety of the site or activity. In this Safety Guide, the word “hazard” or “hazards” refers to both				

				internal and external hazards, and to the combination of these hazards unless where specifically noted. Examples of internal and external hazards are provided in paras 5.16 and 5.17 of SSR-2/1 (Rev. 1) [2].				
Germany	37.	6.1 (a)	… Examples of internal hazards are internal fires, internal floods, internal explosions, turbine missiles, drop of heavy loads, on-site transportation accidents and releases of ~~toxic~~ hazardous substances from on-site storage facilities.	Important internal hazards were missing, mention of only toxic substances is too limiting.	X			
Germany	38.	6.1 (b)	…. Examples of natural external hazards are seismic hazards, ~~external fires (e.g. fires affecting the site and originating from nearby forest fires),~~ external floods, high winds, or severe weather conditions ~~and wind induced missiles~~, examples for man-made external hazards are aircraft crash, explosion pressure blast, off-site transportation accidents, or releases of ~~toxic~~ hazardous substances from outside the nuclear power plant site ~~off-site~~	The list must be systematic and clearly structures. Wind induced missiles is a hazard combination and needs to be treated separately. The guidance in Section 6 on hazards needs to be consistent with the Design Guides for internal and external hazards (e.g. SSG-64)				

			~~storage facilities and severe weather conditions~~.					
Germany	39.	6.1 (c) New issue	(c) Event combinations of hazards or **Combined hazards.** These cover combinations of external with other external hazards, external with internal hazards and internal with internal hazards. Three categories of hazard types can be distinguished as defined in IAEA SSG-64.	The aspect of hazard combinations, often called "Combined Hazards", which according to the state-of-the-art and corresponding guidance (IAEA SSG-64, DS495, DS503) have to be treated in the design of NPPs needs also to be addressed in PSA, The definition of hazard categories "consequent hazards", "correlated hazards" and "unrelated hazards" can be taken from SSG-64.		X Description is added in 6.1 below Internal and external hazards in the paragraph related to combination of hazards.		
Japan	18.	6.1(a)	Internal hazards originating from the sources located on the site of the nuclear power plant, both inside and outside plant buildings. Examples of internal hazards are internal fires, internal explosions, internal floodsing, ~~turbine~~ internal missiles, pipe breaks, heavy load drop, electromagnetic interference ~~on-site transportation accidents~~ and releases of ~~toxic~~ hazardous substances ~~from on-site storage facilities~~ inside the plant.	Keep a consistency with DS494, "Protection against Internal Hazards in the Design of Nuclear Power Plants".		X Combined with the comments from other NUSSC members.		
Germany	42.	6.2 Line 2	… their contribution to core and/or fuel damage frequency …	Please add "fuel damage" as well		X		

						(see response to comment #20 from Germany)		
Germany	43.	6.6 (c) and new additional (d)	Plant layout, geography and topography of the site and surroundings; (d) Environmental conditions, such as climate zone, meteorological characteristics, etc.;	Systematic additions needed for screening	X			
Germany	44.	6.6 (d), now (e)	Information on the location of pipelines, transportation routes (air, water, rail, road) and on-site and off-site storage facilities for hazardous (e.g. combustible, toxic, asphyxiant, explosive, corrosive) materials;	Essential information for screening	X			
Germany	45.	6.6 (e), now (f)	Location of industrial and military facilities in the vicinity of the site;	Essential information for screening	X			
Belgium	6	6.8	For external human-induced hazards, add: (d) Off-site large fires	For instance in nearby industry, from transportation accidents, etc.	X			
Germany	46.	6.8	Internal hazards: … (f) …	List needs to be extended according to SSG-64	X			
Germany	47.	6.8	External natural hazards: … (a) Seismic hazards; (b) External fires; (cb) Hydrological hazards, such as Eexternal floods; (c) Extreme meteorological conditions, such as high wind, precipitation, etc. (d) High winds;	List needs to be extended according to state-of-the-art		X Accepted with some changes.		

			(ed) Extraterrestric phenomena; (e) Geological phenomena; (f) Biological phenomena; (gf) External fires;Extreme meteorological conditions.					
Germany	48.	6.8	External human-induced hazards: … (a) Aircraft crash (accidental); (b) Offsite explosions (c) Offsite transportation accidents; (d) Offsite industrial storage accidents; (e) Accidental releases of hazardous substances.	List needs to be extended according to state-of-the-art	X			
ENISS	111	6.8 or Annex I	A16 Solar storms	Solar storms should be added to the list because they can cause significant risk especially if transformers do not tolerate such electromagnetic disturbances.	X			
ENISS	57	6.8 footnote 20	External floods is a hazard group that includes multiple hazards such as dam failure, tsunami, meteotsunami, riverine flood, storm surge	A tsunami-like wave of meteorological origin can cause a significant risk in certain areas				X Tsunami is mentioned as general category regardless the origin
ENISS	58	6.8 footnote 21	High winds is a hazard group that includes hazards such as tornado, hurricane/typhoon, downburst and straight wind.	Downbursts can cause very strong winds.			X	
ENISS	59	6.11	(…) extreme rain and lightning triggered by a storm ~~extreme meteorological conditions~~	Editorial proposal				X

								Current version is more general
Germany	49.	6.11 (a) to (c)	*Definitions must be made consistent to SSG-64, examples can be taken from SSG-64, DS498 and other publications; Germany can provide such information separately*		X			
Germany	50.	6.12	It needs to be distinguished between consequences of hazards and event combinations of consequent hazards. The assessment of consequences of hazards should be part of the assessment of the primary hazard. Consequential (subsequent) hazards should can either be included in the assessment of the primary hazard or in the assessment of the secondary (subsequent) hazard. , while c combinations of correlated or of unrelated (coincidental) external hazards should be included in the hazard identification process for combined hazards.	Clarity is needed and precision must be given.	1	X Accepted. Introduced with revisions and major simplifications.		
Germany	51.	6.13	Combinations of unrelated (coincidentil incidental) external hazards should consider the duration of the impact of individual hazards in the combination (e.g. a seismic event during a long drought period, a plant internal fire during a long-	1. The text need to be consistent with the definition (see SSG-64) and not only limited to external hazards 2. The last sentence is a result of quantitative screening (by frequency)	X			

			lasting external flooding). ~~Combined coincidental hazards are normally limited to two.~~	and therefore not appropriate here. I must be deleted here. 3. Finally, according to the definition of this combination category, the text maybe unnecessary. This should be discussed.				
Germany	52.	6.14	The potential combined hazards should be identified starting from the list of individual internal and external hazards applicable to the site. The entire list of applicable hazards should be used for this purpose before any screening analysis is carried out. ~~Usually, combined hazards involve only natural hazards (e.g. a combination of high wind and high sea water level). However, combinations of natural hazards and/or human-induced hazards are also possible and cannot be excluded a priori (e.g. an increased risk of ship accidents during severe weather conditions).~~	The last two sentences need to be deleted, they are not correct and limit the guidance unnecessarily.	1			X We propose to keep it because it reflects the current international practice. But to be moved to the footnote for better readability of the 'should' statements
ENISS	60	6.16 Title	SCREENING OF HAZARDS AND HAZARDS COMBINATIONS	The whole section should also be made applicable to hazards combinations.	X			
Belgium	7	6.16	… The successive screening process should be based on clearly defined screening criteria and consistently applied to ensure~~s~~ that	Typographical correction (delete "s" in "ensures")	X			

			none of the significant risk contributors …					
ENISS	61	6.16	The successive screening process should be based on clearly defined screening criteria and consistently applied to ensure~~s~~ that none of the significant risk contributors from any internal, external hazard and hazard combinations relevant to the plant and the site are omitted.	English correction	X			
Finland	9	6.17 (a)	The hazard will not lead to an initiating event. For external hazards, this criterion is generally applied when the hazard cannot occur close enough to the plant to affect it, or when critical components are not impacted (e.g. an ~~internal~~external flooding scenario that does not generate an initiating event). Satisfaction of this criterion will also depend on the magnitude of the hazard.	6.19 points out that "*None of the criteria listed in para. 6.17 are applicable to **internal** hazards that originate inside plant buildings.*" thus, the given example of an internal flooding scenario must be wrong.	X			
Germany	53.	6.17 (d)	~~The hazard has a significantly lower mean frequency of occurrence than other hazards with similar character and will not result in consequences that are worse than those from other such hazards. The uncertainty in the frequency estimate for a hazard screened out in this manner and cumulative impact of all screened out hazards are judged as not~~	This needs to be deleted – one cannot exclude just by comparing different hazards if they are frequent or not. Moreover, this is not a qualitative argument!	X			

			~~significantly influencing the total risk.~~					
Germany	54.	6.17 (e)	The impact of the combined hazard is not more severe than the effect of the most~~re~~ severe hazard in the combination.	Suggestion to move this recommendation to combinations issues only. Mixing single and combined hazards up is not helpful.				X The entire subsection is devoted both to single and combined hazards, therefore it is proposed to keep item (e)
Germany	55.	6.18	Quantitative screening criteria applied to hazards should depend on the overall objective of the Level 1 PSA and should correlate with the overall core and/or fuel damage frequency (typically obtained based on full scope PSA). Hazards of very low frequency but with potentially severe consequences in terms of releases of radioactive material should be considered, e.g. for the purposes of a Level 2 PSA.	For hazards it is essential not to limit the frequency to CDF!		X (see response to comment #20 from Germany)		
Germany	56.	6.19	~~None of the criteria listed in para. 6.17 are applicable to internal hazards that originate inside plant buildings. These hazards should not be screened out as an entire hazard category and should always be the subject of either bounding or detailed analysis.~~	This text is not completely correct and should be deleted. Some of the internal hazards can already be screened out qualitatively if the plant design covers appropriate and reliable (mainly passive) precautionary measures. The authors have not really understood the combined hazards issue	X			

				and should try to understand it from SSG-64 for internal hazards.				
Germany	57.	6.21	~~The following external hazards should not be screened out as an entire hazard category:~~ ~~(a) Seismic hazards;~~ ~~(b) Wind hazards;~~ ~~(c) External floods;~~	The text needs to be completely changed. Reasons are: In areas of low seismicity and appropriate plant design, seismic events can be screened out. Similar argument for flood hazards. Moreover, these are groups but not categories of hazards, for which the one or the other can be completely screened out. Hazard classes see ASAMPSA_E report or German Hazards Screening Tool HST representing good practice.		X According to the Agency Safety Standards the design should consider these hazard groups even with the moderate level (e.g. for seismic see para.2.7 of NS-G-1.6 – currently being revised as DS490). Therefore, the The idea of the paragraph is that the mentioned hazards could not be screened out as not applicable to the site even if the hazard is moderate. The word “hazard class” is used instead of the “hazard category”.		
Japan	19.	6.21.	(a) Seismic hazards; (b) Human-induced hazards; ~~(b)~~(c) Wind hazards; ~~(c)~~(d) External floods;	Human-induced hazards should be added, because it is described in 8.1 that human-induced hazards as selected external hazards, which cannot be screened out.	X			

Netherlands	7	6.21	6.21 The following external hazards should not be screened out as an entire hazard category: (a) Seismic hazards; (b) Wind hazards; (c) External floods; (d) Human induced hazards	It is not clear why "human induced hazards" was deleted from this list of hazards that should not be screened out as an entire hazard category (meaning that human induced hazards can be screened out). In the rest of the document they are discussed. See e.g. in 6.8 (Iidentification of hazards), ch. 8 (Specific aspects of level 1 PSA for external hazards) etc.	X			
Netherlands	8	6.22 – 6.24	Add discussion of "Seismic hazards" and "Human induced hazards"	Par 6.22 and 6.24 discuss only two of the hazard categories in 6.21.		X 6.22-6.24 made more general.		
Germany	58.	6.22	In order to eliminate specific hazards from ~~the high wind category~~ a given hazard class, it should be proven that the ~~climatic~~ conditions specific to the location of the plant (topographic, geographic, meteorological, biologic) support the assumption that these hazards are not sufficient to damage the plant (e.g. hurricanes in a non-coastal area, icing in a tropic area, etc.).	A more general requirement is needed, since this is not wind-specific but valid for several hazard classes!	X			

ENISS	62	6.23	~~Wind hazards~~ External hazards with a certain potential for damage should be screened out only when it is demonstrated that the frequency of exceedance of a particular ~~wind velocity~~ magnitude is negligible or when uncertainties in hazard frequency are so large that they prevent any valuable insight to be driven.	Beginning of paras 6.23 is also applicable to any external hazards. As the frequency (resp. magnitude) of the external hazard decreases (resp. increases), uncertainties become more and more important, so that uncertainties may dominate the analysis. This has to be recognized setting additional screening criterion.	X			
Germany	59.	6.23	~~…~~	This requirement is much too specific for an individual hazard and belongs to an Appendix, should be deleted here		X The paragraph has been made more general (see comment #62 from ENISS)		
ENISS	63	6.24	For the screening process for predictable external ~~flood~~ hazards~~, the following should be taken into consideration:~~ criteria, such as those contained in annex ?, should be considered. ~~(a) The location of the nuclear power plant with respect to distance to a river, sea or lake, and the possibility of any flood reaching the site.~~ ~~(b) The warning time24:~~	Para. 6.24 is too detailed for a SSG. In addition, some parameters mentioned here may be applicable to other predictable hazards than external flooding. It is suggested to move the criteria to a new annex and should be generalized to apply to all predictable external hazards.		X The para is removed. See comment #60 from Germany		

			~~(i). This can be long enough to allow shut-off operations in plants located at river sites (e.g. more than one day in advance).~~ ~~(ii). For plants located at coastal sites, in general, the warning time is shorter and may sometimes be only a matter of hours or minutes in the case of a local tsunami.~~ ~~(iii).In addition to the warning time, the time dependent likelihoods of success in receiving the warning and of the success of potential preventive actions should also be considered.~~ ~~(c) The type of structure in place for retaining water.~~ ~~(d) It is possible that other, adjacent areas will be inundated as the flooding occurs and that the flood level will be higher than expected. A plant at the edge of a narrow flood plain is more likely to be flooded than a plant located in a wide delta area.~~					
Germany	60.	6.24	~~…~~	This requirement is much too specific for an individual hazard and belongs to an Appendix, should be deleted here	X			
Germany	61.	6.25	For each ~~internal hazard originating outside the plant buildings and for each external~~	The understanding of hazards analysis seems to be missing, the sentence	X			

			individual hazard, an approximate maximum impact that could occur, given pessimistic assumptions about events subsequent to the initiating accident, should be determined and should be used in the screening process.	is principally valid for all hazards!				
ENISS	64	7.NEW	The maturity level and uncertainties associated with internal hazards Level 1 PSA may still be much lower than the one associated to internal events Level 1 PSA. As an example, for Fire Level 1 PSA, modelling limitations of Fire codes do not allow a correct description of the fire smouldering phase although operating experience reveals that most fire events are suppressed during this phase. Therefore, Internal Hazards Level 1 PSA risk estimates should be considered with caution when used to support industrial or regulatory applications.	It is proposed to highlight the potential larger uncertainties associated with Level 1 Internal hazards PSA, with respect to Level 1 Internal Events PSA. As an example, for Fire PRA, these uncertainties are mainly driven by the limited modelling capability of Fire codes which can not describe the fire smouldering phase although the OPEX shows that most fires are suppressed during this phase, or by the modelling of transient fires. This has to be recognized when using Level 1 PSA to support industrial/regulatory applications that are presented in chapter 12. See also 6.23 below.				X See comment #55 from ENISS

				It is suggested to introduce a new para. 7.NEW.				
Germany	62.	7.1 (d)	~~Turbine~~ missiles;	Should not be limited to missiles from turbine, the guidance is similar for all missiles	X			
Germany	63.	7.1 new (f)	Component failures (including high energetic, in particular HEAF (high energy arcing fault))	This is a hot topic e.g. in the U.S. PSA, where guidance from NUREG-6850 is being changed; it should be considered, NRC can probably write some requirements.		X The list of internal hazards is removed with the reference to 6.8. HEAF is added in the list in 6.8		
Japan	20.	7.2. / Line 1	Hazards that can occur inside ~~plant buildings~~ the site should be considered in the frame of a bounding assessment and/or detailed analysis; a conservative screening analysis is usually omitted	Clarification 6.1 mentions that the internal hazards originating from sources located on the site of the nuclear power plant, both inside and outside plant buildings.		X The paragraph has been revised (with reference to internal hazards definition described in 6.1 and 6.8)		
ENISS	65	7.2	(c) ~~Integration~~ Derivation of the Level 1 PSA for internal hazards ~~with~~ from the Level 1 PSA for internal initiating events:	Editorial proposal	X			
Germany	64.	7.2	Hazards that can occur inside ~~plant buildings~~ the site boundary inside or outside buildings should be considered in the frame of a bounding assessment and/or detailed analysis; a conservative screening analysis is usually	The requirement is also valid for other hazards and probably should be moved (without “internal”) to an appropriate place. Might		X The paragraph has been revised (with reference to internal hazards definition described in 6.1 and 6.8 where site is		

			omitted (it has been demonstrated in many studies that such internal hazards are often significant contributors to the overall risk). …	stay here as a kind of little duplication Limiting the requirement to hazards inside buildings is not correct. Bullets need to be adapted accordingly.		mentioned instead of buildings)		
ENISS	66	7.3	Some internal hazards (e.g. internal explosion~~s~~, internal fire~~s~~, internal flood~~s~~ing) can occur in a variety of different locations in the plant (rooms, inside or outside buildings ~~or elsewhere on the site~~).	Editorial proposal	X			
ENISS	67	7.3	(b) Second, enclosed plant areas, assuming that the existing protection features (e.g. physical separation, barriers, isolation equipment) in the plant design will effectively contain the damage inside the area~~s~~ where it initiated.	Editorial proposal	X			
Germany	65.	7.3	~~Some~~ Most internal hazards (e.g. internal explosions, fires, floods) can occur in a variety of different locations in the plant (rooms, buildings or elsewhere on the site). In such cases, the hazard characterization should specify: …	"Some" is wrong, a broad majority can occur anywhere on the site.	X			
Japan	21.	7.5.	$f_{\text{hazard core damage}} = \sum (f_{\text{hazard in plant area } i}$	Typo The mathematical expression is not described properly. The summation sign is missing.	X			

Germany	66.	7.12 (d)	The possibility of damage to equipment due to actuation of fire suppression systems (e.g. spray and flood caused by fire suppression systems) may damage equipment that would otherwise survive a fire, or the failure mode of such equipment may be altered).	Clarification	X			
Germany	67.	7.12 (e)	The effects of fire on pieces of equipment (structures, systems and components (as well as including their associated instrumentation and control and power cables). …	For clarity and avoiding unnecessary limitations, rewording of the text	X			
Germany	68.	7.12 (f)	The possibility of damage to such equipment75SSCs and, in the case of severe fires, to the integrity of the civil structures of the plant (walls, ceilings, columns, roof beams).	The limitation to severe hazards is wrong!	X			
Germany	69.	7.12 (h)	The eEffects of the fire, both direct (e.g. the need to evacuate the control room) and indirect (e.g. confusing information resulting from spurious indications), on actions by operating personnel and/or items important to safety.	According to SSG-64 this requirement was too limited.	X			
ENISS	68	7.12 to 7.68		As regards Fire PRA, NUREG CR-6850 (EPRI/NRC-RES Fire PRA methodology) should be referenced as recognized international standard. It is suggested to add this reference.	X			

Germany	70.	7.13 Line 2	… core and/or fuel damage frequency …	Please add “fuel damage” as well		X (see comment #20 from Germany)		
Germany	71.	7.14	Smoke may cause electric and/or electronic devices	Requirement was too limited	X			
Germany	72.	7.15 (b)	The screening should be performed separately to take account of the greater potentially higher and additional fire loads and ~~higher number~~ different and/or additional ~~of~~ potential ignition sources, particularly transient combustibles associated with maintenance ~~operations~~ activities performed during shutdown states.	Clarity and precision	X			
Germany	73.	7.15 (e)	The increased occupancy of different plant locations during outages may improve the fire detection capabilities but may also create additional fie sources.	Additional humans being present has advantages but also disadvantages.	X			
Germany	74.	7.17 Line 7	… For instance, the analyst may prefer to consider several fire compartments as one compartment, if this facilitates the screening analysis. Division of the plant into a large number of small locations may not be necessary, at least at the early stage of the PSA analysis.	These statements are very dangerous and should be deleted according to the State-of-the-art. By choosing too large fire compartments fires located in a large compartment maybe wrongly screened out, even if they are close to a barrier separating the fire compartment from a target important to safety	X			

				and vulnerable to fire effects. The more state-or-the-art approach is to sub-divide very large compartments (e.g., reactor building annulus, turbine hall) virtually into meaningful compartments (openly connected to adjacent compartments) for further analysis.				
Germany	75.	7.20 and further Section 7 items	7.20 needs to be revised in detail. It turned out that the whole Section 7 needs a careful revision (the majority of comments so far to Section 7 are essential ones!) considering good practices from the last ten years in Internal Hazards PSA, in particular Fire PSA. The actual text does not represent fully the state-of-the art. Such a detailed revision unfortunately requires much more time than available within the Step 7 comment process. It is therefore recommended to supplement the detailed revision of the SSG-3 in the next steps after Step 7 using experienced experts in the field of IH PSA, the best would be representatives from different state-of-the art approaches to			X The revision of SSG-3 has been approved by NUSSC and CSS as revision by amendment and the chapter related to internal hazards was not considered to be in the list of the major items required significant revision. Therefore, full revision of Section 7 is not considered to be needed. In the meantime we agree that the text needs to reflect the good practice in this area and that’s what		

			support this revision of the Safety Guide.			was implemented when drafting the document and addressing comments received from NUSSC on this Section. We are planning consultancy meetings after receiving the feedback from the Member States. During these consultancy meetings we will carefuly examine this Section and will further improve it in co-operation with the leading experts in this field. Having said that we count on the participation of the experts highly experienced on internal hazards PSA from various Member States and would appreciate if experts from Germany could join this working group.		
Japan	22(a) .	7.21 p. 55 /FIG.3.	The box of plant walkdown of fire compartment analysis should not be a dashed line box on the FIG. 3.	Clarification The plant walkdowns of fire compartment analysis is only different	X			

				from other walkdowns on the FIG.3. The box of plant walkdown of fire compartment analysis should not be a dashed line box.				
Japan	22(b)	7.21 p. 55 /FIG.3.	~~Multiple~~ Combined hazards analysis	Typo	X			
Japan	23.	7.27. FIG.3 7.78. FIG.4	7.27. Fire frequencies should be estimated as a mean with statistical uncertainty intervals after identification of scenarios and qualitative screening ~~for all unscreened fire scenarios~~. 7.78. Flood frequencies should be estimated as a mean with statistical uncertainty intervals after identification of scenarios and qualitative screening ~~for all unscreened flood areas~~.	Consistency problem between FIG.3 and 7.27, and FIG.4 and 7.78. For example, 7.27 says that fire frequencies should be estimated as a mean with statistical uncertainty intervals for all UNSCREENED fire SCENARIOS. However, the FIG.4 mentions that an estimation of flood frequencies is performed before qualitative screening and identification of scenarios.		X Implemented with minor revisions		
ENISS	69	7.35	~~Then, all possible combinations of fire compartments should be analysed with regard to the potential for spread of fire to~~	As regards multi-compartments fire analysis, para. 7.35 should be consistent with NUREG CR-6850 that				X This simplification could lead to serious underestimation of the risk

			~~adjacent (or connected) fire compartments.~~	states “*Postulate only one barrier failure (e.g., door left open or damper fails to close), unless the analyst observes conditions or has a basis to consider that simultaneous failure of both doors is a likely event.*”				from multicompartment fires. Thorough analysis and screening of fire spread scenarios is needed.
ENISS	70	7.39	(…) all equipment inside the fire compartment itself is pessimistically considered unavailable, ~~and~~ the means of detecting and extinguishing fires are not credited, Type C human error probabilities are penalized to consider fire context (see para 5.121(a)).	Editorial proposal	X			
ENISS	71	7.41	Probabilities relating to recoveries and post-trip human errors should be revised in order to assess the impact of the fire on the credited recoveries and human actions modelled in the Level 1 PSA for internal initiating events (see para 5.121(a)). ~~The assessment of Type C HFEs for fire PSAs should include the following three cases:~~ ~~(a) (…)~~ ~~(b) (…)~~ ~~(c) (…)~~	Avoid duplicating				X The bullets are not really duplicating the para 5.121, they are interpreted for fire

Netherlands	9	7.45 sub (b) [and similarly 7.89 sub (b)]	(b) The contribution of fire in individual fire compartments to the core damage frequency should be sufficiently low to bound all risk significant fire scenarios.	We don't understand this sentence. Please, rephrase it to improve clarity.	X			
Finland	10	7.57	*Analysis of fire in the main control room*	Please add paragraphs on supplementary control room required by SSR-2/1 should be added to the safety guide.	X			
Japan	24.	7.69. FIG. 4	~~Multiple~~ Combined hazards analysis	Typo. Just above 7.95, "multiple" was rewritten to "combined".	X			
Belgium	8	7.89	(b) The contribution of flooding for individual flooding area to the core damage frequency is sufficiently low to bound all risk significant flooding ~~fire~~ scenarios.	We suppose "fire" has to be replaced" by "flooding"	X			
Finland	11	7.89 (b)	The contribution of flooding for individual flooding area to the core damage frequency is sufficiently low to bound all risk significant ~~fire~~flooding scenarios. The threshold for screening may be defined in the same way as for the previous criteria, but should be at least an order of magnitude lower.	The section handles flooding scenarios.	X			
Netherlands	10	7.89 sub (b)	(b) The contribution of flooding for individual flooding area to the	See comment nr. 9.	X			

			core damage frequency is sufficiently low to bound all risk significant ~~fire~~ flooding scenarios. The threshold…	Copy-paste error (from 7.45) we presume…				
ENISS	72	7.94	Probabilities relating to recoveries and post-trip human errors should be revised in order to assess the impact of the internal flooding on the credited recoveries and human actions modelled in the Level 1 PSA for internal initiating events (see para 5.121(a)). ~~The assessment of Type C HFEs for internal flooding should include the following three cases:~~ ~~(a) (…)~~ ~~(b) (…)~~ ~~(c) (…)~~	Avoid duplicating				X The bullets are not really duplicating the para 5.121, they are interpreted for flooding
Finland	12	7.95 & 7.96	Comment: Floods due to seismicity are missing.	Section "Analysis of combined hazards" does not present anything about floods induced by seismicity, although that combination is mentioned in other sections of the document. Compare to 7.63 which presents fires induced by seismicity under "Analysis of combined hazards".	X			

ENISS	73	7.102	The contribution of heavy load drops to initiating event frequencies and the core damage frequency…	Drops of heavy loads during maintenance operations can affect the frequencies of several other initiating events e.g. by causing leakages in safety important primary or secondary side systems.				X Contribution to the CDF is more general includes also contribution to IEF which eventually should be reflected in CDF.
ENISS	74	7.119	~~For the remaining explosion scenarios,~~ ~~t~~The frequency of explosion events should be evaluated using the recommendations in Section 5.	Editorial proposal				
Germany	76.	8	*It turned out that the whole Section 8 is not very systematic, and lots of aspects are missing. Various comments provided before are valid here as well. The Section needs a careful, more detailed revision (considering available good practices in External Hazards PSA). Such a more detailed update and revision, which will be definitely beneficial, unfortunately requires much more time than available within the Step 7 comment process. It is therefore highly recommended to supplement the process by use of experienced experts in the field of EH PSA to support the revision of the Safety Guide in the steps following Step 7 comments.*			X The revision of SSG-3 has been approved by NUSSC and CSS as revision by amendment and the chapter related to external hazards was not considered to be in the list of the major items required significant revision. Therefore, full revision of Section 8 is not considered to be needed (only the combined hazards part).		

						In the meantime we agree that the text needs to reflect the good practice in this area and that's what was implemented when drafting the document and addressing comments received from NUSSC on this Section. We are planning consultancy meetings after receiving the feedback from the Member States. During these consultancy meetings we will carefuly examine this Section and will further improve it in co-operation with the leading experts in this field. Having said that we count on the participation of the experts highly experienced on external hazards PSA from various Member States and would appreciate if experts from Germany		

						could join this working group.		
Japan	25.	8.8. and 8.9. (between the paras)	High windsWind hazards	Subtitle should be modified, because of unification of the term. Since it was replaced from High winds to Wind hazards in 8.1, it should be unified in Section 8. Other than the example on the left, the same description can be found throughout Section 8.		X 8.1 has been modified		
ENISS	75	8.10	(i) Meteotsunamis	A tsunami-like wave of meteorological origin can cause a significant risk in certain areas				X Tsunami is mentioned as general category regardless the origin
ENISS	76	8.27	The applicable combinations of the human-induced hazards with other hazard phenomena identified as described in para. 6.11	Editorial proposal	X			
Belgium	9	8.28	A detailed analysis should be performed for all hazards ~~that~~ for which the simplified analysis with conservative assumptions has demonstrated …	Typographical correction (delete “that”)	X			
Japan	26.	8.28.	A detailed analysis should be performed for all hazards that for which the bounding or simplified analysis with conservative assumptions has demonstrated that the risk coming from the hazard	Clarification The term “bounding analysis” and “simplified analysis with conservative assumptions” seems to		X Throughout the document the term “Bounding analysis” is actually used to		

			might be significant.	have different meanings and are distinguished in Section 8. For instance, for seismic hazard, the recommended approach is a “simplified analysis”, while the non-detailed approach recommended for high winds is bounding analysis. Unless it is clear that “bounding analysis” is approach of “simplified analysis with conservative assumptions”, this comment applies.		express the simplified analysis with conservative assumptions.		
Belgium	10	8.40	When combined consequential hazards are evaluated, a conditional probability of the secondary hazard (e.g. water elevation due to a seismic-induced tsunami) to occur following the primary hazard with specific strength ~~of specific parameter~~ (e.g. PGA or spectral acceleration for the seismic hazard)	Rewording proposed				X Actually not the strength but the parameter is meant in this para.
Japan	27.	8.41.	The occurrence frequency of earthquake~~s~~ ground motions at the site should be based on a site specific probabilistic seismic hazards assessment (see Refs [7, 25, 31]).	Modification Use of accurate term. The outputs of seismic hazards assessment are earthquake ground motions. In addition,	X			

				because the earthquake ground motion has frequency characteristics, it is necessary to specify the frequency as the occurrence frequency.				
US	4	8.42	8.46. SSG-9 [23] issued in 2010 provides recommendations on seismic hazard assessment. Seismic hazard assessment should be conducted in accordance with recommendations in SSG-9 and other state-of-the- ~~art~~ practice national and international guidance on seismic hazard assessment generated in response to Fukushima nuclear power plant accident.	Fukushima event significant resources have been expended to advance state-of-the-practice in seismic hazard assessment. This statement does not acknowledge those advances. Additional references that have captured those advances must also be referenced in this statement.				X Should statement cannot be used to refer to national and other guidance. However it could be used for IAEA Safety Standards
US	1	8.46	8.46. SSG-18 [24] issued in 2011 provides recommendations on wind hazard assessment. Wind hazard assessment should be conducted in accordance with recommendations in SSG-18, and other state-of-the art national and international guidance on wind hazard assessment.	SSG-18 was issued in 2011. Better methods may have been developed since that time. The sentence must be modified to address that possibility.				X Should statement cannot be used to refer to national and other guidance. However it could be used for IAEA Safety Standards
US	2	8.60	8.60. NS-G 3.1[22] issued in 2002 provides recommendations on human induced hazard assessment. Human induced hazard assessment should be conducted in accordance with	NS-G-3.1 was published approximately 20 years ago (2002). A literature search must be conducted to verify that more appropriate methods				X Should statement cannot be used to refer to national and other guidance. However it

			recommendations in NS-G 3.1 and other state-of-the art national and international guidance on human hazard assessment.	have not been published by credible organizations and then the sentence must be modified accordingly.				could be used for IAEA Safety Standards
Belgium	11	8.65	If the combined hazards have different failure mechanisms, the failures should be represented by the individual hazard fragilities~~,~~. ~~I~~If the combined hazard has similar failure mechanism, the compounded fragility should be considered.	Split in two sentences.	X			
ENISS	77	8.67	Depending on the retained combined hazard this may include dams, tsunami walls, internal flooding sources or internal fire sources identified systematically.	Editorial proposal	X			
ENISS	78	8.72	(…)on to a~~n~~ seismic equipment list item	English correction	X			
ENISS	79	8.86	More details on fragility/capacity analysis for aircraft impact are presented in Section 5.4 of [28]. More details on fragility/capacity analysis ~~and~~ for explosions and hazardous releases are presented in Section 5.5 of [28].	Editorial proposal	X			
Belgium	12	8.89	(a) ... In this case, it should be checked whether there is a need to revise the assessment of performance shaping factors due to the possibility that it might **be** harder for operating personnel to	Add missing word	X			

			implement actions than in the base case.					
ENISS	80	8.89	The assessment of Type C HFEs for external hazards should include the ~~following~~ three cases~~:~~ defined in para. 5.121. ~~(a) (…)~~ ~~(b) (…)~~ ~~(c) (…)~~	Avoid duplicating				X The bullets are not really duplicating the para 5.121, they are interpreted for external hazards
Japan	28.	8.100	Seismically induced fires and floods should be included in the Level 1 PSA model for seismic hazards, unless it is clearly justified that other seismic damage bounds additional effects from seismically induced fire and floods. Plant impacts associated with induced fires and floods scenarios should be consistent with the fire and flood scenarios discussed in paras 7.48–7.64 and 7.79–7.84, respectively, except for the occurrence of multiple fires and floods.	Add the exception of multiple fire and flood risk in the consideration of fire and flood scenarios as shown left. Multiple independent fires were described that these could typically be screened out based on low frequency of occurrence in para 7.62 for the internal fire. However, multiple fire and flood risk may come up if multiple equipment are damaged simultaneously.		X The explanation is added as a footnote		
Belgium	13	9.13	... Fuel stored in ~~a~~ spent fuel pools both internal and external to the reactor building	Typographical correction (or “pool” in singular)	X			
ENISS	81	9.13	In para. 5.11, initiating events ~~is~~ are defined with relation to the core damage. As indicated in paras 9.4–9.8, the core can be in very	English correction	X			

			different configurations in different shutdown states. Fuel stored in a spent fuel pools both internal and or external to the reactor building is covered separately in this Safety Guide as part of the PSA for spent fuel pools (see section 10).					
ENISS	82	9.13	This decision should be based on national targets for risk correlated with the probabilistic safety goals or criteria to be verified, if specified in national regulations or guidelines.	The term "*national target for risk*" is not clear. The text should be changed consistently with Paragraph 2.21	X			
ENISS	83	9.17	(a) All initiating events in the group have similar time to end point and recovery possibility; (b) The assignment of plant damage states to sequence end points is the same for all initiating events in the group. (a) All initiating events in the group have a similar effect on the availability and operation of safety systems and support systems. (b) All initiating events in the group have similar success criteria for safety systems, support systems and other systems necessary for mitigating the event. (c) All initiating events in the group place similar requirements on the operator.	Previous paras from SSG-3 is more appropriate. It is suggested to retained the previous para.		X The original text is slightly revised to increase readability		

			(d) The expected response of operators is similar for all initiating events in the group. (e) The assignment of plant damage states to sequence end points is the same for all initiating events in the group.					
Germany	77.	9.24 new (d)	(d) Basis for the number of available redundant trains or components for a certain safety function should be the minimum requirements from the operational limits and conditions. Operational experience should be considered.	Newer plants have more redundant trains (e.g., 4 RHR trains, 8 accumulators, 8 emergency diesels in German PWR plants). Various combinations of the minimum available redundancy are allowed by the technical specifications. It should be clarified, which combination should be considered in the PSA.		X Item (d) incorporated with some modifications aimed to assure consistency with the previous items (a-c)		
Germany	78.	9.27 new (j)	(j) Availability of protection systems for actuation of safety functions	The availability of certain I&C (e.g., for overpressure protection, safety injection) directly affects the event sequences.	X			
Japan	29.	9.27. /Line 1	To ensure that core cooling assumptions are correct, thermohydraulic calculations * should be performed to determine realistic success criteria.	Para. 9.27 describes that thermohydraulic calculations is used to confirm the success criteria. However, the sucess criteria during shutdown states is not				X This is also applicable to some systems in non-shutdown states. We suggest not to highlight it

			(footnote) * In order to compare the success criteria, comparing the required capacity with the design capacity could be the additional option without thermohydraulic calculations.	severe and the calculation is not complicated comparing to those during power operations.				specifically only for shutdown states
ENISS	84	9.32	(b) Containment state — especially ~~where~~ when the containment is open; (e) The water inventory ~~of water~~ in the primary circuit.	English correction	X			
Japan	30.	9.43. / Line 2	For human reliability analysis, close interaction with plant operating personnel and maintenance personnel should be practised taken into consideration in order to ensure that plant design and operating features during shutdown are properly reflected in the analysis.	Clarification. It is important to consider and model the interaction between plant operating personnel and maintenance personnel for human reliability analysis, however the interaction with plant operating personnel and maintenance personnel is not required to analyze human reliability.		X We believe there is a misunderstanding – when saying “interactions” we have meant the interactions between HRA analyst and plant personnel in order to collect detailed information for proper HRA. The corresponding clarification is added.		
Germany	79.	9.67 (a)	~~Core damage~~ Frequencies for end states representing core damage — important contributions integrated over all plant operational states:	Normally different end states are defined in the PSA (e.g., reactor overpressure, coolant level below fuel rod top, failure of RHR) that represent core damage. The contributions to	X			

				these end states should be presented.				
ENISS	85	10 (Title)	**SPECIFICS OF LEVEL 1 PSA FOR THE SPENT FUEL POOLS**	The text in the chapter 10 refers to PSA for **the** spent fuel pool.	X			
ENISS	86	10.2	If they have been specified in national regulations or guidelines, the ~~national~~ probabilistic safety goals or criteria applicable to the spent fuel pool should be the basis of specifying the undesired end points of interest~~, provided that such goals or criteria exist~~.	The term "*national* is not clear. Consistency with para 2.21	X			
UK	2	10.3	"Mechanical damage of a limited number of fuel rods or of one single fuel assembly during refuelling operation may be screened out from further assessment, if it can be justified that these events will not lead to a large radioactive release **and the focus of the PSA is limited to estimating the frequency of core or fuel damage**. **There may be value in retaining these sequences to maximise the influence the PSA has on the design, operation and maintenance of fuel route systems**"	It is stated that "Mechanical damage of a limited number of fuel rods or of one single fuel assembly during refuelling operation may be screened out from further assessment, if it can be justified that these events will not lead to a large radioactive release." This should be balanced against the objectives and applications of the PSA. If the objectives are restricted to 2.11(b), this may be appropriate, but if the PSA has other uses (eg 2.11(a) or 2.17), then	X			

				such screening may not be appropriate.				
ENISS	87	10.3 to 10.5	10.3. 10.5 A criterion (or criteria, if appropriate) should be developed to characterize the specified undesired end points. Regarding the core (see paras 5.42 and 5.43), it is often assumed that fuel damage occurs if design basis limits for the fuel are exceeded. In lack of detailed thermohydraulic analyses, fuel uncovery (i.e. when the water level in the spent fuel pool drops below the top of the active part of the fuel assemblies as a result of boiling or draining) may also be applied as a criterion to assume fuel damage. 10.4. Beyond fuel damage, fuel uncovery and boiling of the pool water (e.g. for spent fuel pools located outside the containment) should also be considered in the identification process as a potential undesired end point. 10.3. 10.5 If necessary for risk assessment, damage of fuel assemblies to a pre-defined degree should be considered to define the main end point of interest. Mechanical damage of a limited number of fuel rods or of one	It is proposed to switch paras 10.5 and 10.3 as para. 10.5, which describes the most commonly used decoupling criteria to define fuel damage (i.e. fuel uncover) should be presented first. Then, should more refined criteria be presented, as these may not correspond to 'recognized best practices', they should be presented as a possibility but with a lower priority.	X			

			single fuel assembly during refueling operation may be screened out from further assessment, if it can be justified that these events will not lead to a large radioactive release.					
Germany	80.	10.6	Gross mechanical fuel damage due to e.g., internal hazards such as heavy load drops or falling objects (including a consequence of hazard induced structural failures), or hazard combinations should also be considered as an undesired end point, since such events can challenge the design basis limits for the fuel.	Completeness, systematic approach	X			
ENISS	88	10.8	(g) The time ~~available~~ for recovery actions and repairs to be credited	The time available for any recovery or repair actions can be deduced from (a) and (b), it corresponds to the grace period before unacceptable consequences are obtained. Instead, the time needed to put in place recovery or repair actions is needed to be compared to the grace period.	X			
US	9	10.8	Such grouping should take into account the following physical and technical aspects and differences in	Fuel loading patterns must also be considered in grouping.	X			

			fuel loading patterns of the plant states					
US	10	10.8(d)		This paragraph uses "lower part" and "upper part" of pool. The meaning of this characterization is not clear. Sentence\s must be added to explain the meaning of these terms.	X Clarification is added			
Ukraine	2	10.9	(g) Events related to reactivity control of the spent fuel pool	To indicate the need to consider boron dilution in the SFP (e.g., due to a leak in SFP cooling heat exchanger) as one of the potential initiating events (if fuel subcriticality in SFP is not ensured by other design measures)		X Added as item (e)		
US	8	10.9(f)	Internal events induced by external hazards that may lead to loss of spent fuel pool heat removal or loss of fuel pool inventory or falling of objects onto the fuel assemblies in the spent fuel pool due to hazard induced structural failure.	Suggest the addition because seismic induced loss of pool inventory has been a significant contributor to the risk.	X			
Germany	81.	10.9 (f)	~~Internal~~ Initiating events induced by external hazards …	Wrong statement	X			
Germany	82.	10.9 new (g)	(g) Initiating events induced by combinations of hazards …	Missing aspect added	X			
Japan	31.	10.9.	(f) Internal events induced by external hazards that may lead to	Add re-criticality events in 10.9. This may be part	X			

			loss of spent fuel pool heat removal or falling of objects onto the fuel assemblies in the spent fuel pool due to hazard induced structural failure. (g) boron dilution or fuel loading errors	of (e), but it is worth listing as separate type of initiating event.				
Netherlands	11	10.9	10.9. Examples of the types of initiating event to be considered in the spent fuel pool PSA are as follows: (a) … (b) … (c) … (d) … (e) ~~Initiating~~ Internal events induced by internal hazards that may lead to loss of the spent fuel pool heat removal system (including pipe ruptures as sources of internal flooding in systems other than the heat removal circuit) or falling of objects onto the fuel assemblies in the spent fuel pool originated by lifting activities; (f) Internal events induced by external hazards that may lead to loss of spent fuel pool heat removal or falling of objects onto the fuel assemblies in the spent fuel pool due to hazard induced structural failure.	(e) and (f) are not clear. Please rephrase them (and possibly combine them) to clarify what kind of hazards should be considered inducing which events etc. Also add that these events may lead to loss of *coolant* (and not only loss of *cooling*).		X E and F were slightly modified and combined hazards have been added. Also considering the other comments received for this paragraph.		
Japan	32.	10.11. /Line 3	The specific characteristics of recovering the cooling system of	Clarification	X			

			the spent fuel pool, recovery from pipe ruptures and recovery from loss of off-site power should be taken into account in the assessment (e.g., repairment of the failed component). For assessing the time available to recovery, the initial water inventory in the spent fuel pool, the residual heat of the fuel assemblies stored in the spent fuel pool as well as the capacity of the systems available for mitigation should be considered.	Add examples of the assessment.				
Germany	83.	10.12	Potential dependencies between Level 1 PSA for the reactor core and Level 1 PSA for the spent fuel pool should be considered, with respect to shared ~~mitigating~~ systems <u>and human resources</u> in the case of common initiating events.	Completeness according to the state-of-the-art (see OECD Site-Level PSA task). ➔ Perhaps both, 10.12 and 10.19 need some re-wording.	X			
UK	3	10.12	"Potential dependencies between Level 1 PSA for the reactor core and Level 1 PSA for the spent fuel pool should be considered, with respect to shared mitigating systems in the case of common initiating events. **Consequential effects between SFP and reactor PSA should also be considered, for example flooding effects, structural loads due to external hazards or other phenomena, draining events**	In addition to shared mitigating systems, consequential effects between SFP and reactor PSA should also be considered.	X			

			when SFP and reactor are connected etc.”					
Netherlands	12	10.16 – 10.17	10.16 Owing to slow accident progression in the case of loss of spent fuel pool cooling events, recovery actions and repair activity should be credited. 10.17. The slow accident progression in the case of loss of spent fuel pool cooling events makes possible the participation of multiple actors in the process of diagnosis, decision-making and as well as in the execution of recovery actions and repair activity. This should be considered when defining performance shaping factors that mostly affect the success probability of recovery actions in these situations. Recovery actions and repair activities in general should not be taken into account. Exceptions should be justified in relation to the pace of accident progression and the ability of the organization to act sufficiently in time, as demonstrated by e.g. a plant simulator and training records.	The wording of 10.16 paragraph is not appropriate (it states that recovery actions should be credited, which in a SG is a recommendation). We propose to change the wordings and state that these actions can be credited only in case of slow pace of the accident. We suggest to delete 10.16 end to add a couple of sentences at the end of the current paragraph 10.17.	X			
ENISS	89	10.17	This should be considered when defining performance shaping factors that mostly affect the success failure probability of	In PSA, estimated probabilities rather correspond to failure probabilities than to success probabilities	X			

			recovery actions in these situations.	which are, for the vast majority, very close to one.				
ENISS	90	10.21	The combined or separate interpretation of risk from accidents involving the spent fuel pool and the reactor core should be consistent with the ~~national~~ probabilistic safety goals specified in national regulations or guidelines.	The term *"national"* is not clear. "*probabilistic*" is missing. Consistency with para 2.21	X			
Republic of Korea	1.	10.22 / Lines 2-3	10.22 There is no international consensus on whether or not to aggregate the Level 1 PSA risk results of the spent fuel pool with those of the reactor. ~~However, the risk results for the reactor and the spent fuel pool should be aggregated in the Level 2 PSA.~~	Since the Chapter 10 (Specifics of Level 1 PSA for spent fuel pools) mainly describes the specifics of the Level 1 spent fuel pool PSA and there is no consensus on aggregation of SFP risk as described in para. 10.22, we strongly suggest this sentence should be deleted. Instead, IAEA should develop the methodology on how to consider the SFP risk in PSA, if necessary.		X It is acceptable that since there is no consensus on that it cannot be presented as a 'should' statement. Nevertheless given the fact that there is international experience on aggregating risks coming from reactor core and SFP in PSA Level 2 and 3, the statement is made as informative (not should statement) and is moved to the footnote.		
US	11	10.22	There is no international consensus on whether or not to aggregate the Level 1 PSA risk results of the spent fuel pool with those of the	Risk can be aggregated after Level 3. Not Level 2 PSA. Modified text to address that point. Also		X Simplified version is addressed		

			reactor. However, the risk releases from results for the reactor and the spent fuel pool and reactor core should be appropriately aggregated in the Level 2 PSA. The risk can be appropriately aggregated after a Lovel 3 PSA.	added the word "appropriately" to acknowledge that release from SPF and the reactor cannot be simply added.				
ENISS	92	10.23	If both risk metric estimates are to be aggregated to generate an overall risk metric estimate that quantitatively describes the vulnerability of the plant to severe accidents, the correlations between the accident sequences of the spent fuel pool and the reactor should be considered, rather than simply summing these estimates (i.e. similar to aggregating multi-unit or site core damage frequencies, see Section 11).	For clarity. The outputs of the level 1 PSA are a risk metric rather than a risk to the public or environment. Risk metric is used in section 11 which is referenced.	X			
UK	4	11.2	MUPSA models **will usually be** developed based on single unit PSA models, and take into account the specifics of each unit under consideration.	Whilst the IAEA MUPSA methodology (Safety Report to be issued) relies upon a single unit approach, this should not be mandatory.		X Use the word "typically"		
ENISS	91	11.3	As described in para. 2.2, the scope and the need for MUPSA should be correlated with the ~~national~~ probabilistic safety goals or criteria, if they ~~latter~~ have been ~~set~~ specified in national regulations or guidelines.	The term "*national*" is not clear. Consistency with para 2.21	X			

UK	5	11.4 & 11.5	~~If the national policy requires, then~~ Additional risk metrics other than the ones used in single unit PSA (e.g. core damage frequency) ~~should~~ **can** be developed in order to express the risk profile in the context of multiple unit nuclear power plants for corresponding decision-making.	A MUPSA may not be required by national safety goals but may be developed by designers or operators risk inform design, operation and decision making.				X The statement is related to the risk metrics not the safety goals. Risk metrics is defined in TECDOC-1804 as *Risk metrics: A measure that is used to express the risk quantity of interest.*
Germany	84.	11.5 line 14	As announced in para 1.12 this Safety Guide focusses on the reactor core and the fuel in the spent fuel pool. However, depending of the scope of the PSA, for risk aggregation, multi-unit aspects as well as potential effects from other radioactive sources on the nuclear power reactor(s) and/or the spent fuel pool(s) collocated on the site (e.g. interim fuel storage facilities, nuclear waste treatment facilities) should be considered within the PSA. Risk metrics for multi-unit PSA should be defined so as to capture…	Missing aspect of MUPSA was added		X The issue is not related to the risk metrics and more relevant to the MUPSA scope. It jas been added to the 11.4 as a footnote.		
Germany	85.	11.23	In order to address all effects and interdependencies of multiple collocated units and/or sources it is recommended to use a combined common site risk model including all considered initiating events, accident sequences and mitigating	Missing aspect of MUPSA risk aggregation		X Added with slight modification (the word recommended is related to the “should” statement, so it was		

			system functions. The quantification of the MUPSA risk profile…			replaced with the word “practical”). Also the word “integral” model is used in accordance with the other IAEA PSA publications that are currently under development.		
ENISS	93	11.24	Minimal cutsets should be reviewed to ensure that the model correctly account~~ed~~s for aspects of multiple unit plants, (…)	English correction	X			
Finland	13	12	Security PSA	Discussion on security PSA should be included in the chapter USE AND APPLICATIONS OF PSA				X This application is not well established in Member States and no consensus might be made for formulating “should” statements. The IAEA considers this topic as an emerging and important and therefore there is a new project launched to develop a specific safety security interface publication on use of PSA for security purposes. The available experiences on this topic will be summarized there.
Japan	33.	12.4.	The PSA to be used for any application should be maintained as a ‘living PSA’ that is regularly	TECDOC is not consensus document reviewd by Member	X			

			updated to reflect the current design and operation of the plant and current analysis of its transients and has been fully documented so that the analysis can be traced back to details of the design and supporting analysis. ~~The quality attributes of Level 1 PSA models essential for particular PSA applications are provided in IAEA-TECDOC-1804 [35].~~ (footnote nn1) The quality attributes of Level 1 PSA models essential for particular PSA applications are provided in IAEA-TECDOC-1804 "Attributes of Full Scope Level 1 Probabilistic Safety Assessment (PSA) for Applications in Nuclear Power Plants".	States and related SSCs, and then move it to footnote. Information from TECDOC-1804 is referred in footnote 14 attached to para 12.15,				
ENISS	94	12.9	PSA to be used for decision making purposes is required to be of appropriate quality and scope ~~adequate~~ for particular decision-making purposes.	English correction	X			
UK	6	12.16	Review statements where general uses of PSAs explicitly refers to Level 1 PSA.	Use of PSA for Design Evaluation – often in this section Level 1 PSA is referred to explicitly, however the statements being made are often equally true for all levels of PSA. Whilst this a		X In most of the places the statements are applicable to PSA in general not only L1PSA.		

				Level 1 PSA document, it is not necessary to make the distinction between Level 1 PSA and PSA in general needs to be made in all cases. This is also present in other sections and should be reviewed throughout.				
ENISS	95	12.20	The results of the Level 1 PSA should also be used to determine the needs for additional measures ~~need~~ to be incorporated to reduce risk.	English correction	X			
Finland	14	12.21.	The PSA should include an investigation of variants and exploratory design options, the sufficiency of the redundancy and diversity of systems, and the effectiveness of emergency response and accident management measures. PSA results should be used to allocate reliability and availability targets for SSCs to meet probabilistic safety goals or criteria, thereby forming part of the design specification. PSA should be also used as a supporting tool to select or modify the design basis accidents and design extension conditions (DEC), to define general design criteria. PSA may also be used to provide an input to cost-benefit analysis.	Please clarify. Add DECs to be considered. it would be better to have a separate sentence for the cost benefit analysis and in may form. The use of cost benefit analysis varies in Member States.	X			

Germany	86.	12.30	For multiple unit and/or sources collocated at a site~~s~~ the impact of one ~~unit~~ of these to ~~on the other~~ a NPP unit~~s~~ being investigated should be considered in risk-informed design optimization process to support reduction of the risk significance of such impact.	Aspects for risk-aggregation from other sources than reactor units should be added. They need particularly to be considered in case of hazards or hazard combinations.	X			
Japan	34.	12.31./ Line 5	The assessment of the overall plant safety is necessary for applying for an operational licence and usually involves a full scope Level 1. A comparison of the results against probabilistic safety goals or criteria (if set) should be performed within this application. A safety evaluation for applying for a pre-construction licence may involve a limited scope of the PSA (e.g. using the data from the similar plants); however, at the stage of applying for an operational licence, a full scope level 1 PSA should be available48.	Clarification with an example of “a limited scope of the PSA.”	X			
ENISS	96	12.39	A safety assessment process for this application should consists ~~of identification of~~ identifying safety issues,	English correction	X			
ENISS	97	12.41	As a part of periodic safety review, PSA ~~could~~ should be used to support the extension of the lifetime of the plant, (…)	“Should” is usually used in guides.				X The statement is related not to the safety but to the cost-benefit analysis,

								therefore in the safety guide the "should" statement could not be used. The para is moved to the footnote
ENISS	98	12.43	The Level 1 PSA supporting optimization of the design against internal and hazards external hazards should be used to provide input for the following: (a) Robustness of the SSCs against internal hazards and external hazards, including containment (based on the results of internal and external hazards PSA ~~seismic PSA, tsunami PSA, tornado and aircraft crash PSAs~~);	The list of relevant hazards PSA should not be limited as suggested in the original version. Instead, it is proposed to adopt an open wording.	X			
ENISS	99	12.46	**"A probabilistic safety analysis should be used to ensure that effective programmes for maintenance, testing, surveillance and inspection are established and implemented".**	Policy doesn't need to be in bold.	X			
Netherlands	13	12.46	12.46. Requirement 31 of SSR-2/2 (Rev. 1) [34] states: "A probabilistic safety analysis should be used to ensure that effective programmes for maintenance, testing, surveillance and inspection are established and implemented".	Requirement 31 in SSR 2/2/ (rev.1) states: "The operating organization shall ensure that effective programmes for maintenance, testing, surveillance and	X			

			In 12.46 reference is made to requirement 31 of SSR 2/2 rev.1, but the text reported in 12.46 does not match the text in SSR 2/2 (rev.1). *Please check and correct.*	inspection are established and implemented." (Please note also that a requirement in a SSR is formulated as "shall" and not as "should")				
ENISS	100	12.48	Insights from PSA should be used as an input to the process of establishing or ~~verification~~ verifying of measures	English correction	X			
ENISS	101	12.52	The goal of this application~~s~~ is to optimize (…)	English correction	X			
Japan	35.	12.56. (d)	In providing input from the Level 1 PSA for the optimization or justification of the service testing interval strategies the following should be investigated and taken into account: (a) The correlation between the surveillance test interval and the component failure probability (e.g. wearing due to frequent tests); (b) Common cause failures with due account taken of the type of testing (staggered or non-staggered); (c) The potential for HFEs during and after testing, leading to component(s) unavailability and/or an initiating event; (d) The potential for errors of commission that may be	It would be difficult to identify the commission error from the PSA.				X Yes, but there are HRA methods aimed on systematic identification of EOCs (see response to the comment #15 from Japan)

			introduced due testing strategies, if it could be identified.					
Japan	36.	12.62. / Line 5	The aim of the application of a risk informed approach to in-service testing is to use the risk information provided by the PSA to help optimize the in-service testing programme so that it focuses on the components that have the highest risk significance. From the point of view of the operating personnel, a risk informed approach to in-service testing can prioritize the components that have various risk significance and has the potential to ~~reduce overall maintenance costs,~~ , prevent undue adverse effects of testing on components, and increase availability of components while still maintaining a very high level of safety.	Prioritization of the components that have various risk significance should come first, and cost reduction should not be the purpose of applying PSA.	X			
Finland	15	12.68 →	Risk informed pre- and in-service inspection	Pre-service inspections should be included as well.	X			
Finland	16	12.68 →	The essence of the risk informed pre- and in-service inspection methodology should be described more clearly i.e. the risk significance of the piping segment (welds) is determined through a combination (risk matrix) of the assessment of the degradation potential (qualitative or		X			

			quantitative) and the assessment of the potential consequences of the piping segment failure (e.g. CCDP ←PSA)					
Finland	17	12.69	wrong reference in footnote 42. Should be [39]?		X			
Japan	37.	12.69. / Line 6	The risk informed approach should be used to provide the insights from the PSA to revise the programme of inspections (in terms of the frequency of inspection, methods used and sample size) and focus it on those segments of pipework that have the highest risk significance and reduce the inspections carried out on segments of pipework with a low risk significance. The expectation is that this will lead to a reduction in the overall number of pipework inspections that are carried out, ~~a reduction in costs~~ and a reduction in the associated occupational exposure, without increasing the risk from the plant	The IAEA Safety Standards should not address cost reduction.	X			
ENISS	102	12.74	For pipework failures leading to the unavailability of mitigating systems or failure of mitigating systems ~~on demand~~ on demand,	Editorial correction	X			
US	3	12.78 last paragraph	"The contribution of the SSC to reduction in the overall plant risk is an important factor in the assignment of its safety class. Consistency between the deterministic and probabilistic	Based on significant experiences in this area revealed since the publication of SSG-30 in 2011, it should not be expected that	X			

			approaches will provide confidence that the safety classification is correct. ~~Generally, it is expected that probabilistic criteria for safety classification will match those derived deterministically. If there are differences, however, further assessment should be carried out in order to understand the reasons for these and a final safety class should be assigned, which should be supported by an appropriate justification". (Para. 3.28 of SSG-30 [40].)~~	probabilistic criteria for safety classification will match those derived deterministically. That statement is factually incorrect,				
Japan	38.	12.83.	Cumulative risk significance of SSCs that proposed for re-classification should be also taken into account when making the decision.	Please clarify "cumulative risk significance".	X			
US	12	12.107	If the event in question is an initiating event, the living Level 1 PSA model should be used to estimate the conditional core or fuel damage probability.	For initiating event, CCDP is the correct metric.	X			
ENISS	103	12.121	qualitative or ~~quantities~~ quantitative risk insights derived from Level 1 PSA should be used to prioritize and to optimize	Editorial correction	X			
ENISS	104	12.126	Risk insight should also provide information on the particular human actions that should be included	Editorial correction	X			
ENISS	105	12.134	~~Level 1 PSA should also provide the basis for specifying the~~	The decision criteria that define the transition from		X		

			~~decision points for when the transition to severe accident management guidelines should occur.~~	EOPs to severe accident management guidelines should occur shall be defined on the basis of operational criteria relying on available measurements. Then, PSA should consider these criteria when modelling transition from Level 1 to Level 2.		Not deleted but reformulated		
ENISS	106	References		Many references are still draft document. Will these documents be published prior to SSG-3 update ?		X The draft references are in the advanced stage of revision. Taking into account that the publication of the Safety Guide is planned for 2023, it is expected that the draft documents will be already published.		
ENISS	107	References		A number of TECDOCs are referenced, it should be ensured that these aren't used to support the recommendations. Applicable references: 11, 13, 16,17,28 and 31.		The TECDOC references is mainly to illustrate the available practices for the relevant topic. They are not supporting the "should" statements		
Germany	87.	References	References need to be updated and added		X			

ENISS	108	Annex I W3	High water levels may be due to storm surges, waves, meteotsunamis or seiches.	A tsunami-like wave of meteorological origin can cause a significant risk in certain areas	X			
ENISS	109	Annex I	A2 Tornado The hazard is defined …. A3 Downburst This hazard has also unique characteristics (e.g. wind speed vertical profile) that differ from strong winds. Wind speed does not decrease at lower levels from the ground, as with strong winds. A3 A4 High air temperature	This hazard has also unique characteristics (e.g. wind speed vertical profile) that differ from strong winds. Wind speed does not decrease at lower levels from the ground, as with strong winds.	X			
ENISS	110	Annex I M3	The hazard is defined in terms of intake clogging or toxic impact…	E.g. crude oil can cause clogging of cooling water intake strainers or heat exchangers.	X			
Germany	88.	Annex I	Annex I needs to be completely updated and re-written, better references are available.			X The revision of SSG-3 has been approved by NUSSC and CSS as revision by amendment and the Annex I was not considered to be in the list of the major items required significant revision. Therefore, full revision of Annex I is not considered to be needed.		

						In the meantime we agree that the table needs to reflect the good practice in this area and that’s what was implemented when drafting the document and addressing comments received from NUSSC on this Annex. We are planning consultancy meetings after receiving the feedback from the Member States. During these consultancy meetings we will carefuly examine this Annex and will further improve it in co-operation with the leading experts in this field. Having said that we count on the participation of the experts highly experienced on external hazards PSA from various Member States and would appreciate if experts from Germany or other members of		

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>ASAMPSA_E project could join this working group.</td><td></td><td></td></tr>
<tr><td>Germany</td><td>89.</td><td>Annex II</td><td>Annex II is in principle still valid, but more state-of-the art material is available and should be added here</td><td></td><td></td><td></td><td></td><td>X

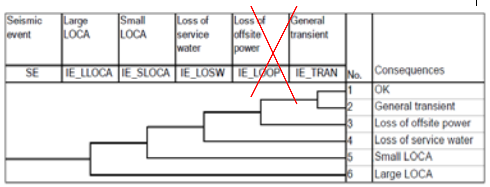
The revision of SSG-3 has been approved by NUSSC and CSS as revision by amendment and the Annex II was not considered to be in the list of the major items required significant revision. Therefore, full revision of Annex II is not considered to be needed.</td></tr>
<tr><td>Japan</td><td>39.</td><td>ANNEX II. II-2.</td><td>

FIG. II–2. Example of an event tree for the modelling of a seismically induced initiating event. Loss of coolant accident.</td><td>Modification of event tree is needed.

According to the sentence of II-2, it is assumed that the seismic initiating event always leads to a loss of off-site power in this example. However, the example event tree of FIG. II-2 has the heading of loss of off-site power.</td><td></td><td>X

The para II-2 was modified accordingly.</td><td></td><td></td></tr>
<tr><td>Germany</td><td>90.</td><td>Annex III</td><td>Annex III needs to be updated to the state-of-the-art, a German reference particularly providing guidance on shutdown PSA (FAK 16] should be added.</td><td></td><td></td><td>X

The revision of SSG-3 has been approved by NUSSC and CSS as revision by amendment</td><td></td><td></td></tr>
</table>

						and the Annex III was not considered to be in the list of the major items required significant revision. Therefore, full revision of Annex III is not considered to be needed. We are planning consultancy meetings after receiving the feedback from the Member States. It would be great if experts from Germany could join this working group to provide input on FAK-16 guidance and potential updates of German experience reflected in Annex III.		