	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
EGYPT	1	Page 4 Para1.2	Seismic design aspects also play an important role in this field, and relevant recommendations are provided in IAEA Safety Standards Series No. SSG-9 (Rev. 1), Seismic Hazards in Site Evaluation for Nuclear Installations [2].	Seismic design aspects are dependent upon local geology and seismicity. Familiarity with seismic terminology and conventional dynamic analysis is necessary, as are innovative methods such as performance-based seismic engineering (PBSE) and pushover analysis			x	Agree, but no changes have been made to the text as a result of this comment.
GERMANY	4	1,3	This Safety Guide supersedes IAEA Safety Standards Series No. NS-G-3.6, Geotechnical Aspects of Site Evaluation and Foundations for Nu-clear Power Plants1."	Editorial. The same for the title page of DS531	x			
SWITZERLAND	1	1,3	This Safety Guide explicitly expands the scope to include nuclear installations other than large nuclear power plants and presents recommendations for applying a graded approach to geotechnical site investigations and activities for other types of nuclear installation. It does not include subsurface nuclear installations such as underground intermediate storage or final storage facilities, as for their site evaluation, much more weight has to be put into subsurface exploration and tunnel construction issues.	The current text does not exclude subsurface facilities. The reader therefore may believe that the safety guide is also applicable to underground facilities built to store radioactive waste below the surface. We recommend to explicitly exclude such facilities.		Added 'This Safety Guide does not include recommendations specific to subsurface nuclear installations, which necessitate a higher level of effort and focus on subsurface exploration, tunnel construction and site specific considerations.' at the end of para. 1.3		
UK	1	1.3 Line 5	"….scope to include nuclear installations other than large nuclear power plant but excluding facilities for the disposal of nuclear waste (in line with para 1.7 of SSR-1)"	The current document title/scope suggests it applies to any nuclear installations. But para 1.4 refers to SSR-1 and para 1.7 of SSR-1 does not include nuclear waste facilities (near-surface or geological). Also, the content of the document does not address nuclear waste facilities as such (that is done in other IAEA documents).	x			
FINLAND	2	1,6	The scope of the document described in the chapter 1.6 covers all needed geotechnical aspects important to the safety of nuclear installations.				x	Comment not understood. No changes made to the text as a result of this comment
INDIA	1	Page 4/Para 1.6/Line 2	In this Safety Guide, „geotechnical aspects" refer to those aspects of geotechnical site investigation, evaluation, engineering design and safety assessment related to the subsurface conditions at nuclear installation sites.	The term „**condition**" encompasses both materials and presence of cavities, fracture/fault zones etc.	x			
ISRAEL	1	Title of the Guide and par. 1.6	General Comment: Following the remark in paragraph 1.6 as to 'geotechnical aspects' in this Safety Guide referring only to **subsurface** materials at nuclear installation sites: We suggest considering emphasizing that point by including it in the title of the Guide, for example by including the words 'subsurface' or 'underground' in the title.	Clarity And Completeness			x	Note that para. 1.6 just defines the term 'geotechnical aspects' as it should be understood within the Safety Guide. Hence, para. 1.6 does not define the scope of the Safety Guide. Scope is defined in paragraphs 1.7 through 1.10. Note that 'subsurface' refers to materials under the surface of soil or terrain. This is in contrast with 'subgrade', or materials located under the plant grade level.

RUSSIAN FEDERATION	26	Section 1.7	Replace subsurface conditions with engineering-geological conditions.	Soil-a term of predominantly biological or agricultural application. Geotechnical enginereing surveys assess the engineering geological properties of soil mass and generate a mathematical model that takes into account the physical and mechanical properties of the soil mass as well as geological and man-made factors. Comment: It includes a programme of engineering surveys carried out to ensure a proper understanding of the subsurface conditions necessary to determine the suitability of the conditions for the foundations and construction of the nuclear facility.			x	Agree with the idea, but this is a matter of terminology. The term 'engineering-geological' (=geothechnical) is more limited than 'subsurface' conditions and, in some Member States, it could be understood as including only stress/strain parameters for foundation or slope design, that is, not including other subsurface conditions such as groundwater regimes.
EGYPT	2	Page 5 Para 1.8 Line 3	This Safety Guide provides recommendations on the methods of analysis appropriate for the safety assessment of a site for a nuclear installation, particularly for the assessment of the effects of earthquake and other external events on site	Not only earthquake	x			
RUSSIAN FEDERATION	27	Section 1.8	It is proposed to use "change in physical and mechanical properties of soils due to earthquake" instead of "liquefaction"	Seismic liquefactions - this term appears in some sceintific articles concerning methods for assessing the change in the state of dispersed soils as a result of seismic action. However, it does not appear in the regulatory literature. Comment: Particularly, to evaluate the effects of an earthquake on a site, including determining site-specific response spectra and assessing the potential for liquefaction.			x	The drafting team agrees that the proposed definition is scientifically more accurate than the term "liquefaction". However, the term "liquefaction" is what is used in SSR-1, and is broadly used in practice to designate the phenomena referred to by the commenter and it will be better understood by practitioners.
FINLAND	4	1.11, 2, 5, tables 1, 2, 3 and 4	Although the monitoring program must be described as a separate entity due to its continuous nature and special data and management needs, the methods of monitoring form an important part of overall data acquisition on the site, and form the basis of site undestanding. Hence, it could be reasonable to mention this comprehensive perspective on the application of all spatial data together, for example in paragraph 2.			Added a new paragraph at the beginning of Section 5. 'A documented site monitoring programme should be established latest when a site is selected. The monitoring program should identify and address needs for specific data (its monitoring frequencies and management needs), methods of monitoring and overall interpretation and review expectations. The monitoring plan should be evaluated regularly but backward comparison of safety relevant parameters to monitoring baseline should be preserved.'		

GERMANY	5	new para. 1.11 in the sub-section “Scope”	This Safety Guide is applicable to all types of nuclear installation as specified in the IAEA Nuclear Safety and Security Glossary [X], as follows: (a)Nuclear power plants; (b)Research reactors (including subcritical and critical assemblies) and any adjoining radioisotope production facilities; (c)Storage facilities for spent fuel; (d)Facilities for the enrichment of uranium; (e)Nuclear fuel fabrication facilities; (f)Conversion facilities; (g)Facilities for the reprocessing of spent fuel; (h)Facilities for the predisposal management of radioactive waste arising from nuclear fuel cycle facilities; (i)Nuclear fuel cycle related research and development facilities.	The scope of this Safety Guide needs to be clearly defined. A paragraph similar to the proposed statement can be found in several more recently issued IAEA safety standards whose scope was extended from NPPs to nuclear installations, e.g. •SSR-1, para. 1.7; •SSG-9 (Rev. 1), para. 1.7; •SSG-50, para. 1.6; etc As an alternative option, the following statement could be added as new para. 1.4 in the subsection “Background”: “Terms used in this Safety Guide are to be understood as defined and explained in the IAEA Nuclear Safety and Security Glossary [X], unless otherwise stated.” Such statement covers the fact that the term ‘nuclear installation’ is defined in the Glossary. As references for the alternative option, see e.g. •SSG-35, para. 1.9; •SSG-69, para. 1.4; •SSG-79, para. 1.4.			x	Agree, but IAEA editorial rules discourage reminders of the meaning of terms already defined in the IAEA Safety Glossary. In fact, in all Safety Standards there is an initial set of pages where the IAEA Safety Standards are introduced in general terms. At the end of this set of pages, there is a section named "Interpretation of the text", in which it is said that "Safety related terms are to be understood as defined in the IAEA Safety Glossary". The reminders suggested by the commenter are therefore not necessary.
FINLAND	3	2	Guidelines for monitoring of the sites is well described in the chapters 5.4 - 5.12, but the role of the monitoring programme and specifically its connections to the other site investigations activities could be emphasized already in the chapter 2.				x	The need for monitoring and its role are acknowledged and addressed in Section 1 (1.4, 1.7, 1.11, 2.4, 2.10,2.24, 2.25, 2.26).
ARMENIA	2	2,2	Add a table to indicate common stages for the geotechnical studies in site evaluation.	It would be convenient to have a common table describing enlarged stages for geotechnical investigations for specific references in the subsequent sections.			x	Geotechnical site investigations and assessments are continusly performed in all stages of planning, design, construction, commision and decomission stages. Hence the suggested table will not provide any new information.
CANADA	1	Para 2.2/Line 2	“The purpose of such investigations is…”	Clarification that there are multiple investigations in question.	x			
GERMANY	6	2,2	Investigations of the subsurface conditions at potential sites for a nuclear installation should be per-formed at all stages of the site eval-uation process (see paras 2.7–2.26). The purpose of such investigation is to obtain information and basic data on the physical and mechanical properties of the subsurface materi-als, to be used when making deci-sions about the suitability of the site for a nuclear installation, necessary soil improvements and design choices.	The site investigations are not only relevant for the decision whether the site is suitable or not, but also for several decisions to be made when the site is con-sidered suitable. The additional text tries to cover these aspects.		2.2.Investigations of the subsurface conditions at potential sites for a nuclear installation should be performed at all stages of the site evaluation process (see paras 2.7–2.26). The purpose of such investigations is to obtain information and basic data on the physical and mechanical properties of the subsurface materials, to be used when making decisions about the suitability of the site for a nuclear installation, and to ensure the safety of the installation throughout its lifetime.		
SWITZERLAND	2	2,2	The purpose of such investigation is to obtain information and basic data on the physical and mechanical properties of the subsurface materials, to be used when making decisions about the suitability of the site for a nuclear installation and the planning of the construction of it after site selection.	The gathered information about the subsurface materials does not only serve the decision about siting or not but has also an impact on future construction or design measures at a selected site.		2.2.Investigations of the subsurface conditions at potential sites for a nuclear installation should be performed at all stages of the site evaluation process (see paras 2.7–2.26). The purpose of such investigations is to obtain information and basic data on the physical and mechanical properties of the subsurface materials, to be used when making decisions about the suitability of the site for a nuclear installation, and to ensure the safety of the installation throughout its lifetime.		
FINLAND	6	2.3/1	The geotechnical investigation programme, based on a documented plan, for a …	Investigations should be based on a documented investigation plan			x	2.39 (a) requires the documentation of the investigation programme

FINLAND	7	2.3/3	… historical documents, <u>geological evidences, marine geological datasets,</u> geophysical…	direct geological evidences (e.g. paleofaults, sedimentary disturbance structures, etc.) are data as well. please see comment 5 above.		...The various methods of investigation - that is, the use of current and historical documents, **geological data**, geophysical and geotechnical **investigations**, in situ and laboratory testing - are typically applicable to all stages of the site evaluation process, but will vary from stage to stage, as necessary. In general, the investigations should become more detailed in character when approaching the later stages of the investigation programme.		
INDIA	2	Page 6/Para 2.3/Line 4	The various methods of investigation – that is, the use of current and historical documents, geophysical and geotechnical **investigations**, in situ and laboratory testing – are typically applicable to all stages of the site evaluation process, but will vary from stage to stage, as necessary.	„Investigations" is more appropriate term here rather than „Exploration"		...The various methods of investigation - that is, the use of current and historical documents, **geological data**, geophysical and geotechnical **investigations**, in situ and laboratory testing - are typically applicable to all stages of the site evaluation process, but will vary from stage to stage, as necessary. In general, the investigations should become more detailed in character when approaching the later stages of the investigation programme.		
RUSSIAN FEDERATION	11	Section 2.3		Given that Section 2.3 provides general recommendations and is structured before the sections (paragraphs) specifying each considered site evaluation stage, it should be noted that the existing contents of Section 2.3 are stated rather for the Selection, Characterization/Verification and Characterization/Confirmation stages, when geotechncial survey programs should provide for studies necessary and sufficient (in detail for each corresponding stage) for making structural and spatial-planning solutions, selecting foundation types, foundation analysis and design, as well as for engineering protection measures. At the same time, it should be noted that in Section 2.3, having the preambula status in the document structure, it is reasonable to reflect the provisions that survey programs (their scope, contents, methods) are provided also for Pre-operation (see also comment No. 12) and Operation Stages. Also in this Section, following the text, it is recommended to provide relevant references to the sections/paragraphs that specify the relevant site evaluation stages. So, at Pre-operation stage (also see comment No. 12), when the designed facilities are under construction, the most important condition for ensuring operational reliability and safety is strict compliance with all the requirements of the design regarding preparation of the foundations. At the same time, programs of required surveys (their scope, contents, methods) include geotechnical control of quality of soil base preparation to control engineering-geological processes occuring during the construction period, to establish compliance of design engineering-geological conditions and estimated indicators of physical-mechanical properties of soils, whether they are soils of natural base to be studied during excavation of the pits or, for example, soils filled in embankments, layer-by-layer replacement soils, modified (stabilized) soils etc. with the actual characteristics identified during construction works. At the Operation stage, the required survey programs (their scope, contents, methods) include			x	The suggested text would generate redundancy which initially written into the first draft of this safety guide revision. However, editorial and committee review cycles have advised to limit redundancy for clarity reasons. No changes made to the text as a result of this comment.
SWITZERLAND	3	2,3	The geotechnical investigation programme for a nuclear installation should provide the data necessary for an appropriate characterization of thesubsurface at each stage of the site evaluation and later construction phase.	Same reason as for comment no. 2			x	As stated in "The geotechnical investigation programme for a nuclear installation should provide the data necessary for an appropriate characterization of the subsurface at each stage of the site evaluation", site evaluation involves all stages of geotechnical assessments.
ARMENIA	7	2,4	Indicate the recommended ranges of variabilities for each parameter in corresponding sensitivity analyses.	It would be useful to have guidance/ recommendations on the range of variability of geotechnical parameters in sensitivity analyses			x	Comment not understood. It seems to be not applicable to Paragraph 2.4 but to Paragraph 2.12. Recommending ranges of variabilities for geotechnical engineering parameters are beyond the scope of the safety guide.
ARMENIA	12	2,4	In these analyses, the effect of uncertainties in the geotechnical parameters have to be evaluated by sensitivity of site response (impedance) analyses by certain criteria of influences	It is recommended to set sensitivity evaluation criterion. For instance, geotechnical data variability is acceptable if integral site response is ≤20%			x	Comment not understood. It seems to be not applicable to Paragraph 2.4 but to Paragraph 2.12. Recommending ranges of variabilities for geotechnical engineering parameters are beyond the scope of the safety guide.

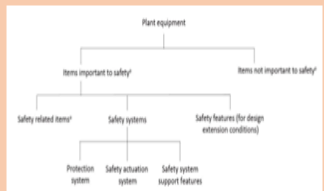
FINLAND	8	2.4/2	replace sentence: "Relevant precautions …" or only add sentence "Boreholes used for monitoring should be appropriately maintained to minimize the long-term impacts."	Most likely impact of drillings is mixing, upwelling, or drawdown of waters in open holes. Reasoning is the same as in the final sentence of the para.			x	Only the boreholes needed for monitoring purposes (see Section 5) will be kept. No additional explanation is believed to be needed.
RUSSIAN FEDERATION	28	Section 2.4	It is proposed to replace with "should be liquidated in accordance with the current regulatory documents (instructions) for liquidation plugging of boreholes".	"Suitable materials" is a vague and unacceptable term and can be interpreted in different ways. Comment: All boreholes not needed for monitoring purposes (see Section 5) should be filled and sealed with suitable materials.		...Relevant precautions should be taken to **eliminate any long term negative impacts**. All boreholes not needed for monitoring purposes (see Section 5) should be filled and sealed with suitable... Not all regaulatory agencies may have a document on how to plug boreholes.		
SWITZERLAND	4	2,4	The long term impact of investigative drilling on the geological environment and aquifers should be considered. Relevant precautions should be taken to understand the long term impact and, if negative on safety, to minimize it.	The proposed text includes the option that a long-term safety effect could also have a positive impact, e.g., in the case, where existing subsurface cavities are filled with concrete to avoid any future impact of these cavities with respect to safety.		...Relevant precautions should be taken to **eliminate any long term negative impacts**. All boreholes not needed for monitoring purposes (see Section 5) should be filled and sealed with suitable...		
SWITZERLAND	5	2,4	All boreholes not needed for monitoring purposes (see Section 5) should be filled to minimize the hydrogeological effect of the boreholes (separation of hydrostratigraphic horizons) and sealed with suitable materials.	The former text could be misunderstood in such a way that the "suitable materials" would refer to the sealing. However, different hydrogeological horizons may become separate again after filling of the boreholes.		...Relevant precautions should be taken to **eliminate any long term negative impacts**. All boreholes not needed for monitoring purposes (see Section 5) should be filled and sealed with suitable...		
ARMENIA	3	2,5	Instead of rock and soil characterization use "subsurface" or "foundation materials".	Generally, by "soil and rock" the boundary types of subbase materials are specified which include the range of soft, medium, or hard types of subbase materials.	x			
RUSSIAN FEDERATION	12	Section 2.5		Section 2.5 (b) should also include filtration soil and rock properties. These soil and rock properties are critical for design solutions, e.g. calculation of groundwater inflows into pits, design of dewatering systems, etc. Also, the following should be added in Section 2.5 for the site selection stage: (f) "Geomorphological conditions", since, for example, structural elements and terrain features, terrain surface elevations, etc., also affect the design solutions, including the grading design (g) "Geological and engineering-geological processes", since the existence and distribution, hazard degree of processes and phenomena should be established in a timely manner, because development and/or activation of adverse processes can complicate the safe operation of installation. Account of impacts of adverse natural phenomena is included in the engineering protection design of the territory. - (h) "Specific soils", since specific soils (e.g., such as collapsible, swelling, waterlogged, man-made soils, etc.) can impact the design solutions on foundation preparation (e.g., removal of specific soils and their layer-by-layer replacement or engineering reclamation to improve the subgrade bearing capacity), selection of foundation type, depth of foundation, etc. Specific soils should be timely accounted for in the design solutions to ensure the safety and reliable operation of the designed facilities in permissible range of settlements and tilts. The suggested items to be added at the stage of development of geotechnical site survey program may also be critical in site selection and level of site survey details at later stages.		Added filtration to (b) Added bullet (f) Geomorphological information documenting the landforms and terrain features, and its interaction with geological processes Did not add suggested bullet (h) as the specific soils are included in 2.5 (b) as part of geological classification. Swell is included in 2.7 (a) as an unacceptable subsurface condition.		
SPAIN	2	2.5 (f) 2.7 (d) 2.9 (l)	When aplicable. frost depth must be determined to establish the minimum coverage of the foundations.	To ensure the minimum coverage of the foundations. in order to avoid their freeze.			x	In Section 2.7 (a) permafrost was referred to. Further discussions including the discussion of frost depth is beyond the general scope of this safety guide. The level of detail requested is not appropriate for a safety guide
SPAIN	3	2.5 (g) 2.7 (e) 2.9 (m)	When aplicable, the study of hight temperatures laking into acount their future increases due to the climate change, in order to consider it for the concrete cracking in the long term.	To ensure the lack of concrete cracking in the long term			x	Too specific to be convered in this safety guide.
FINLAND	9	2.6/1	… clearly documented in accordance with investigation plans. The documentation should have a particular reference to site conditions …	Emphasize the fact the investigation programme needs to be documented and that the result reporting needs to be in accordance with the plan.			x	2.39 (a) requires the documentation of the investigation programme
RUSSIAN FEDERATION	13	Section 2.6		Reference to 2.39 Reporting should be added in 2.6	x			
ARMENIA	4	2,7	The purpose of an investigation at the site selection stage should be to determine the preliminary suitability of the sites, including multiunit sites.	Site selection is addressed for the new design, however, in case of an additional unit aspects of an additional unit at an already selected site should also be considered.				Even at an existing facility, a new location needs to be investigated complying with this safety guide. However, available data can be used to accelerate the site selection process at existing nuclear installations
EGYPT	3	Page 7 Para 2.7 Line 2	In this stage, geophysical, geologica, geomorphological, geotechnical and hydrogeological aspects are considered, and	Geophysical is part of the aspects		In this stage, **geophysical**, geological, geomorphological, geotechnical and hydrogeological, hydrological aspects are…		

GERMANY	7	2,7	The purpose of an investigation at the site selection stage should be to determine the preliminary suitability of sites (see para. 2.3 of IAEA Safety Standards Series No. SSG-35, Site Survey and Site Selection for Nuclear Installations [5]). In this stage, geological, geomorphological, geotechnical and hydrogeological aspects are considered, and some re-gions or areas may be excluded from further consideration. Subsurface information at this stage is usually obtained from current and historical documents (see paras 2.30 and 2.31) and by means of field reconnaissance, including geological, geophysical and geomorphological surveys (see paras. 2.32–2.34), and this information is used in the following considerations: ….	Clarification, as SSG-35 is mentioned for the first time. Additionally, the relevant subsurface information is given in paras 2.32–2.34, please verify.		Addressed but will also be edited later in the process.		
GERMANY	8	2.7 (a)	(a) Unacceptable subsurface conditions. A site with geological conditions that could challenge the safety of a nuclear installation and that cannot be corrected by means of geotechnical treatment or compen-sated for by construction or design measures is unacceptable, and, consequently, such conditions are considered as exclusion criteria. The potential for geotechnical hazards should be identified and analysed regarding their effects on the safety of the nuclear installation (see Requirements 21 and 22 of SSR-1 [1]), including slope instability, collapse, subsidence or uplift of the site surface, soil liquefaction, as well as ~~associated with~~ faulting, ground motion, uneven bedrock movements, ~~liquefaction~~, flooding, volcanic activity, landslides, permafrost, swelling, erosion processes, subsidence and collapse due to underground cavities (both natural and those de-riving from human activities) or other causes ~~is required to be identified and evaluated in accordance with Requirements 21 and 22 of SSR-1 [1]~~.	For consistency, please put in line with wording of Requirements 21 and 22 of SSR-1.		The proposed text paraphrases the requirements and turns them into recommendations. The original text is slightly modified as a result of this comment.		
GERMANY	9	2.7 (a) Line 9	…. The scope and extent of the investigation should be sufficient to estimate the hazard under consideration with a level of ~~uncertainty~~ confidence that can enable the application of the relevant exclusion criteria.	Using the term "uncertainty" the sentence reads as if "uncertainty" is a prerequisite for the application of the exclusion criteria. On the other hand, it might be understood as a recommendation to quantify uncertainties at this point. Both is not the intention of this paragraph. Therefore, using the term "confidence" might be more appropriate (besides sounding more positive).	x				
GERMANY	10	2.7 (c)	Groundwater regime. If there is a lack of detailed data, at this stage the hydrogeological literature may allow a preliminary estimation of presence and level of groundwater, potential groundwater– surface water interactions and the groundwater regime. In later stages further investigations should be carried out in line with (~~see~~ para. 5.26 of SSR-1 [1] and IAEA Safety Standards Series No. NS-G-3.2, Dispersion of Radioactive Material in Air and Water and Con-sideration of Population Distribution in Site Evaluation for Nuclear Power Plants [6]~~)~~ (currently DS529).	Clarification. Please put in line with pa-ra. 5.26 of SSR-1, which states: "… groundwater shall be studied…", other-wise misleading.		Comment accepted. DS529 is noted in Reference list only (as advised by Safety Standards Specialist)		
GERMANY	11	New issue 2.7 e) or new paras after 2.7 2.7A and 2.7B	e) Undesirable subsurface conditions (1) The geotechnical site investigation programme for a nuclear installation should consider the potential presence of particularly undesirable subsurface conditions, i.e. which could have serious implications for the integrity of the foundation of the installation due to ground instability and/or collapse, bedrock block movements and changes in groundwater conditions. In investigating such undesirable subsurface conditions, the following should be considered: …. (list as now in para.2.27) (2) The detection of most types of undesirable subsurface conditions is expected to result from the standard site characterization activities (see paras 2.1–2.28). However, the criteria for exploration, testing and analysis of some of the undesirable conditions might be difficult to specify to ensure that investigation programmes cover all abnormal subsurface conditions. For this reason, the recommendations in Section 3 of this Safety Guide should be followed to address any undesirable subsurface conditions for which the potential for their occurrence has been indicated during the standard site characterization. Investigation programmes for complex subsurface conditions should include prediction, detection evaluation and treatment.	Depending on the insights gained from investigations according to Para. 2.27 and 2.28 the site might be deemed unsuitable. Therefore, these investigations should be performed during the site selection stage. Consequently, it might be reasonable to shift these paragraphs (2.27 and 2.28) to the respective sub-section, e.g. between para. 2.7 and 2.8. See also comment "General 2"		2.27 and 2.28 moved to after 2.8.		
INDIA	3	Page 7/Para 2.7a/Line 6	The potential for geotechnical……….erosion process, **migratory sand dunes**, subsidence and ……	Migratory sand dune is another important condition on the surface, like flood, which affect the subsurface condition for inland sites	x				
INDONESIA	1		2.7 .... (a) The scope, ~~and~~ ~~extent,~~ and **area** of the investigation should be sufficient to estimate the hazard under consideration with a level of uncertainty that can enable the application of the relevant exclusion criteria.	The area of the investigation should be appropriate to the hazard under consideration.				x	The extent of investigation implies also the extent of the area to be investigated.

INDONESIA	2	Page 16 / Line 14	.. (l) Descriptions of the groundwater regime and the physicochemical, physical and chemical properties of the groundwater; **(m) Description of the potential undesirable subsurface characteristics and/or unstable condition.** (n) Data collection should include a documentation of the magnitudes and sources of uncertainties.	Detail report should include all information obtained during investigation as the report will be used as a base for further detail investigation and treatment.		x		
IRAN	1	Page 7, para 2.7, (a)	Concerning the unacceptable subsurface conditions using historical data, considering the increasingly accurate tools and the provision of newer methods for soil improvement it seems that this method is not correct.	It is advisable to defer this consideration until after comprehensive studies and estimating soil improvement costs			x	Unacceptable subsurface conditions can be identified through all available methods and data, especially at this early stage.
RUSSIAN FEDERATION	1	2.7 a	It is necessary to take into account the possible influence of hydrogeological conditions on the seismic resistance of buildings and structures, ai well as the possibility of seismic events influencing changes in hydrogeological conditions.	Seismic events can change the direction of groundwater, feeding and unloading areas, which may lead to a violation of the conditions of pollution migration taken into account in the project and in monitoring programs. The conditions of activation of dangerous geological processes and flooding can affect the strength and stability of buildings and structures, thereby affecting tl1eir seismic resistance.			x	or all other causes covers other causes to be considered. Please note that the provided list is not necessarily exhasutive.
RUSSIAN FEDERATION	2	2.7 c	It is necessary to take into account the aggressiveness of groundwater in relation to buildings and structures and the possibility of changing the composition and dynamics of groundwater during construction, operation anc decommissioning.	The aggressiveness of groundwater in relation to buildings and structures is determined by the materials and composition of groundwater, which is subject to change over time, especially in technogenically altered conditions.			x	In 2.39 chemical content of groundwater table was listed to be studied.
SWITZERLAND	6	2,7	In this stage, geological, geomorphological, geotechnical, hydrogeological and hydrological aspects are considered, and some regions or areas may be excluded from further consideration.	This text should also include hydrological aspects as "flooding" is considered in paras. 2.7a, 4.4, and 4.7.	x			
SWITZERLAND	7	2.7a	The potential for geotechnical hazards associated with movements along capable faults, ground motion, uneven bedrock movements	The fact that faults around does not necessarily mean that these faults will be in danger to be reactivated. You use the term "capable faults" (so fault must be capable), so the orientation of these faults within the regional stress field is important for their "capability" of being reactivated. If the evaluation of the stress field would be seen as part of the verification stage, it should be included as part of the "site characteristics" in para. 2.10.	x			
TURKIYE	6	2.7/19	Classification of the site. The site should be classified for the purposes of seismic response analysis, using the ~~seismic velocities~~ **shear wave velocities** (Vs,30) as criteria (see para. 2.43).	It is clearly indicated in para 2.43 that seismic site categorization is done using shear wave velocities (Vs,30), whereas "seismic velocities" in the preceding text "Classification of the site. The site should be classified for the purposes of seismic response analysis, using the seismic velocities (Vs,30) as criteria (see para. 2.43)." indicate both shear and compressionalwave velocities. Therefore, the proposed revision is believed to add more clarity to the preceding text.		(b)Classification of the site. The site should be classified for the purposes of seismic response analysis, **using shear wave velocities (e.g.: Vs,30)** as criteria (see para. 2.43). If such site classification is not applicable, the subsurface conditions at a site can be derived from geological and geotechnical literature, and the site may be classified into one of three main categories: a rock site, a soil site or a combination of rock and soil. If applicable, the hardness (soft, medium, or hard) of the rock at a rock site should be further classified. If applicable, the stiffness (soft, medium, or stiff) of the soil at a soil site should be further classified. However, this rough classification might not apply to certain sites. For instance, quaternary formations or intensive bedrock fracturing and alteration may introduce complex interfaces and ambiguity in defining the contacts between the different subsurface materials.		
FINLAND	10	2.8/4	… bearing capacity, <u>slope stability</u>, potential settlement …	Slope stability should be mentioned. Cf. Monju NPP, Japan		2.8.On the basis of the above mentioned information on subsurface conditions, candidate sites can be ranked in accordance with the suitability of foundation works. In addition to the assessment of the potential geotechnical hazards (see para. 2.7 (a)), inferences can be made about seismic amplification effects, bearing capacity, **slope stability**, potential settlement and swelling, and soil–structure interactions. After this stage, sites with unacceptable subsurface conditions for which there are no generally practicable engineering solutions should be excluded, and sites with acceptable subsurface conditions would be retained for further consideration.		

GERMANY	12	2,8	On the basis of the above mentioned information on subsurface conditions, candidate sites can be ranked in accordance with the suitability of foundation works. In addition to the assessment of the potential geotechnical hazards (see para. 2.7 (a)), inferences can be made about seismic amplification effects, bearing capacity, potential settlement and swelling, and soil–structure interactions.	Para. 2.7 of this Draft needs to be improved in wording, in order to serve as reference for the as-sessment of the potential geotechnical hazards. Otherwise please use as reference Requirement 22 and paras. 5.27 – 5.31 of SSR-1.		2.8.On the basis of the above mentioned information on subsurface conditions, candidate sites can be ranked in accordance with the suitability of foundation works. In addition to the assessment of the potential geotechnical hazards (see para. 2.7 (a)), inferences can be made about seismic amplification effects, bearing capacity, **slope stability**, potential settlement and swelling, and soil–structure interactions. After this stage, sites with unacceptable subsurface conditions for which there are no generally practicable engineering solutions should be excluded, and sites with acceptable subsurface conditions would be retained for further consideration.		
FINLAND	11	2.9/(c)	(c+) Riverbank or coastal erosion potential	Erosion potential at meandering rivers or tidal shores should be considered		(c)Liquefaction potential; **(d) erosion potential PLEASE RE-NUMBER THE REMAINING ITEMS** (d)Feasible foundation types; (e)Preliminary bearing capacity and other factors of foundation stability; (f)Preliminary settlement ranges; (g)Shoring needs for deep excavations; (h)Dewatering requirements; (i)Excavation difficulty; (j)Prior use of the site; (k)Site preparation requirements.		
GERMANY	13	2,9	In the verification stage, it is assumed that the generalized layout and foundation loads are established and the primary geotechnical and geological characteristics of the site are known (based on the site selection stage investigations). In addition to the features stated in para. ~~2.5~~ 2.7, the following factors should be considered in the evaluation, to account for both normal conditions, geohazards and other extreme conditions: …	If we understand it correctly, para. 2.5 is dealing with grouping of data, and para. 2.7 with the selection stages. Verification will use data from the selection stage. If so, reference to para. 2.7 might be a correct one.		2.9.In the verification stage, it is assumed that the generalized layout and foundation loads are established and the primary geotechnical and geological characteristics of the site are known (based on the site selection stage investigations). In addition to the features stated in para. **2.7,** the following factors should, **among the others**, be considered in the evaluation, to account for both normal conditions, geohazards and other extreme conditions:		
SWITZERLAND	8	2,9	… , the following factors should, among others, be considered in the evaluation, …	Depending on the sites under investigation, other "factors" may be considered, but any previous "factors" as well, where there are large data uncertainties so far.		2.9.In the verification stage, it is assumed that the generalized layout and foundation loads are established and the primary geotechnical and geological characteristics of the site are known (based on the site selection stage investigations). In addition to the features stated in para. **2.7,** the following factors should, **among the others**, be considered in the evaluation, to account for both normal conditions, geohazards and other extreme conditions:		
SWITZERLAND	9	2.9a	(stratigraphy and geological structure)	I note that the documents use both "geologic" and "geological". This should be adapted to one term unless there should be a difference in meaning.			x	both are correctly used in the text.
FINLAND	12	2.10/(b) 17	… be investigated [6], and possible other long-term effects of open holes evaluated.	Same reasoning as in 8.	x			
GERMANY	14	2.10 Line 5	… The site geotechnical investigation phase should be carefully planned to ensure that it is structured, complete and sufficient to satisfy ~~all stakeholders'~~ expectations of the interested parties and to address any uncertainties. …	Clarification, as the term "stakeholder"- according to IAEA Glossary - has disputed usage and is mis-leading and too all-encompassing for clear use.	x			
RUSSIAN FEDERATION	8	2.10 (d)	Laboratory soil dynamic testing should be conducted to obtain shear modulus and damping ratio vs. shear strain dependence in shear strain range of $10^{-6}…10^{-2}$	Degradation of shear modulus for each soil layer of seismological section should be considered in evaluation of site-specific response (2.14(f))		add 'dynamic' after classification in first line of 2.10 (d)		
RUSSIAN FEDERATION	29	Section 2.10 (d)	It is proposed to replace with: in order to determine the mechanical properties of the subgrade soils.	More engineering defined terminology. Comment: Laboratory tests should be conducted to measure the mechanical properties of subgrade soils.		Add after stata 'and subgrade media'		
SWITZERLAND	10	2.10a	The geophysical investigations should be designed to optimally reflect the site characteristics and their spatial variability, and this may include an extension of such investigations to a more regional scale.	With respect to seismic hazards, the most important faults may not be in the close neighbourhood of the site, but more distant to it. (see also para. 2.52).	x			

SWITZERLAND	11	2.10b (line 10)	… along at least two intersecting seismic lines …	Otherwise, it is not clear, what kind of lines the text referring to.	x			
CANADA	2	Para 2.11/Line 5	“Therefore, the preliminary characteristics of the nuclear installation, such as loads, physical dimensions of the buildings, preliminary structural engineering criteria and the preferred plant layouts should be known at the ~~beginning~~ end of the ~~confirmation~~ verification stage.”	Paras 2.9 to 2.11 describe geotechnical site investigations of the verification stage.	x			
CANADA	3	Para 2.13/Line 5	“It is advisable that data validation and other necessary validation ~~is~~are undertaken timely, to enable additional or repeat testing if it is deemed necessary.”	Clarification.	x			
GERMANY	15	2.13 Line 5	… It is advisable that data validation ~~and necessary validation~~ is under-taken timely, to enable additional or repeat testing if it is deemed neces-sary. …	Redundancy. Alternative: … that data validation and ~~necessary validation is~~ verification are undertaken timely …	x			
SWITZERLAND	12	2,13	… as identified in the verification stage …”	Using “verification” instead of “previous” gives more clarity about which stage is addressed here.		x previous stages		
SWITZERLAND	13	2,13	It is advisable that data validation and reduction of uncertainty is undertaken timely	It is not clear what “necessary validation” is referring to. However, data validation could also mean to reduce uncertainty, which is an important issue for the future safety assessment.		x this part was deleted		
RUSSIAN FEDERATION	3	2.14 (i)	Preliminary evaluation of a site specific response spectrum at free surface	There is no design spectrum at the site characterization stage yet. The design base spectrum will be obtained after completion of seismotectonic, seismological and geotechnical studies at the stage of nuclear installation designing in site-specific conditions		add preliminary before site specific to (f)		
RUSSIAN FEDERATION	14	Section 2.9 and 2.14		In view of comment No. 9 on 2.9 (a,b) and on 2.14 (a) and other subparagraphs dealing with input data related to results of engineering-geological and geotechnical surveys, it is recommended that for each site evaluation stage, the importance of providing the design with input data with an appropriate level of detail and sufficiency should be emphasized, and this in turn is achieved by, for example, reducing the distance between boreholes and ensuring their sufficient number, ensuring the required survey depth, i.e. not less than the compressible layer (zone of structure influence) depth, densifying of geophysical profile stakes, more frequent soil/rock sampling intervals, reliable statistical coverage of physical and mechanical properties of geological elements (layers) composing the basement of the designed facilities, etc.			x	This will be covered in more detailed agency publications, such as tecdocs or handbooks
RUSSIAN FEDERATION	15	Section 2.9 and 2.14		In view of comment No. 9 on 2.9 (a,b) and on 2.14 (a) and other subparagraphs dealing with input data related to results of engineering-geological and geotechnical surveys, it is recommended that for each site evaluation stage, the importance of providing the design with input data with an appropriate level of detail and sufficiency should be emphasized, and this in turn is achieved by, for example, reducing the distance between boreholes and ensuring their sufficient number, ensuring the required survey depth, i.e. not less than the compressible layer (zone of structure influence) depth, densifying of geophysical profile stakes, more frequent soil/rock sampling intervals, reliable statistical coverage of physical and mechanical properties of geological elements (layers) composing the basement of the designed facilities, etc.			x	This will be covered in more detailed agency publications, such as tecdocs or handbooks
GERMANY	16	2,15	A subsurface investigation and laboratory testing programme extending the one described in Para. 2.10 (b) should be conducted at the site using a drilling scheme that is suited to the planned layout of the nuclear installation, in order to adequately characterize the geotechnical conditions of the site. …	Borehole investigations have already been ad-dressed in the Characteri-zation stage (see 2.10 (b)). If the intend of Para. 2.15 is an extension of these investigation, it should be clarified in the text (see proposal). If completely other investigations are meant, they should be ex-plained in detail.	x			

SWITZERLAND	14	2,15	Where heterogeneity and discontinuities are present, the usual investigation process should be supplemented with investigation holes at adequate spacing, depths, and angle to permit detection of the geological and geotechnical features and their proper evaluation.	Specific data (e.g., on (sub-)vertical fault densities) cannot be gained with vertical drilling directions alone. We therefore suggest adding a link to also consider inclined boreholes.	x			
GERMANY	17	2,17	In the confirmation stage, the subsurface investigation campaign should include sufficient in situ data and laboratory testing to address the goals defined in para. 2.14.	It looks like a word or phrase is missing here, we made a suggestion. Please verify.		in 2.14, …investigations should **sufficient in situ and laboratory testing to** address..		
SWITZERLAND	15	2,17	Delete entire paragraph.	The content of this paragraph can be combined with para. 2.14.	x			
RUSSIAN FEDERATION	30	Section 2.20	It is proposed to amend and add: discontinuity breaches	A more understandable geological term. Comment: penetrate to the greatest depth at which discontinuities or zones of weakness or alteration could affect the stability of the foundation.			x	The terminology that is widely used in English does not translate the same to Russian. By discontinuity we mean what 'breach' 'нарушение' shows as a translation to Russian, rather than 'fault' 'разрыв' which is the English term that in Russian would be 'discontinuity'.
EGYPT	4	Page 12 Para 2.21	For sites of weathered shale or soft rock, drilling may need to penetrate deeper down to the end of the soft rock.	The frequent occurences of soft rocks if not checked may cause collapse and subsidence of the site surface		Add collapse and subsidence before 'studies'.		
SWITZERLAND	16	2,22	Delete entire paragraph.	The same issue is also found in para. 2.10b. Thus, it is an issue that is valid for any of the stages and should be included in a higher-level recommendation.	x			
ENISS	1	2,23	2.23. The distinction between the structures, systems and components important to safety and other items should be considered when defining the detail of the site investigations. The subsurface investigation and testing programme for structures that are not ~~safety related~~ important to safety should follow relevant local, national or international codes and standards and with proven engineering practices. Depending on the site characteristics, drillings may be necessary at the planned location of buildings not important to safety. At least one investigation hole should be drilled at the planned location of every safety related structure[2]. Where conditions are found to be variable, the number and spacing of drillings should be chosen to obtain a clear definition of changes in soil and rock properties.	Safety related items do not include systems and components for safety systems and design extension conditions. Items important to safety includes these systems and components. Also term "important to safety" is used already once in the paragraph before the proposed correction. The definitions are given in glossary (https://www-pub.iaea.org/MTCD/Publications/PDF/IAEA-NSS-GLOweb.pdf) and the hierarchy is given in the figure below (taken from the glossary). These definitions have impact to many paragraphs. 	x			
GERMANY	18	2,23	The distinction between items important to safety ~~the structures, systems and components important to safety~~ and other items should be considered when defining the detail of the site investigations. The subsurface investigation and testing programme for structures that are not ~~safety related~~ important to safety should follow relevant local, national or international codes and standards for conventional, non-nuclear planning and building and ~~with~~ proven engineering practice. Depending on the site characteristics, drillings may be necessary at the planned location of buildings not important to safety. At least one investigation hole should be drilled at the planned location of every ~~safety related~~ structure important to safety.	Something is wrong with the termology, especially for "safety related" → "important to safety", "structures, systems and components" → "items". They are mixed up and this is confusing. For example, according to IAEA Glossary 1) safety related item is an item important to safety that is not part of a safety system or a safety feature for design extension conditions. 2) safety related system is a system important to safety that is not part of a safety system or a safety feature for design extension conditions. Please put in line for this para and for all the Draft as well.	x			
GERMANY	19	2.23, Footnote 2	"Some ~~Member~~ States define a min-imum of 3 investigation holes for every safety related structure [7]."	Please put in line with Footnote 6 (relating to para. 4.31), Footnote 7 (relating to para. 4.61) and Footnote 8 (relating to paras 4.62 and 4.63), all of which say "Some States …". May we ask you kindly, for consistency reasons, to check the entire Safety Guide for this issue.	x			
EGYPT	5	Page 12 Para 2.24	Geotechnical investigation studies and monitoring should start even before the construction of nuclear installations and should be continued after the start of construction	In order to enable the assessment of site characteristics by including geological and geotechnical data are newly obtained			x	Correct. The sentence emphasizes 'continued' after the start of construction. Unnecessary addition proposed, as this is presented for the pre-operational stage in this paragraph

TURKIYE	4	2,24	**In the pre-operational stage**, geotechnical investigations, studies and monitoring should be continued after the start of construction of the nuclear installation and until the start of operation of the installation to complete and refine the assessment of site characteristics by incorporating geological and geotechnical data that are newly obtained during the excavation and construction of the foundations.	The intention here is to emphasize that these activities typically continue throughout the entire lifetime of nuclear installations; however, it is only for the purposes of this pre-operationalstage section that the phrase of "after the start of construction of the nuclear installation and until the start of operation of the installation" is used.			x	The title immediately above the paragraph is intended to cover this issue sufficiently.
RUSSIAN FEDERATION	16	Section 2.24 - 2.25		We believe that the Pre-operation stage title doesn't fully reflect the actual meaning of 2.24 and 2.25, describing specifically the Construction stage. It is therefore recommended to give a more specific title to the stage, i.e. Construction stage.			x	Pre-operational stage is what the stage is called and referred to in SSG-35. The intent of the stage separation is to reinforce the link between SSG-35 and DS531.
ISRAEL	2	Par. 2.26	We suggest to add appropriate indicative examples to 'associated safety related items', in the manner it is done a couple of words later for 'as well as parameters': 'such as the level of water table and its seasonal fluctuations'.	Clarity		x replace 'associated safety related items' with 'items important to safety'.		
GERMANY	20	2.27 - 2.28	Investigations for undesirable subsurface conditions 2.27. The geotechnical site investigation programme for a nuclear installation should consider the potential presence of particularly undesirable subsurface conditions, i.e. which could have serious implications for the integrity of the foundation of the installation due to ground instability and/or collapse, bedrock block movements and changes in groundwater conditions. In investigating such undesirable subsurface conditions, the following should be considered: …. (List as now in para.2.27) 2.28. The detection of most types of undesirable subsurface conditions is expected to result from the standard site characterization activities (see paras 2.1–2.28). However, the criteria for exploration, testing and analysis for some of the undesirable conditions might be difficult to specify to ensure that investigation programmes cover all abnormal subsurface conditions. For this reason, the recommendations in Section 3 of this Safety Guide should be followed to address any undesirable subsurface conditions for which the potential for their occurrence has been indicated during the standard site characterization. Investigation programmes for complex subsurface conditions should include prediction, detection evaluation and treatment.	Depending on the insights gained from investigations according to Para. 2.27 and 2.28 the site might be deemed unsuitable. Therefore, these investigations should be performed during the site selection stage. Consequently, it might be reasonable to shift these paragraphs in the according subsection, e.g. between para. 2.7 and 2.8.		move to after 2.8		
RUSSIAN FEDERATION	4	2,27	It is necessary to take into account the aggressiveness of groundwater with a technogenically modified composition in relation to rocks.	The conditions for the formation of karst processes depend on the composition of groundwater, and the groundwater of the site is characterized by a technogenically altered composition and dynamic chemical and temperature conditions.		para 2.5 (e) and 2.27 bullet (v) covers this topic in a general (higher level) sense		
RUSSIAN FEDERATION	17	Section 2.27 - 2.28		We believe that 2.27-2.28, under the general title Investigations for undesirable subsurface conditions, are not appropriate in the Guide structure. We suggest moving it to 2.1-2.6 relating to Geotechnical Investigation Program for Siting of Nuclear Installation, with an explanation regarding the necessary detailing of investigations at the appropriate site evaluation stages.		x to be moved - after para 2.8		
RUSSIAN FEDERATION	31	Sections 2.27, 2.28	Here the question arises: Can't all potential highly undesirable geotechnical processes and conditions be identified earlier during the site selection, characterization and confirmation phases? Why are additional investigations of undesirable engineering-geological conditions needed?	The geotecnical site investigation programme for a nuclear installation should consider the potential presence of particularly undesirable subsurface conditions…		the section will be moved to after para. 2.8		
GERMANY	21	2,28	The detection of most types of un-desirable subsurface conditions is expected to result from the standard site characterization activities (see paras 2.1–2.27~~2.28~~).	Editorial. The standard site charac-terization activities are described in paras 2.1–2.27.	x			
GERMANY	22	2.28 Last line	… Investigation programmes for complex subsurface conditions should include prediction, detection, evaluation and treatment.	Editorial: A comma is nec-essary.	x			
JAPAN	1	2.28/L7	……… Investigation programmes for complex subsurface conditions should include prediction, detection, evaluation and treatment.	Typo. “,” is missing between “detection” and “evaluation”.	x			
GERMANY	23	2,29	~~The purpose of the geotechnical investigations is to gather infor-mation to allow informed decisions to be made concerning the nature and suitability of the subsurface materials.~~ The sources of data for geotechnical investigations are as follows: …	The purpose of geotech-nical investigations has already been explained previously (see para 2.2) and the redundancy should be kept to a minimum.		Data collected during geotechnical investigations allows informed decisions to be made concerning the nature and suitability of the subsurface materials. The sources of data are as follows:		
RUSSIAN FEDERATION	18	Section 2.29 - 2.32		In 2.29 (b) and 2.32, 'In situ **field** investigations and tests" should be clarified			x	In situ means field. Adding this would be redundant.
EGYPT	6	Page 15 Para 2.30	Add: r) Historical & Archeological activities in the vicinity.	It is one of the important documents			x	The opening text of para 2.30 (before the bullet list) specifies historical documents. No addition is made due to this comment.

FINLAND	5	2,30	The list of the "appropriate documents" in the section 2.30 could be supplemented by adding "marine geological datasets (e.g., bathymetry)". This can be added under the "d)" after "LIDAR".				x	The list is not intended to be an exhaustive list, and too much detail is not conuducive to the level of safety guide.
PAKISTAN	14	2,30	Results from Artificial Intelligence and supporting data may be considered for modelling and analysis where possible	May be considered in 2.30			x	Safety guides represent the state of practice rather than state-of-the-art approaches. AI is too new of a concept to be written into a safety guide.
RUSSIAN FEDERATION	19	Section 2.30		Paragraph 2.30 should also state that Historical and current documents and data sets should be considered starting from the stage of survey program development			x	This is stated in para. 2.7 as it relates to survey
SWITZERLAND	17	2,30	The site review should include any available references (including internationally acknowledged scientific literature, if existing) within the corresponding discipline and ensure an adequate interpretation and evaluation of the available data.	It is not guaranteed that internationally acknowledged literature in the site is available. Thus, we recommend choosing an optional text.			x	The paragaraph is referring to internationally acknowledged scientific literature related to the discipline and not to the geographical location of the site
RUSSIAN FEDERATION	20	Section 2.32		In 2.32, along with geophysical and geotechnical test types, hydrogeological aquifer testing to determine filtration parameters of subgrade soils should be added	x			
RUSSIAN FEDERATION	21	Sections 2.32-2.34 2.35-2.37		Besides, to the above-mentioned paragraphs with recommendations for field and laboratory studies, it should be added that the scope of field and laboratory studies for determination of physical-mechanical, filtration, seismological, etc. properties of the main geological elements/layers composing the subgrade at the depth of structure inifluence should be statistically sufficient to provide the design with reliable input data.		x Comment accepted, but this concern is already addressed in paras 2.13 - 2.18 (no changes made due to this comment)		
SWITZERLAND	18	2,32	While both types of test should be performed, their extent can vary based on the scale and goal of the investigation as well as the already available information (see paras. 2.30-2.31)	With respect to the information available, it may turn out as an endmember of possibilities that sufficient information has already been gathered.	x			
GERMANY	24	2.33 Line 7	… Geophysical tests can be verified or compl~~i~~emented by the subsequent insitu tests. Compl~~i~~ementary data sets may be combined to provide a robust characterisation and understanding of ground conditions.	Typos	x			
JAPAN	2	2,34	Geotechnical tests address the near field area (to a depth of at least two times the shorter dimension of the structure's base or to a depth where the change in the vertical stress during or after construction due to applied loads are less than 10% of the effective in situ overburden stress). If competent rock is encountered at lesser depths, boring should penetrate to the greatest depth where discontinuities or zones of weakness or alteration can affect foundations and should penetrate at least 6 m into sound rock[7].	The specific numbers, 10 % and 6 m, are based on the APPENDIX D of RG 1.132 of USNRC, referred to this guide as [7]. Add it as a reference in this guide.	x			
SPAIN	1	After 2.34 (end of para./ page 16),	Hidrogeological In situ test, to carry out in order to understand the characteristic, behaviour and distribution of the groundwaters, their flow direction and interaction with the sorround1ng geological formations. A previous radiochemical analysis of the groundwaters should be done 1n order to compare these during the operational phase of the nuclear site.	To include the hidrogeology in situ test and radiochemical of groundwaters analysis to follow them up during the construction and operational phases.	x			
PAKISTAN	2	Para 2.35	New Text may be included in the Para as following: Laboratory testing should be conducted on samples obtained using methods of direct investigations. ***Continuous sampling in at least one borehole for safety related structure should be done to acquire complete subsurface strata information to delineate the undesirable subsurface conditions*** …	Continuous sampling in one or more boreholes is essential to get complete information about subsurface strata and further preservation of samples and rock core for record. Some international standards recommends the same.			x	comment is not related to the topic of the paragraph. This is very site specific and dependent, and would not be suited for a safety guide (as it is not applicable to all)
PAKISTAN	3	Para 2.35	It may be necessary in certain circumstances to freeze 'cohesionless' soils in order to obtain undisturbed samples, and the effects of this potential disturbance should be considered. ***Samples and rock core from principal boring should be retained at least until the nuclear facility is licensed to operate and all matters relating to the interpretation of subsurface conditions at the site have been resolved***	Samples and rock core from principal boring should be retained for longer period of time for validation of data and future reference.			x	This is addressed in Section 7, see paras 7.12 and 7.13.
SWITZERLAND	19	2,35	The recovery of good representative samples is important to the overall success of the laboratory testing.	It is not important that samples are "undisturbed" (perhaps the subsurface rocks may be strongly weathered…), but they should mirror the real properties of the subsurface material (see also para. 2.37).			x	Undesturbed is referring to the state of the soil column, and is intended to mean that the methods of recovery should minimize the disturbance of the soil profile/column. Also see 2.10
GERMANY	25	2.37, last sen-tence	… A list of some techniques for laboratory investigations of soil and rock samples and their purposes is shown in Table 3.	Amendment for being consistent with the heading of Table 3 as well as with the introduction of Table 2 in para. 2.34	x			

ARMENIA	5	2,39	Describe approaches to assess, interpret, and manage discrepancies in the results of in situ and lab testing.	In practice, we usually obtain a large spread of discrepancies in data and results, which need to be followed by certain recommendations and regulations.			x	Specifics of approaches are too detailed for the level of this publication.
ARMENIA	6	2,39	In case of embedded foundation, it is reasonable to refuse the use of "Vs30" approach.	Depending on the building structure foundation embedment level (E/B –depends on the ratio of embedment and horizontal short size) it is reasonable to refuse the use of Vs30 for NPP reactor building structure. For Control and Turbine buildings, as well as for 2nd and 3rd seismic category building structures the Vs30 may remain a valid approach.			x	The presented categorization is presented as 'one option', and Vs30 is commonly used in existing literature. Alternative approaches are that are justifiable and reasonable are not prohibited or discouraged.
FINLAND	13	2.39/2	… documented in accordance with the investigation and monitoring plans in a detailed …	See comment #5 and para 2.3. Reporting investigations and monitoring should conform the documented plans/programme.	x			
GERMANY	26	2.39, bullet (m)	… The report(s) should include the following items: … (m) Data collection should include a ~~d~~Documentation of the magnitudes and sources of uncertainties in the data collection. ***Alternative:*** ~~(m) Data collection~~ The report should include a documentation of the magnitudes and sources of un-certainties	Clarification, as wording in bullet (m) does not fit into the list.		x (m) - delete 'data collection sould include a'		
PAKISTAN	4	2.39/ m	Data collection may include documentation of respective stage of site characterization and identification of sources of uncertainties. Statistics may indicate significant reduction of uncertainties from characterization stage to confirmation stage.	At early investigation stage uncertainties (up to certain extent) in site characterisation is acceptable but later at site confirmation stage uncertainties in the dataset may be minimized and recorded for comparison		documentation of the magnitudes and sources of uncertainties is a higher level type of statement and it can include the listed items - no changes to the text are necessary		
RUSSIAN FEDERATION	5	2,39	It is necessary to carry out pilot filtration and pilot migration works to assess the filtration, reservoir and migration parameters of rocks and engineering safety barriers.	The results of engineering and geological surveys should contain filtration parameters for preliminary and final calculations of geofiltration (temporary water supply, permanent drainage, flow between aquifers, flooding, assessment of groundwater reserves, etc. tasks) and migration (leakage from storage facilities, assessment of the effectiveness of engineering safety barriers, etc.).			x	The presented text is a high level list of the types of documenation. Bullet item (i) and (l) would include this information. This is a report about the site investigation work related to site characterization.
RUSSIAN FEDERATION	22	Section 2.39		The following should be added to 2.39: -description of types, scope and procedure of performed studies; -description of geology, including structural and tectonic aspects; -description of seismogeological conditions; -description of geological and engineering-geological processes; -description of specific soils			x	These are detailed parts that would be addressed already by the high level list that is specified in the current text. This is a report about the site investigation work related to site characterization.
SWITZERLAND	20	2,39	The report(s) should include the following items: … (n) any (geo)technical measures taken to improve the on-site soil- and rock properties in case such measures have been taken.	In the pre-operational phase, the site-specific characteristics might be changed by on-site measures such as e.g., filling of cavities by concrete, removal of weathered rocks, mixing of unconsolidated gravel sediments to avoid liquefaction within sand lenses, using a foundation with pillars into the underlying rock etc.			x	This is a report about the site investigation work related to site characterization and it would not include soil improvement information.
EGYPT	7	Page 17 Para 2.40(d)	Characteristics of the groundwater table, the design level of the water tables taking into consideration the maximum water level due to the maximum probable flood and the minimum due to heavy pumping that may create the so-called interference of cone of depression affecting the mechanical stability and creating intolerable settlement of the underlying soils	Building stability is not affected only by overflooding which create the maximum water level but is also affected by under flooding with which lowering of water table may greatly change pore pressure resulting in intolerable settlement of the building		Note that this should be 2.41(d) Not relevant to site investigation. Add to 4.26 since its more of a design issue. In 4.26(b) change text to "…. Such as dewatering (including water table fluctuations due to pumping), excavation ….		
RUSSIAN FEDERATION	23	Section 2.40		The current wording of 2.40 emphasizes only laboratory tests, while parameters of geotechnical profiles should be evaluated taking into account the results of the whole set of performed studies (especially in-situ tests as the top priority), joint analysis of data and their interpretation as necessary and sufficient input data for designing.			x	The first sentence details that both in-situ and laboratory testing is included.

RUSSIAN FEDERATION	32	Sections 2.40, 2.41	These paragraphs probably consider requirements for statistical analysis of strength and deformability of soils and probably provide for analysis of statistical relationships of individual parameters among themselves (for example, GOST 20422-2012 does not consider statistical treatment of strength and deformability parameters). It is proposed to clarify which geotechnical parameters are used as estimated parameters.	It is necessary to clarify the list of geotechnical parameters used as estimated parameters Comment: Subsection <<Parameters of the geotechnical profiles>>.			x	The level of detail requested exceeds that appropriate for a safety guide. Too site specific.
ARMENIA	8	2,41	Remove “Primary or pressure (P) and secondary or shear (S) wave velocities”.	Stress-strain relationships, static and dynamic strength properties, strain-dependent modulus degradation, and damping relationships may be evaluated also by static and dynamic laboratory tests, based on P and S waves.		accepted but the wording suggested by the next comment (comment 27) is used		
GERMANY	27	2.41 (c)	Primary or pressure (P) and secondary or shear (S) wave velocities (V_p and V_s respectively), stress–strain relationships, static and dynamic strength properties, strain-dependent modulus degradation and damping relationships, consolidation, permeability and other mechanical properties obtained by in situ tests and/or laboratory tests;	The abbreviation V_s should be introduced. We suggest to make such an introduction here.	x			
GERMANY	28	2.41 (d)	Characteristics of the groundwater table, the design level of the water tables and the maximum water level due to the ~~maximum probable flood~~ design basis flooding and other conditions (e.g. runoff inundation or erosion, depth to groundwater, spring or groundwater discharge within or near the site).	Please put in line with IAEA terminology, see SSG-68. The concept of “maximum probable flood” or “probable maximum flood” (PMF) is a deterministic design basis flood concept specific to the US. In many countries it is not used and consequently the more general term “design basis flood” should be used in this guide.	x			
ARMENIA	9	2,42	Exclude (e) Soil–structure interaction and (f) Settlements and heaves;	Related to geotechnical profile assessment these tasks are useless since they consider building structure availability and their impact.			x	The site profile has to be defined with the requirements needed to model the structure in the soil structure interaction model. Similarly, for settlement the profile needs to be defined sufficiently detailed to estimate the response parameters of interest
ARMENIA	10	2,43	For V_{s30} evaluation the embedded foundation level must be used	This site categorization and strong impedance contrast shall consider also foundation embedment design data and level. Especially for the modern NPP and SMR designs, this is very actual too.			x	The provisions of this paragraph apply to all nuclear facilities. The level of investigation will be related to the hazard category which is assigned to the facility (see Table 5). The need for detailed site response holds true for Type 2 and 3 sites, and for Type 1 sites that are "stiff" and do not consist of gradually increasing velocity with depth. Thus, Type 1 sites having layer contrasts that might be important for the building response are required to be performed. Thus, the concern identified in this comment is addressed by the sentence immediately following the definition of the site types.
ARMENIA	17	2,43	Seismic site categorization for not reactor building subbase soil	Since the reactor building foundation is deeply embedded into the base, propose this categorization spread for all building foundation subsoil excluding the reactor building structure			x	The provisions of this paragraph apply to all nuclear facilities. The level of investigation will be related to the hazard category which is assigned to the facility (see Table 5). The need for detailed site response holds true for Type 2 and 3 sites, and for Type 1 sites that are "stiff" and do not consist of gradually increasing velocity with depth. Thus, Type 1 sites having layer contrasts that might be important for the building response are required to be performed.
CANADA	4	Para 2.43	“For type 3 soils the feasibility of the nuclear installation foundation to be reliably supported by the soil strata shall be evaluated together with options for soil improvement/strengthening.”	Recommend adding some caution for “weak” soils (i.e., with low Vs). Soils with Vs below ~220-200m/s are not “competent” soils and options for soil replacement/ strengthening are desirable. Vs,30m below 360m/s strongly suggests presence of “weak” soil layers. If soils are to be removed/replaced/ strengthened, there is no need to invest too much in studying their initial/natural properties.			x	This section addresses the site response requirements and not the design decisions that will be made based on the collected data. The final sentence is sufficient to identify that, given the soil investigations, further analyses including the potential for improvement/strengthening may be needed.
GERMANY	29	2.43, Line 5	… This site categorization is based on the assumption that the shear wave velocity V_s smoothly increases with depth.”	Clarification to make the text more reader friendly.	x			
GERMANY	30	2,43	For the purpose of seismic site response analyses, the following categorization of soils/rocks can be used:	Clarification. Additionally: The parameter $V_{s,30m}$ should be introduced. Also, a reference for the used classification of soils would be helpful.		For the purpose of seismic site response analyses, the following categorization of subbsurface media can be used: add "where Vs30 is the average shear wave velocity over the upper 30 m of the soil profile		
GERMANY	31	2.43 Footnote 4	$V_{s,30m} = \sum_{i=1}^{n} \frac{30m}{\Delta t_i}$ $v_{s,30m} = \frac{30\ m}{\sum_{i=1}^{n} \Delta t_i}$	According to https://www.tandfonline.com/doi/full/10.1080/19475705.2022.2161953 the formula is not correct. Please verify. Moreover, it is not explained why this formula is chosen, as the literature includes other models too. Hence, a reference would be helpful.		Delete equation or insert note that "one possible estimate of Vs30 is" and then drop the equation to a footnote		
INDIA	4	Page 18/Para 2.43/Line 4	-Type 3 sites: **$V_{s,\ 30m}$ < 360 m/s**	Following the convention	x			

IRAN	2	Page 18, para 2.43	For the purpose of seismic site response analyses, the following categorization can be used: Type 1 site: $V_{s,H} > 4Hf_{str}$ Type 2 site: $V_{s,H} < 4H_{fstr}$ $V_{S,H} = \Sigma^{n}_{i=1} H(m)/\Delta t_i$ H stands for the depth of the investigation and f_{str} stand for main frequency of reactor structure.	Given the structural similarities between the reactor building and past practical experiences, drilling depth for subsurface soil investigation often exceeds 30 meters. Hence, setting the seismic bedrock depth should align with reactor structural characteristics to attain an average shear wave velocity.			x	The presented categorization is presented as 'one option', and Vs30 is commonly used in existing literature. Alternative approaches are that are justifiable and reasonable are not prohibited or discouraged.
TURKIYE	7	2,43	Related to "Seismic Site Categorization", nuclear facilities other than NPPs (i.e. SMRs) should also be considered and classified in terms of seismic site response analysis.	Seismic site categorization is defined as Type 1, 2 and 3 for nuclear facilities in this part. However, the categorization may be changed regarding Vs,30 values for different kind of nuclear installations. Thus, consideringgraded approach principle, seismic site categorization should also be defined for nuclear installations other than NPPs.			x	The categorization in this section apply to all nuclear facilities, not just NPPs (Note that for U.S. nuclear facilities, the use of ASCE 43 could result in using Vs30 conditions)
ARMENIA	11	2.46 (iv)	Add "For each soil layer…"	For each layer, there should be developed strain-dependent modulus degradation and damping relationships (i.e. (G versus γ) and (ξ versus γ) curves).			x	the last line of bullet item (iv) already addresses this (… of the soil layers…) Note that often some of the layers are considered to behave linearly
INDIA	5	Page 19/Para 2.46/Line 3	….reference conditions. **Type 1 is normally considered a rock site and a site response analysis is not necessary if it can be determined that modifying the control point of seismic motion has a neglible effect.** Site response ……	The sentence is required to be inserted for completing the essence of the matter under discussion. The Phrase is borrowed from IAEA SSG-67, 2021 (page 14)			x	This is an uncommon occurrence/exception and would take away from the focus of this paragraph while affecting its clarity and intent.
RUSSIAN FEDERATION	6	2,46	(in addition) In case of non-uniform stratified soil profile, seismic site response assessment should be also performed for Type 1 sites	Seismic response, in the case of an extended soilprofile (more than 30 m) and high contrast seismic impedance at boundary of rocks and loose soil strata covering the rocks, may depend not only on seismic wave velocity and soil/rock characteristics in the model layers, but also on structure (geometry) of the profile layers. In particular, soil profiles with same Vs30 (Vs50, Vs70) parameter but different layer structure can express different response (spectrum).			x	This condition is addressed by the caveat in the paragraph that requires that Vs does not decrease significantly with depth. - a slightly modified version of th text is covered in para. 2.43
SWITZERLAND	21	2.46b	An appropriate model of the site, based on: (i) The geometrical description of the soil and rock layers; (ii) The velocities of the S and P waves in each layer; (iii) The relative density and density in each layer; (iv) …	We assume that these requirements are valid for both, soil, and rock layers. Accordingly, it should be "soil and rock" in the text (and one "soil" was taken out at (iii). This adaption would also include cases, where the uppermost rocks are strongly weathered and in a transitional state to soil. (see also para. 2-49).	x			
RUSSIAN FEDERATION	7	2,47	(in addition) Characteristics and elevation of top of bedrock in the soil profile considered as reference soil for the site should be determined.	Typical calculation methods for site response assessment assume that within a small area (site), the input ground motion set for bedrock (reference soil) remains constant and does not depend on the structure and characteristics of the loose soil strata underlying the bedrock		These outcrop input motions should be chosen in accordance with the event type, magnitude, distance to the seismic source, ~~and~~ directivity effects, and characteristics and elevation of bedrock in the soil profile which govern the intensity, frequency content, duration and other relevant seismic parameters.		
GERMANY	32	2,48	In the case of an input ground motion provided as a free field outcrop motion, a deconvolution of the outcropping input motion to a within motion should be performed. As part of deconvolution assessments, a reduction in the ~~within motion~~ intensity levels of ground motion at the foundation level as compared to those of the outcrop should be carefully reconsidered and justified by means of parametric studies.	The term "within motion" is not generally used. Therefore, it should be defined to avoid misunder-standings. Does it mean the ground motion at the foundation level, i.e. the input motion for the struc-tural analysis? We made a suggestion, please verify.		In the case of an input ground motion provided as a free field outcrop motion, a deconvolution of the outcropping input motion to a point within the soil column should be performed (e.g. at the foundation level, at a point of interest for liquefaction assessment). As part of deconvolution assessments, a reduction in the motion intensity levels of ground motion at the location within the soil column as compared to those of the outcrop should be carefully reconsidered and justified by means of parametric studies. Provide clarification of the use of the term "within motion" while not limiting the location of concern to just the foundation level since there are other levels of interest within the soil profile.		
INDONESIA	3	2.51/line1	Uncertainties in the mechanical and dynamic properties of the site materials should be considered through parametric studies, **at least on the shear modulus value**. A single set of soil profile parameters should not be assumed conservative for all the considered scenarios (a conservative profile for deconvolution might not be conservative for the site response analysis).	Para 3.12 NS-G 3.6 Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants, states that one method is to vary the shear modulus between the best estimate value times (1 + Cv) and the best estimate value divided by (1 + Cv), where Cv is defined as the coefficient of variation. The minimum value of Cv is 0.5			x	including the proposed phrase in the guidance would tend to imply that just considering variability of Vs is sufficient to adequately capture the effects of variability of the properties of the soil profile. Material damping and modulus relationships as well as variations in input ground motions can have significant affects on the computed site response.

FINLAND	14	Chapter 3	Investigation of potential undesirable subsurface conditions should include acid sulphate soils known worldwide. These can cause soil acidification and corrosion of structures. Investigation programme should include the detection of the location of acid sulphate soils. The amount of sulphate sediments and sulphide-bearing soil should be identified by aboratory testing.	To be considered as a separate hazard.			x	Suggestion is too specific, and is covered by the overarching text in section 3. List of Geo-hazards were defined in Requirement 22 of SSR-1.
SWITZERLAND	24	3,2	This should include a consideration of soluble rocks (which are usually sedimentary rocks including carbonates (mainly limestone and dolomites that are appreciably soluble in water or in weakly acidic solutions) and evaporites (i.e., halite, gypsum and anhydrite among others).	Evaporites are sedimentary rocks (even carbonates may be formed from evaporation), we therefore make suggestions on how to modify the passage.	x			
SWITZERLAND	25	3,2	The current size and future evolution of the size of potential cavities or underground solutions are governed by geological factors and environmental factors, both of which should be considered.	We propose to enter a "potential" in this case as well (see first sentence), as the investigations may start without knowing whether there are cavities or soluble rocks at all.	x			
EGYPT	8	Page 25 Para 3.4	The conventional methods of site exploration are applicable, including geophysical surveys, remote sensing, drilling, sampling, excavation, borehole logging, hydraulic pressure tests	rearrange according to tool functions as follows: geophysical surveys, remote sensing, drilling, sampling, excavation, borehole logging, hydraulic pressure tests	x			
SWITZERLAND	26	3,4	The investigation programme at a site, as outlined in Section 2, should provide for the detection of potential subsurface cavities, and should allow the extent and formation of such cavities to be evaluated in more detail.	It should be stressed that the absence of knowledge about cavities is no reason why not to have such an investigation programme. It may also be wise to explore the reasons for cavity formation, as this may tell us more about not yet detected cavities.		Modified in draft document		
ENISS	3	3.50.	3.50. Liquefaction engineering assessment procedures should also be followed for beyond design basis external events, where the seismic input level is selected for a return period exceeding SL-2. The performance of ~~safety related~~ structures, systems and components important to safety during and after beyond design basis external events should be evaluated against predefined acceptance criteria to avoid cliff edge effects. OR 3.50. Liquefaction engineering assessment procedures should also be followed for beyond design basis external events, where the seismic input level is selected for a return period exceeding SL-2. The performance of items important to safety ~~safety related structures, systems and component~~s during and after beyond design basis external events should be evaluated against predefined acceptance criteria to avoid cliff edge effects.	Safety related items do not include systems and compo-nents for safety systems and design extension conditions. Items important to safety in-cludes these systems and com-ponents.	x			
GERMANY	38	3,5	~~If the presence of subsurface cavi-ties is suspected at a site, the initial subsurface exploration programme to locate cavities should be based on probabilistic methods such as the theory of optimal search.~~	As not everyone (including the commentator) might be familiar with the "theory of optimal search", it should be explained briefly, e.g. in a footnote, or the paragraph should be deleted.		could delete 'theory of optimal search' …the initial subsurface exploration programme should aim to identify their size and spatial distribution. Combine with para 3.6.		
SWITZERLAND	27	3,8	The result of an investigation programme to detect potential subsurface cavities and, if present, define their potential geometry, …	Again, it should be stressed that the cavities are not necessarily present, so defining their "potential pattern" is a second step. We find, by the way, the term "potential pattern" not very useful, we have replaced it by "potential geometry", as we think that is what you mean.	x			
GERMANY	39	3.10.	Detection of significant mechanical discontinuities in the rock mass should follow the ~~standard~~ site investigation procedures (see para. 2.10).	"standard site investigation procedures" is very unspecific. Either the paragraph should be deleted, or the term should be specified, e.g by reference to an appropriate paragraph in this guide or by explanation in a footnote. We made a suggestion.	x			
SWITZERLAND	28	3,10	Detection of significant mechanical discontinuities in the rock mass should follow the standard site investigation procedures as defined in paras. XX.	The text should refer to an existing paragraph, where the "standard site investigation procedures" are defined.	x			
SWITZERLAND	29	3,11	This should enable an understanding of how these discontinuities are arranged into fault and fracture systems and networks. Such understanding is necessary in evaluating their potential to cause movements of bedrock blocks and faulting, …	Regarding the fault and fracture systems and networks, any movement may be relevant for nuclear facilities. We therefore suggest deleting the word "slow".	x			
SWITZERLAND	30	3,13	A site that is underlain by a potentially large and complex cavity system should be excluded, since a realistic evaluation of the hazard posed by the cavity system might be very difficult. It should therefore be evaluated as a first step as to whether state-of-the-art exploration techniques are able to sufficiently guarantee the absence of a safety- relevant cavity. In areas where the size and geometry of the cavity can be reliably determined, analytical techniques such as finite element analysis and finite difference analysis should be used for the evaluation of the stability of natural cavities and mechanical discontinuities below the foundation level. The size of the cavity, its depth, the patterns and properties of the associated mechanical discontinuities, type of rock and bedding inclinations above the cavity are primary factors that influence the stability of the roof and the depth for consideration. Changes in the vertical pressures due to structural loads or seismic events could cause instability of the roof of the cavity.	We suggest changing the order of the sentences and modify them slightly, as it does not make sense in our opinion to come up with the argument of giving up a site in the middle of the paragraph. We have also added a sentence that proposes to initially evaluate the technical possibilities to understand the system in such a degree necessary for safety.		Paragraph modified in draft document		

GERMANY	40	Headline above pa-ras 3.15 and 3.16	Improvement of ~~surface conditions and~~ subsurface conditions	The headline contains "improvement of surface conditions", but the text does not include any related information.			x	3.16 proposes a surface condition improvement technique
TURKIYE	1	3,17	Environmentally friendly methods might be selected as a ground improvement technique by taking into consideration surface, subsurface and design conditions. Techniques with less carbon footprint are likely to be favoured over the techniques using cement and lime, which have significant carbon dioxide emissions. In instances, where techniques involving cement and lime such as jet grouting and ground cementation are chosen, they might undergo evaluation according to their carbon dioxide emission profiles.	The environmental impacts ofgroundimprovement techniques should be considered. When techniques that respect ecosystems, promotethe use of sustainable materials and have a low carbon footprint are preferred, the environmental impacts of ground improvement projects can be significantly reduced. For this reason, the proposed new text could be added after the para. 3.16.			x	This topic is out of the scope of this safety guide. Although a valid point is raised, the topic is not relevant to this Safety Guide and the safety of nuclear installations.
ENISS	2	3,18	If a slope is determined to be distant enough that it would not affect any ~~safety related~~ structures, systems and components important to safety, emergency planning zones or other important site features, no further measures are necessary. OR If a slope is determined to be distant enough that it would not affect any items important to safety ~~safety related structures, systems and components~~, emergency planning zones or other important site features, no further measures are necessary.	Safety related items do not include systems and components for safety systems and design extension conditions. Items important to safety includes these systems and components.	x			
FINLAND	15	3.18/5	… rebound, riverbank erosion, coastal erosion, groundwater …	Erosional consequences to slopes should be listed as well	x			
SWITZERLAND	31	3,18	Slope stability assessment will depend largely on the distance from the nuclear installation and site and the potential outreach of slope- generated processed on the site.	We suggest deleting "separation", as the term distance is sufficient. We also suggest replacing "features" by "potential outreach" of slope on the site", as the slope may have many features and only those processes matter that eventually may cause a hazard on the site.	x			
GERMANY	41	3,19	The stability of slopes ~~surrounding~~ in the vicinity of items ~~structures, systems and components that are~~ important to the safety of a nuclear installation should be assessed with regard to the safety of the installa-tion. … ***Alternative:*** The stability of slopes ~~surrounding~~ in the vicinity of structures, systems and components ~~that are important to the safety~~ of a nuclear installation should be assessed with regard to the safety of the installation. …	1. "Surrounding" seems to imply that the SSCs are really "surrounded" by the slope(s). This is probably not meant. In particular, instable slopes might also pose a hazard to sites on or above / on top of the slope. Therefore, it might be better to use a wording like "in the vicinity". 2. Please put in line with IAEA Safety Glossary. We have "items important to safety" (can be also items **not** important to safety) and "structures, systems and components (SSCs)", which **always – by definitio**n - contribute to protection and safety.	x			
GERMANY	42	3.20 Line 6	… In slope stability calculations, the resulting safety factor calculated based on the pseudo-static equilibri-um should be at least 1.1.[5] Footnote 5. Different national regu-lations and practices may specify a minimum safety factor as high as 1.5.	Justification for values -safety factor as 1.1 and safety factor as 1.5 - should be given. Otherwise these numbers leave a place for questioning and interpretation. For example, are the available models secure enough to allow for such a low safety factor as 1.1? It looks like the minimum safety factor should be higher: If it is not reached, further analyses are demanded (see 3.21), which seems to be justified considering the risk associated with slope failure.		delete last sentence of 3.20. Put footnote in 3.21 after 'minimum' (to include 1.1 number in footnote).		
GERMANY	43	3,21	If the resulting safety factor is not greater than the specified minimum (regulatory expectation), a dynamic response analysis should be performed based on the design seismic ground motion to evaluate the seismic effects more precisely. ~~For sites on (or surrounded by) natural slopes, these evaluations are important for beyond design basis external events, and the results should be considered with respect to cliff edge effects for nuclear installations.~~	If the safety factor does not satisfy regulatory ex-pectations, building an installation under these conditions is probably not allowed anyway. Therefore, this is not a matter of beyond design basis external events but a question concerning the design basis (or even site selection).			x	Not fulfilling a pseudo-static target factor of safety value requires more detailed assessments to check if the performance is acceptable or not.
SWITZERLAND	32	3,22	If natural slopes are credited as barriers against floods or tsunamis or natural slopes occur next to the site going downwards, the influence of ground erosion and related changes of material properties and slope geometry should be taken into account in the safety assessments and evaluations.	We propose to include cases where nuclear installations are or are to be placed onto gravel terraces that may be high above a river but may be influenced by extreme flooding events. The recommendations in paras. 3.23-3.25 also apply to this case.			x	The proposed text already covers this concern as written.
GERMANY	44	3.24 Line 6	… A three-dimensional slope stability analysis might be needed to more realistically evaluate the stability of the slope and the impact of ~~the portion of~~ the failed slope portion.	Editorial	x			
GERMANY	45	3,26	If a natural slope is assessed as not sufficiently safe, ~~(~~i.e. by a safety factor and/or any other criteria (e.g. residual displacements)~~)~~, measures for prevention and mitigation of slope failure should be considered, …	Editorial	x			

SWITZERLAND	33	3,27	There is a large variety of possible measures; therefore, reference should be made to appropriate determination of the best option for a specific scenario.	We propose to be more direct in the requirement, and not include the step of designing a manual for this purpose. In some cases the best solution may be obvious and does not need documentation in a manual. Since you are referring to a dialogue with the regulator, the decision may also be documented in the minutes of a meeting, if needed.		Reworded as: *There are different mechanisms to strengthen a slope with anchors (e.g. providing extra confining pressure to increase the strength of the slope material by a pretension of the anchor, using the strength of anchors to hold a sliding block after sliding is initiated). The approach selected should be supported by a quantitative comparison of the various options and should be agreed with the regulatory body.*		
SWITZERLAND	34	3,28	The wall should be designed with consideration of the maximum size of the falling debris that is estimated to reach the wall.	We suggest deleting "and minimum". It is not clear, what the effect of the minimum size debris would have on the design of the wall. If there is an influence, it may be wiser to state: "with consideration of the entire size spectrum of the falling debris".			x	Cable systems or nets may be used in some cases, so it is necessary to use minimum too
SWITZERLAND	35	3,29	Soil liquefaction should be fully described using definitions of the soil behaviour and loading conditions (e.g. flow liquefaction versus cyclic softening, soil response to shear, controlling stresses, onset of threshold strain levels, excess pore pressure ratio). This forms the basis of any liquefaction engineering assessment for a nuclear installation site. Such a basis should be established, and acceptable performance levels should be defined.	We propose to change the order of the sentence. If you start with the "basis of liquefaction engineering assessments", it is not clear to the reader what you mean by "basis".	x			
GERMANY	46	Para 3.31 (c)	Groundwater regime. Piezometric and/or borehole water level data should be used to define the phreatic surface. The seasonal fluctuations in the phreatic surface as well as the potential effects of climate change should be conservatively considered in the assessments.	The effects of climate change need to be consid-ered.	x			
GERMANY	47	3.31, bullet (d)	Index properties. For coarse grained soil mixtures, sieve and ~~sedimentation/laser diffraction~~ sedimentation, laser diffraction and/or hydrometer tests should be performed on soil samples to assess grain size characteristics.	Editorial	x			
GERMANY	48	3.31 (e)	(e) Standard penetration tests. There exists significant variability in the equipment used, and procedures and protocols adopted, for standard penetration testing. Testing should be performed according to international standards (e.g., those developed by the International Organization for Standardization (ISO). ~~To minimize this variability, such testing should be performed in conformance with standardized testing methodologies (e.g. those developed by the International Organization for Standardization (ISO) and American Society for Testing Materials (ASTM)). Additionally, to enable the execution of test corrections, the equipment details (e.g. sampler type and dimensions, hammer type, cathead-rope-pulley system details (for none-automatic hammers), rod type, rod length, coupling type and dimensions, anvil-hammer, anvil-rod inclinations) should be fully documented. Either a calibrated standard penetration test hammer system should be used or direct stress wave energy measurements should be performed in situ in conformance with standardized testing methodologies (e.g. ISO, ASTM~~).	This paragraph is too detailed. It should be clear that test should be performed according to international standards.			x	Detail is necessary because SPT tests are widely performed in non-standard ways, and emphases is necessary for quality and data preservation reasons.
GERMANY	49	3.31, bullet (g), Line 1	Shear wave velocity (Vs) measurements. Such measurements are a ~~complimentary~~ complementary tool for liquefaction triggering assess-ments.	Editorial	x			
GERMANY	50	3.31, bullet (g), Lines 6-7	Seismic cone penetration test systems may also be considered to measure V_s ~~and unite cone penetration test and V_s based assessments~~.	Sentence is not clear. We made a suggestion. Please verify.		Seismic cone penetration test systems may also be considered to collect both Vs and cone penetration test data simultaneously, which can enable Vs and cone penetration based assessments		
INDIA	9	Page 30/Para 3.31b/Line 2	….with special emphasis on their spatial variabilities **and liquefaction features, if any,** should be developed **through detailed ground geological investigations.**	Liquefaction features, if recorded in the Quaternary sediments, are important in depicting epicentral location and magnitude of the previous earthquakes.			x	The proposed addition is too detailed and does not fit with the intended meaning of the text
SWITZERLAND	36	3.31c	Seasonal fluctuations in the phreatic surface should be conservatively considered in the assessments. Based on national regulations, this should also include the occurrence of floodings occurring every 1000, 10'000 years (or similar). Additionally, borehole pump and/or cone penetration test with pore water pressure measurement (commonly referred to as CPTu) data can be used to determine the permeability parameters. Even with low phreatic surfaces, the long-term water yield should be in accordance to the future water need that may apply in the case of a loss of cooling water supply.	In many countries, regulations exist that are based on very rarely occurring flooding events (every 1000, 10'000 or even more years). It should at least be referred to such regulations, as they may also be a good basis for other countries. In addition, if relevant with respect to the design of the future nuclear installation, tests should be performed on the long- term water yield of an on-site fountain.		'The changes in the phreatic surface (due to seasonal flucuations, flooding, tsunami, climate change effects)…' instead of seasonal fluctuations		

SWITZERLAND	37	3.31d	Grain size characteristics. For coarser grained soil mixtures, …	The key word "Index properties" does not occur in the text and is not very specific. "index" of what? In addition, we suggest replacing "coarse" by "coarser", as the term "coarse" in the literature is frequently used for clastic sediments coarser than sand fraction. However, the sand fraction is important for liquefaction processes. Alternatively, one may directly specify: "For soil mixtures, with substantial sand and gravel fraction,…"			x	Index soil properties and coarse-grained soil terminologies are widely used in geotechnical engineering.
CANADA	5	Para 3.33/Lines 1 and 2	"As part of susceptibility assessments, fully saturated clean sands, clean gravels, non-plastic to low plasticity silts, and ~~clean sand-gravel~~ their mixtures should be considered as susceptible to liquefaction."	Case histories demonstrate that non-plastic to low plasticity silts are susceptible to liquefaction and should be included in liquefaction susceptibility assessments.	x			
SWITZERLAND	38	3,33	Clean sands or gravels are defined as soils with a fines content < 5%.	See para. 3.31h.	x			
SWITZERLAND	39	3,33	… in the overall stratigraphic context.	We note that the text contains the terms "stratigraphic" and "stratigraphical". Unless there is a clear difference between the two, we suggest using only one term.	x			
UK	2	3,33	"As part of susceptibility assessments, fully saturated clean sands, clean gravels, and clean sand–gravel mixtures should be considered as susceptible to liquefaction. The influence of clay particles should also be considered, given their influence on susceptibility."	The presence of clay in the soil has been shown to influence the susceptibility of the ground to liquefaction.			x	The effect of clay content on liquefaction susceptibility was considered under the category of fine grained soils.
SWITZERLAND	40	3,36	… generate limited deformations, even …	Delete space before comma	x			
GERMANY	51	3,37	For deterministic assessments, the safety factor against liquefaction triggering should include a sufficiently conservative safety margin ~~be greater than the limit value considered for the calculation~~ and should be consistent with the methods used (regulations or standardized codes). For probabilistic assessments, a sufficiently low threshold ~~the~~ frequency of liquefaction triggering should be established ~~sufficiently low~~ to satisfy performance targets.	Deterministic safety assessments need to be sufficiently conservative and therefore need suitable safety margins in safety factors applied. Depending on the parameters used for deriving the safety factor and their level of conservatism it is important that the safety margins of the safety factor are conservatively chosen. For probabilistic assessments the target (threshold) frequency must be enough conservative to ensure that the results of the analyses are not too optimistic.			x	Second part of the comment accepted. First part rejected, due to confusion in proposed language. Original text is clearer
GERMANY	52	3.42 (2)	The analytical approaches to liquefaction triggering assessments should comprise of the following steps: … (2) Deconvoluting or convoluting the outcropping reference rock motions to the ground motion at the foundation level ~~within motions~~, and estimating induced cyclic shear stress histories through a set of site response analyses.	The term "within motion" is not generally used. Therefore, it should be defined to avoid misunder-standings. (see also com-ment on para. 2.48.)		(2)Deconvoluting or convoluting the reference **surface** motions to motions **at the depth of interest** and estimating induced cyclic shear stress histories through a set of site response analyses.		
JAPAN	3	3,48	If cyclically induced deformations and displacements do not fall within the acceptable performance levels described in para. ~~3.44~~ 3.47, mitigation solutions should be engineered and implemented.	Missing the paragraph number.	x			
UK	3	3,48	Consider providing further guidance suggesting how ground that might be subject to liquefaction may be improved.	One of the objectives of the report was the provision of methods for site improvement in the case of unfavourable conditions however little is provided in terms of guidance or case studies.			x	This issue will be covered in the Liquefaction Tecdoc in detail.
GERMANY	53	3,49	The engineering mitigation of the unacceptable liquefaction hazard should be performed on the basis of applicability, effectiveness, the ability to verify the reliability of the mitigation achieved, regulatory requirements ~~cost~~ and other concerns (e.g., costs ~~regulatory requirement~~s, environmental issues).	Although in practice, "cost" is an important aspect for the decision which mitigation measure to use, it should not be a major factor in a safety guide. On the other hand, listing "regulatory requirements" only as an example for "other concerns" seems quite strange and not appropriate for IAEA Safety Guide.	x			
SWITZERLAND	41	3,49	The engineering mitigation of the unacceptable liquefaction hazard should be performed based on applicability, effectiveness, the ability to verify the reliability of the mitigation achieved and other concerns such as e.g., regulatory requirements and/or environmental issues.	As a regulator, we would not agree with the fact that "costs" are mentioned before "regulatory requirements". It does not seem to be favourable to bring up cost issues in this context. We all would agree that the fulfilment of the requirements in this document are always to be balanced against costs. If costs are too high for site evaluation, then a site should be abandoned anyway.	x			
INDONESIA	4	3,50	Reposition of paragraph 3.50 to paragraph between paragraph 3.31 and paragraph 3.32	Description of paragraph 3.50 does not match with paragraph 3.48 and 3.49. Engineered mitigation describes on how to mitigate unacceptable liquefaction hazards. Otherwise, paragraph 3.50 describes that liquefaction engineering assessment is also taking into account for beyond design basis (SL-2).		I suggest moving it before 3.31 (after 3.30)		
ARMENIA	18	4	Propose to add an Annex with exemplary degradation curves for clay, sand, gravel, and rock.	Such data and curves may be generated within the coordinated research program and be included in TecDoc.			x	The requested information is too detailed for a safety guide. These details exist in publications such as TECDOC-1990 (SSI)
PAKISTAN	5	4	Title may be changed as following: Geotechnical consideration for ***evaluation of site and design*** for nuclear installation	Keeping in view the sequence of activities the design for nuclear installation is after site evaluation	x			

GERMANY	54	4,1	The term dyke is used to describe a structure running along a water course and the term (earth) dam applies to a structure, used to create a water reservoir upstream or downstream from a nuclear installation.	1. Although in the context of this guide, earth dams might be the most important type of dams, there could also be concrete dams upstream (or downstream) of the site. Please indicate this. 2. Failures of reservoirs formed by dams can pose a hazard to a nuclear installation independent of whether they happen upstream or downstream of the site (flooding hazard if upstream, low water level hazard if downstream).	x			
GERMANY	55	4,3	The potential hazard associated with the failure of upstream or downstream water control structures such as dams is required to be analysed (see para. 5.21 of SSR-1 [1]). …	Failures dams can pose a hazard to a nuclear installation independent of whether they happen upstream or downstream of the site (flooding hazard if upstream, low water level hazard if downstream).		x First sentence of 4.3 is deleted.		
GERMANY	56	4.3 Line 2	… The design of dykes and dams at the site should consider all possible failure modes (including those that are dependent on pore pressure inside the embankment and on internal erosion caused by water seepage and flow inside the embankment). ***Alternative:*** The analysis of the design of dykes and dams should consider all possible failure modes (including those that are dependent on pore pressure inside the embankment and on internal erosion caused by water seepage and flow inside the embankment).	In many countries, nuclear regulations (such as IAEA Safety Standards) are pertinent only to nuclear installations. Therefore, design requirements / recommendations in this guide should be limited to the area under control of the licensee. If the focus of this paragraph is on the "analysis of the design of dykes", the wording should be modified as follows: "The analysis of the design of dykes and dams should consider all possible failure modes (including those that are dependent on pore pressure inside the embankment and on internal erosion caused by water seepage and flow inside the embankment)."		x design and evaluation ,reject at the site because it is irrelevant		
SWITZERLAND	42	4,3	The design of dykes and dams should consider all possible failure modes (including those that are dependent on pore pressure inside the embankment and on internal erosion caused by water seepage and flow inside the embankment, including also the possibility that more than one dyke or dam undergoes failure due to a common cause such as a large earthquake).	We propose to add a hint to the possibility that more than one dyke/dam may be present upstream and may fail due to a large earthquake.			x	The paragraph already implies multiple dams and dykes.
GERMANY	57	4,4	The design requirements for dykes and dams at site related to the consequences of their failure ~~of dykes and dams~~ that might impact the safety of the nuclear installation (e.g. due to the loss of cooling water), should be consistent with the design requirements for the installation itself, especially with regard to the evaluation of natural hazards (e.g. earthquakes, rainfall), including the return period for flooding.	Please make it clear, the design requirements for what exactly are meant.		x accept rephrase, reject 'at the site'		
GERMANY	58	4,4	The design requirements related to consequences of failure of dykes and dams under control of the licensee that might impact the safety of the nuclear installation (e.g. due to the loss of cooling water), should be consistent with the design requirements for the installation itself, especially with regard to the evaluation of natural hazards (e.g. earthquakes, rainfall), including the return period for flooding.	In many countries, nuclear regulations (such as IAEA Safety Standards) are pertinent only to nuclear installations. Therefore, design requirements / recommendations in this guide should be limited to the area under control of the licensee. (Cf. comment on para. 4.3.)			x	SSR-1 specifies this requirement, adding the control here is not possible
ENISS	5	4,5	4.50. The effects of seismically induced soil–structure interaction effects related to foundation overturning and sliding, and potential differential displacement for single foundations and between ~~safety related~~ piping and conduits connected to the foundation or the superstructure important to safety should be considered.	Safety related items do not include systems and components for safety systems and design extension conditions. Items important to safety includes these systems and com-ponents. These pipings / conduits may be be part of safety systems or safety features for design extension conditions. At least pipes are components, not structures, so using term "safety related" for them is not correct if they are part of safety systems or safety features for design extension conditions.		...conduits that are important to safety and are connected to the foundation ...		
GERMANY	59	4,6	Surveillance (periodic inspection and monitoring of dams and dykes under control of the licensee) and maintenance work should be per-formed continually during construc-tion and operation of the nuclear installation (by third party or shared by dam operator/safety organization) to prevent and predict potential damage such as internal erosion of dykes. ….	In many countries, nuclear regulations (such as IAEA Safety Standards) are pertinent only to nuclear installations. Therefore, design requirements / recommendations in this guide should be limited to the area under control of the licensee. (Cf. comment on para. 4.3.)			x	SSR-1 specifies this requirement, adding the control here is not possible
ENISS	4	4,7	4.7. Sea walls, breakwaters and revetments are civil engineering structures used for protecting nuclear installations against the wave action of an ocean or a lake during storms and tsunamis. These structures should be properly designed to withstand soil erosion, flooding and structural failures that might jeopardize ~~safety related~~ structures, systems and components important to safety at the nuclear installation. OR 4.7. Sea walls, breakwaters and revetments are civil engineering structures used for protecting nuclear installations against the wave action of an ocean or a lake during storms and tsunamis. These structures should be properly designed to withstand soil erosion, flooding and structural failures that might jeopardize items important to safety. ~~safety related structures, systems and components at the nuclear installation.~~	Safety related items do not include systems and components for safety systems and design extension conditions. Items important to safety includes these systems and components.	x			
EGYPT	9	Page 36 Para 4.9/7	All civil engineering structures {sea walls, bulkheads and breakwaters} should be checked to ensure that water can leave the site	It is necessary to ensure that these external barriers do not act as a dam preventing the release of water to any available water bodies		x add to 4.7 … after ...flooding (including considerations for drainage).		
SWITZERLAND	43	4,9	If sandy soils are present at the foot of these structures, their potential for liquefaction should be evaluated, assessed and, if appropriate, resulting consequences mitigated.	We suggest rephrasing to place the recommendation more directly.	x			

EGYPT	10	Page 36 Para 4.10/4	A warning system should be installed/established for prior detection of potential flooding/tsunami allowing sufficient time to complete safe shutdown	Early warning is one of the major features in graded approach which implies simple as possible but complex as necessary			x	Out of scope, please consider providing this comment to the revision of SSG-18 if appropriate.
SWITZERLAND	44	4,13	… occurs in the backfill and/or foundation soil. In case that the analysis of retaining walls fails to prove stability, engineering measures may be proposed and taken to affirm stability.	The paras. 4.10-4.13 do not include the possibility that an unsafe wall may be stabilized by engineering measures.			x	In specific situations, as the one described, engineering measures to improve design and/or ensure stability would be allowed. However, providing this text in the guide could give the impression that accepting some displacements may be unacceptable. The text is unchanged.
ARMENIA	13	4.14 (d)	It would be better to write the removal of the subsoil instead of rock and soil removal			x removal of subsurface material		
ARMENIA	19	4.14 (f)		Provide criteria to distinguish structural and non-structural backfill for further analyses.			x	Too detailed for a safety guide. Project specific technical specifications usually define what the requirements for structural backfill (sometimes referred to as 'engineering backfill') are.
INDIA	10	Page 37/Para 4.14d/Line 10 insertion of (After 4.14d one more point suggested)	After 4.14d (Line 10), the following point may be inserted: **Geological mapping of floor and wall of excavated pit**	Geological mapping of excavated pit at sites of major nuclear installations like Nuclear Power Plant is important in order to identify heterogeneities at foundation level; based on the outcome of this study, suitable remedial measures can be planned.			x	Covered in section 2. (2.24) this is part of the site investigation and characterization work.
SWITZERLAND	45	4.14d	Rock removal (if rocks are removed by strong forces, controlled techniques should be used to minimize induced fractures below foundations);	Other techniques than blasting may also cause fractures. We therefore suggest formulating in a more general sense.		x modified as '…(controlled removal techniques should be used to minimize induced fractures below foundations)'		
SWITZERLAND	46	4.14g	Placement of mud mats or any type of protective layer of sufficient lifetime.	It is to be assured that the applied material may have a like time beyond the lifetime of the nuclear installation.			x	The lifetime of the materials is not addressed anywhere else, and would be a decision to be taken by the designers and/or owners.
ARMENIA	14	4,17	Unacceptable amplification of the transfer function Unacceptable residual deformation	If unacceptable differential settlements or unacceptable deformation (settlements) may be controlled by the Standards criteria, the amplification rate may be controlled by the transfer function amplification coefficient (shape). Unacceptable deformation means inelastic deformation.			x	A large amplification of a very small transfer function does not matter, therefore the text remains unchanged. Unacceptable deformation is the prefered terminology, as inelastic deformation is often accepted and results in damping.
SWITZERLAND	47	4.17c	There are heterogeneities, on the scale of the building size, which can lead to unacceptable differential settlements;	We do not see the need to refer to "tilting" separately, as tilting may either be an acceptable process or is an "unacceptable differential settlement".	x			
SWITZERLAND	48	4.18d	Performance of a prototype testing programme, if necessary, to verify experimentally the effectiveness of the methods proposed to improve the subsurface conditions;	Such test may not be necessary, if the methods are state-of-the-art and there is a lot of experience for its application. Therefore, we suggest adding "if necessary" (see also para. 4.14).		x Performance of a testing programme to verify experimentally the effectiveness…		
SWITZERLAND	49	4,20	Shallow foundations should be used when the distribution of the load is sufficiently uniform and the upper layers of the soil are sufficiently competent. In the case of weak soil conditions and heterogeneous load, deep foundations should be used to transfer the loads to stiffer soil layers at depth. This may also include separate foundations for separate buildings.	The argument of a "sufficiently uniform is not taken up again in the second half of the sentence. We propose to add it. In addition, the option to develop separate foundation for different buildings should be added.	x			
SWITZERLAND	50	4.21e/f		We suggest merging those two points, as (f) represents only an explanation to (e).	x			
ARMENIA	15	4,23	Add "peeling"	Depending on base soil adhesive features' possible peeling (отлипание фундаментной плиты от основания) has to be considered as well.			x	the possible mechanism that would cause detachment of the foundation slab from the base is already addressed in the paragraph as originally drafted.
GERMANY	60	4,25	Rock property characterization should include rock ~~type~~ class (i.e. sedimentary, igneous, ~~volcanic~~ or metamorphic), type (volcanic etc), lithology (e.g. mineralogy, texture), overall geometry (e.g. strike and dip of bedding), discontinuities (e.g. joints, shear zones, fractures), weathering and depositional environment, ~~field and laboratory measurements of~~ engineering properties (e.g. mechanical, dynamic, hydraulic and geochemical properties), and rock mass conditions. Characterization could be carried out by means of field and laboratory measurements.	1. Do we understand it correctly that volcanic rock is a subgroup of the class "igneous rock"? Please clarify. 2. The measurements do not fit into the list of properties. We made a suggestion.		x Accept changes, but remove all the details from parenthesis. Accept last sentence		
SWITZERLAND	51	4,26	If the subsurface materials are soils or soft rock, …	No change in text recommended, but we note that there is no paragraph dealing with the case that the subsurface materials are solid rocks (such as consolidated sediments or metamorphic or magmatic rocks). At some sites, a thin layer of soil may be removed to place the nuclear installation directly onto hard ground. For those cases, some other aspects such as e.g., the degree of weathering, karstification, volume of gas bubbles (in magmatic rocks) should be analysed. E.g., which of the aspects listed in 4.26c could be of importance for these rocks? See also e.g., "fractured rock" in para. 4.87.			x	the stress history does not govern the behaviour/response of a solid/sound rock formation, therefore, no changes have been made to the document as a result of this comment
ARMENIA	20	4.28-4.42		To avoid repetitions, it is proposed that cl. 4.28-4.42 remain as prerogative of Chapter 5 SSG-67 "Seismic design for nuclear installations" where these tasks are presented in more detail.			x	More specificity provided in the text within this guide. For example: embedment is not covered in SSG-67 and some other details would be lost if this comment was to be accepted.

TURKIYE	3	4,28	The response of a structure depends on the characteristics of the ground motion, the applied dynamic and **static loadings**, the surrounding soil, and the structure itself.	The expression "the structure itself" is not sufficient to indicate static loads.	x			
IRAN	3	Page 41, para 4.29	This statement should be deleted.	The statement holds true for surface foundations without embedment depth. However, ifthere is embedment depth, the absence of net shear deformation in the excavated medium, generates the rotational component perpendicular to the excitation axis. As embedment depth increases, so does the rotational component, contributing to an additional factor in the structure's overturning moment.		Add 'surface' before structures in first sentence of paragraph.		
TURKIYE	2	4,29	For structures founded on hard rock or very stiff soils, the foundation motion during an earthquake is essentially the same as the ground motion at the foundation level in the free field. However, for softer ~~media~~ **rock and soil types**,the effects of soil–structure interaction should be evaluated since the foundation motion differs from that in the free field due to the interaction of the soil and structure during the seismic excitation.	It is considered that the use of "rock and soil types" instead of "media" is more appropriate for the technical explanations in the text.	x			
ARMENIA	16	4.31 (b)	Replace ~~In general soil–structure interaction analysis should be performed for sites with conditions of Type 2 or Type 3 foundation material (see para. 2.43)~~.	This is associated with Vs30 which we consider as non-applicable, especially for the reactor buildings for modern NPP designs. (Vs30 is applicable to turbine and control buildings as well as for conventional building structures)			x	The concern is addressed through the caveat in the second paragraph. Second sentence of 4.29 refers to this topic as well.
IRAN	4	Page 41, para 4.31, (a)	Employing appropriate 3D numerical modeling of foundation considering incomplete base contact geometry provides a more accurate understanding.	Beyond the previous comment, the non-uniform mass distribution on a nuclear reactor structure's foundation and uneven stress distribution beneath may create the rotational component, even in surface foundations without embedment depth.			x	Although the statement is valid, a change to this paragraph would imply that a fixed based model would not be acceptable, and such implication would not reflect current and proven MS practices
IRAN	5	Page 41, para 4.31,(b)	Employing appropriate 3D numerical modeling of soil layering and all the states of separation geometry (incomplete contact between soil and foundation)provides a more accurate understanding.	As mentioned in comment number 2, soil categorized based on the first 30 meters of soil in the case of reactor structure, unlike general structures with wide range of frequency (0.2-10 Hz); reactor structures have a specific, limited frequency range. As a result, relying on this classification can pose issues.			x	Although the statement is valid, a change to this paragraph would imply that a fixed based model would not be acceptable, and such implication would not reflect current and proven MS practices
GERMANY	61	4.38, bullet (c), item (ii) … bullet (d), item (i)	For the flexible boundary methods, …" For the rigid boundary methods, …"	Editorial, to be in line with para. 4.37, where flexible boundary method is used in Singular. Same for rigid boundary method (in Singular).	x			
JAPAN	4	4.43(b)	(b) Assuming no connectivity between the structure and the lateral soil over the upper half of the embedment or 6 metres, whichever is less. Full connection between the structure and lateral soil elements may be assumed if adjacent structures founded at a higher elevation produce a surcharge equivalent to at least 6 metres of soil [xx]. REFERENCE [xx] Seismic Analysis of Safety-Related Nuclear Structures (4-16), American Society of Civil Engineers (2017)	Add the reference as a basis of 6 m issued by American Society of Civil Engineers in 2017 as "Seismic Analysis of Safety-Related Nuclear Structures (4-16)". It helps users understand the conditions for using this value "6 m" more easily.			x	A reference to a specific Member State codes and standards is not typically allowed in Safety Guides.
GERMANY	62	4.45 Line 3	~~(a)~~ … There are two sources of incoherency or horizontal spatial variation of ground motion: random spatial variation (scattering of waves due to the heterogeneous nature of the soil or rock beneath the foundation and along the propagation paths of the incident wave fields), and wave passage effects (systematic spatial variation due to difference in arrival times of seismic waves across a foundation).	1. Please delete (a), as there is no (b) 2. Punctuation is necessary (listing after "ground mo-tion")		x Modified as suggested by Japan #5		
IRAN	6	Page 44, para 4.45	It is better to emphasize numerical modeling for all wave types and angles in the soil half space is crucial.	Recent research indicates that under certain conditions, a rigid foundation may activate six components of foundation motions. Rather than relying on the exception statement about non-vertical wave propagation, and considering induced wave types for the torsional component effect while in the all previous paragraph the induced wave was assumed horizontal shear wave with vertical propagation.			x	Recent research is not inteded to be reflected in a safety standard. Additionally, studies and practice show that the approach presented is valid. (See NUREG CR-6896 and ASCE 4-19)
JAPAN	5	4.45(a)	Seismic wave incoherency effects should be considered in the soil–structure interaction analysis. Seismic wave incoherency arises from the horizontal spatial variation of both horizontal and vertical ground motions. There are two sources of incoherency or horizontal spatial variation of ground motion as follows: - Random spatial variation (scattering of waves due to the heterogeneous nature of the soil or rock beneath the foundation and along the propagation paths of the incident wave fields) ;~~and~~ - Wave passage effects (systematic spatial variation due to difference in arrival times of seismic waves across a foundation). ...	For better expression. This sentence seems to be describing "two sources".	x			

JAPAN	6	4.50.	~~The effects of s~~Seismically induced soil–structure interaction effects related to foundation overturning and sliding, and potential differential displacement for single foundations and between safety related piping and conduits connected to the foundation or the superstructure should be considered.	Duplication.	x			
INDONESIA	5	Para. 4.51/Page 46	4.51. The distribution of contact pressure beneath the foundations and the stresses induced in the ubsurface materials should be derived from the analysis of the static soil–structure interaction. In addition to the elastic and geometric parameters of the structures (e.g. geometry and stiffness of the foundation mats and of the superstructure of the buildings), the mechanical characteristics of the	To make it clearer and more detailed			x	Too much detail for a safety guide - this guide is intended to provide recommendations and not specific details.
INDONESIA	6		subsurface materials should be included in the design profile to allow the foundation contact pressure to be computed. **Mechanical characteristics and other parameters to be computed are:** - **Elastic moduli and Poisson's ratio of the soil and their variation with depth and with strain level;** - **Subgrade reaction;** - **Unit weight of the subsurface materials;** - **Groundwater regime**				x	Too much detail for a safety guide - this guide is intended to provide recommendations and not specific details.
JAPAN	7	4,54	For structures located close together, the possible ~~effects of~~ impacts of adjacent structures on the response of the foundation soil should be evaluated. In this case, a three dimensional analysis should be considered.	The meaning of "effects of impacts of adjacent structure" seems unclear. "effects of " could be deleted.	x			
GERMANY	63	4,58	For structures founded above the groundwater ~~table~~ level, the angle of shearing resistance between soil and structure should be less than or equal to the angle of effective shearing resistance for cast-in-place foundations and should be less than or equal to two thirds of the angle of effective shearing resistance for precast foundations.	Editorial (either "table" or "level" should be enough)	x			
GERMANY	64	4,69	An assessment of settlement under static loads should be performed. The possibility of differential settlements or heaves between the buildings of a nuclear installation ~~because of~~ potentially affecting connecting pipes, conduits and tunnels should be investigated. …	Clarification. The wording should be reconsidered. Pipes, conduits and tunnels are not the reason for settlement or heave (as implied by "because"), but they might be affected by those differential movements.	x			
GERMANY	65	4,71	Time dependent settlements may be computed by applying the classical theory of consolidation ~~and~~ or other sophisticated non-linear analyses. In saturated soils, the following three components should be considered: […]	Clarification. "and" could be interpreted as a requirement to use multiple methods. As this is probably not meant, "or" might be more appropriate.	x			
GERMANY	66	4,83	The water level should be assumed to be equal to the highest water level expected due to the ~~maximum probable flood~~ design basis flood for static loading. The groundwater level should be assumed to be the mean level, due to the maximum probably flood, for the determination of the bearing capacity under seismic loading.	The concept of "maximum probable flood" or "probable maximum flood" (PMF) is a deterministic design basis flood concept specific to the US. In many countries it is not used and consequently the more general term "design basis flood" should be used in this guide, as it is already done in other IAEA Safety Guides, see SSG-68 etc.		x Accept change. Second sentence - delete 'maximum probably flood'		
GERMANY	67	4,86	If an adequate ~~a~~ safety factor is achieved ~~on the basis of~~ based on ~~a~~ conservative assumptions, no further analysis is generally necessary. Acceptable safety factors providing sufficiently high margins depend on the methods applied for the analysis and on other considerations. …	Particularly for deterministic safety assessments it is important that there are adequate (for a conservative assessment) safety factors in accordance with regulatory requirements.			x	Adequate is accepted. The suggested change is not accepted, as the paragraph includes all the proposed information as stated, and it reflects deterministic safety assessment practice, while addressing necessary conservatism as well. Margins are also discussed in the original text.
SWITZERLAND	52	4,91	The effects of heave due to excavation and unloading, expansive soils or rocks should be evaluated where applicable.	High amounts of surface uplift due to glacial rebound, as they occur e.g., in Sweden and Finland are in the range of several mm/year (up to 10 mm/year, e.g., 6-7 mm/year in Forsmark). Assuming a lifetime of a nuclear installation of 100 years, this would amount to 1000 mm = 1 m. However, such glacial rebound does not produce sharp local gradients in rebound rates, so within the site of a nuclear installation, there is, to our knowledge, no measurable difference in uplift, if not active faults are present. We therefore suggest deleting "glacial rebound" in this paragraph.			x	Glacial rebound has to remain, as part of the expansion of scope of this publication was focused on including recommendations for sites located in regions where glacial rebounds may be significant.
SWITZERLAND	53	4,92	The design of earth structures and buried structures …	It is not clear to us, what "earth structures" and "buried structures" are. We note, that several chapters start with an explanatory paragraph (e.g. 4.1, 4.7, 4.10, 4.28, 4.98), so why not including a definition here as well, that also includes an explanation about the difference between the two terms?		x Buried structures was removed from the title - they are covered by embedded structures and burried pipes, conduits and tunnels		

UK	4	4.92 to 4.116	Consider the addition of a section briefly discussing potential ground contamination, if sited next to an existing facility.	Give that it is common for new plants to be sited next to existing facilities. This gives advantages but also potential concerns such as ground contamination.			x	Para 2.5 (e) and 2.7 (c) provides the necessary provision this comment suggests. Additional considerations for contamination are not within the scope of this publication, they need to be addressed in the Environment Impact Assessment work.
GERMANY	68	4,94	At sites that are expected to experience inundation caused by a flood or tsunami, potential ground erosion including changes in geometry and material properties should also be taken into account for evaluations according to the nature of the event (duration, peak flow, maximum water height). This holds in particular for considerations of ~~phenomenon~~ phenomena related to water flows leading to the failure of earth structures or soils foundations such as internal and external erosion, or scouring.	Editorial	x			
GERMANY	69	4,95	Evaluations of the consequences of failure of earth structures and buried structures that are important to safety should be conducted with special consideration of ~~their~~ the significance and purpose (e.g. a buried electrical conduit may fail due to breaches in watertightness) of these structures.	Editorial. “their” might be read as referring to “consequences of failure”; this would be inconsistent with the following use of “purpose”	x			
ISRAEL	3	Paras. 4.95 and 4.97	Following comment no. 2: In par. 4.95, … 'e.g. buried electrical conduit' is pointed out as a good example. It could be useful to bring an appropriate example in paragraph 4.97 too, regarding structures that are only indirectly related to the safety of nuclear installations.	Clarity And Completeness		x Add to 4.97 'e.g. retaining walls, dykes, levees, ductbanks'		
ENISS	6	4,96	4.96. The consequences of failure of safety related earth structures and buried structures, and any structures, systems and components dependent on them, that could endanger items important to safety, should be evaluated against stability and/or deformation criteria.	I items that that not important to safety, and whose failure could not endanger the items important to safety, may be dependent on these structures. In these cases it is not neces-sary to make the evaluation for items not important to safety.	x			
GERMANY	70	4,98	Embedded structures are buildings with foundations deep enough that the interaction of the underground walls with the surrounding ground is significant. Two ~~consequences~~ aspects of such embedment should be taken into account, as follows: (a) ~~The consequences of~~ underground walls acting as retaining walls (see paras 4.10–4.13); (b) ~~The consequences for~~ the building itself (see paras 4.99–4.102).	Neither (a) nor (b) addresses “consequences”. Therefore, a modified wording (as proposed) might be more appropriate.		x 'should be considered' instead of 'should be taken into account' (b) the effects of the soil on the structure		
JAPAN	8	4.101 4.102	4.101. A building can be regarded as embedded only if the backfill has been properly compacted or if other appropriate measures have been taken. In such cases, the effects of embedment on the impedance of the foundation and on the soil–structure interaction should be taken into account. If the building is not mechanically embedded, only the consequences of the depth of the foundation should be taken into account, disregarding the effects of the interaction of soil with the underground walls. 4.102. For stability analysis of mechanically embedded foundations under seismic loads (see paras 4.55–4.66), the friction between soil and walls should be disregarded.	Please clarify the definition of “mechanically embedded.” Only “embedded” seems enough.		x replace mechanically with effectively		
CANADA	6	Para 4.103 - 4.116	Add a paragraph: “An assessment of the potential effects of soil, backfill, and any other pertinent factors on the efficacy of cathodic protection systems should be included in the site investigation programme.”	To ensure that cathodic protection systems meet their design intent.			x	Cathodic protection systems are out of the scope of this document. Section 2, para 2.5 contains provisions for obtaining the data necessary for design of such systems.
GERMANY	71	4.103 Line 4	The layout of buried pipes or conduits should be considered in the geotechnical site investigation programme. Adequately spaced boreholes, drillings, soundings and/or test pits should be made along the pipe routes. Special consideration should be given to identifying areas of discontinuities or changes in the foundation material along the route of the piping. Routing pipes or cables via areas ~~Areas~~ that are susceptible to inundation by floods or tsunamis should be avoided~~.~~ This holds also for buried pipes or conduits - if feasible. In areas that are susceptible to frost the effects of frost depth and frost heave should be considered in the design and analysis of buried pipes, and if necessary, frost protection measures should be implemented.	Avoiding areas susceptible to flooding (of any kind) is certainly reasonable. But if it is unavoidable to cross such areas with pipes or cables, it is probably more reasonable to have them under the ground surface than above. Therefore, a more careful wording might be in place here.	x			
ENISS	7	4,108	4.108. ~~Safety related~~ Buried piping, conduit systems and tunnels important to safety should be designed to resist the effects of earthquakes.	Safety related items do not include systems and components for safety systems and design extension conditions. Items important to safety includes these systems and components. SSG-67 “Seismic Design for Nuclear Installations” paragraph 2.3 states: *“5.15A. Items important to safety shall be designed and located, with due consideration of other implications for safety, to withstand the effects of hazards or to be protected, in accordance with their importance to safety, against hazards and against common cause failure mechanisms generated by hazards.* Items important to safety is the right term, not safety related as the paragraph 4.108 is not mentioning only structures, but pipes (the may be pipes of safety systems or safety features).	x			

ISRAEL	4	Paras. 109 and 114	Referring to buried pipes or conduit, we think that it could be appropriate to mention suitable bellows to be used for avoiding potential damages caused by both parallel and perpendicular displacements.	Completeness			x	The safety guide provides recommendations related to nuclear safety, and not details such as suitable parts. This level of detail may be found in a TECDOC level publication.
ISRAEL	5	Paras. 109 and 110	We propose to add to paragraph 5.9 the subject of possible **calibration needs** for the devices monitoring the geotechnical parameters on sites for nuclear installations, addressing the relevant calibration frequency and/or unique calibration needs.	Completeness		x See para 5.14 where calibration is addressed		
ENISS	8	4,116	4.116. The consequences of the failure of ~~safety related~~ ducts and pipes and other underground features passing near or through ~~other~~ safety related structures at the nuclear installation site should be given appropriate consideration. If hazardous effects are expected, appropriate measures should be taken to protect the installation; alternatively, the site layout should be reconsidered.	Ducts and pipes failing may be part of systems/structures that are not important to safety. It would make sense to consider impact of failures (regardless of the purpose of the pipe or duct) to safety related structures.	x			
FINLAND	16	5.1.-	A new para: A documented site monitoring programme should be established latest when a site is selected. The monitoring plan should be evaluated regularly but backward comparison of safety relevant parameters to monitoring baseline should be preserved.	Start the chapter with a recommendation of a documented monitoring plan.	x			
SWITZERLAND	54	5,1	Depending on the monitoring objectives, a baseline monitoring programme may be needed to document the undisturbed environment and provide data for preservation of evidence.	Monitoring programmes may consider the need and benefit of a baseline monitoring programme to document the undisturbed environment, the impact of the nuclear facility on the site, and recordings/evidence therefore. We therefore suggest adding such a sentence to para. 5.1 or put this recommendation in a new paragraph.		x Addressed as suggested by Finland #16		
SWITZERLAND	55	5,2	In order to verify the performance of the foundations and earth structures, their actual field behaviour should be monitored from the beginning of siting activities through construction to operation and decommissioning.	Monitoring phases should cover the entire lifetime cycle of a facility, e.g., from siting (potentially including a baseline monitoring) until decommissioning.		x added 'to the end of opeartion', decommissioning is out of the scope of this document		
EGYPT	11	5,5	"The groundwater regime" under the building…Regime is not the proper term as per it expresses a system of collective parameters defining the physical and chemical conditions of the groundwater, while the term groundwater dynamics is more precise in defining hydrogeological environment expressing the interaction between groundwater and the building of nuclear installations. Groundwater dynamics is interpreted as the process of ongoiong temporal and spatial changes in level, flow rates and chemical composition of the groundwater. Groundwater dynamics maybe natural or artificial. So, the main goal is to assess interconnection and interference between building and groundwater	Groundwater regime EXPRESSES the collective parameters of groundwater such as groundwater levels as well as physical and chemical parameters. However, it doesn't express groundwater aggressiveness towards concrete and metal structures as well as groundwater contamination caused by operation of power plant. Accordingly, we may not be able to verify the conditions outlined in the design assumptions specially if deep dewatering systems are installed.		x change to groundwater conditions instead of regime Although this comment is valid, it seems that it hints to monitoring of environmental conditions, rather than geotechnical parameters. The monitoring section here refers to geotechnical parameters and aspects only. It is not intended to cover the monitoring programme in its entirety.		
RUSSIAN FEDERATION	33	Section 5.5	Hydrogeological monitoring should be carried out at all stages of the life cycle. It is necessary to use monitoring data to update constantly operating calculated hydrogeological models. The types of hydrogeological monitoring (including monitoring of levels, temperature, chemical and radionuclide composition of groundwater) should be reflected, as well as the processes, parameters and types of impacts controlled during monitoring.	Hydrogeological monitoring at all stages of the life cycle is necessary to take into account up-to-date data in the calculations of geofiltration and geomigration, to confirm compliance with design conditions and safety. The reflection of the types of hydrogeological monitoring, controlled processes, parameters and types of impacts makes it possible to unambiguously present the purpose and task of monitoring in the work program.		x add 'and continued throughout the operational life' to last sentence		
SWITZERLAND	56	5,5	The groundwater regime under buildings and in adjoining areas at the site of a nuclear installation should be monitored to verify the conditions outlined in the design assumptions, especially if deep drainage systems or permanent dewatering systems are installed.	No text changes. We note that here, for the first time, "deep drainage systems" and "permanent dewatering systems" are mentioned, while there are e.g., not mentioned in paras. 3.26-3.28 or 4.18.		Comment accepted and noted. No addition necessary, those systems are out of scope		
ENISS	10	5,7	This paragraph may be modified for clarification	Detailed and practical scope of this article is not clear (especially regarding pore water monitoring in comparison of other requirement regarding groundwater monitoring)		Added a footnote: pore water pressure transducers (piezometers) capable of measuring dynamic changes in excess pore water pressure		
SWITZERLAND		5,10	The new device may represent an updated technology and direct equivalence in measurement capacity is not compulsory, provided that the minimum requirements for resolution, accuracy, data collection and environmental impact during installation are satisfied. Where possible, a final set of measurements should be taken from the device to be replaced, to be calibrated with respect to reference measurements from the new device. Timewise overlapping measurements of the old and new devices would be preferable for such purpose.	Any comparison between old and new data might trigger the question of their comparability. Timewise overlapping measurements during a representative monitoring period might help to reduce uncertainties regarding different behaviour of the times series and might provide indications regarding uncertainties (see also para. 5.14).			x	Although this claim may be valid, many times instruments are replaced due to their failure. Additionally, overlap periods needed are instrument and enviromentally specific and cannot be reliably define a priori.
SWITZERLAND	57	5,12	A periodic review of the monitoring programme should be performed. The review period should be dependent on the rate of technological advances in the field, geotechnical and/or structural requirements during the lifetime of the installation, the results of the monitoring itself, and any other conditions that would necessitate an updated monitoring programme.	The review period should also be chosen based on the monitoring results. These results may show that changes are underway, the understanding of which may be important for safety, requiring an adaption of the monitoring.	x			
GERMANY	72	5.13, Line 5	For seismic monitoring devices, see paras 3.54-3.59 of SSG-9 (Rev. 1) [2].	Editorial	x			

SWITZERLAND	58	5,13	Specifications for the selection of geotechnical monitoring devices — including preferences in terms of sensors, data acquisition systems and related components and accessories — should be defined based on an assessment of long term exposure to environmental conditions, including atmospheric conditions, temperature, hydrogeological conditions, hydrochemical conditions, electromagnetic interference, sources of background noise, and the measuring precision required.	The selection of the appropriate devices for monitoring is also dependent on the required precision of the measurements. We have therefore added a few words to address this issue.	x			
ENISS	9	5,16	5.16. Monitoring of safety related structures should include total and differential settlements, lateral displacements and deformations, earth and pore pressures, and inclinations along sloping ground surfaces. Monitoring of the performance of other structures with a potential impact on ~~safety related~~ structures, systems and components important to safety should also be considered. OR 5.16. Monitoring of safety related structures should include total and differential settlements, lateral displacements and deformations, earth and pore pressures, and inclinations along sloping ground surfaces. Monitoring of the performance of other structures with a potential impact on items important to safety ~~safety related structures, systems and components~~ should also be considered.	Safety related items do not include systems and components for safety systems and design extension conditions. Items important to safety includes these systems and components.	x			
EGYPT	12	Page 56 New Para 5.17 based on 5.4 and 5.5	1. The majority of wells are set in the first from the groundwater of which directly impacts the underground parts of the buildings and structures. 2. The inspection wells are installed on two or three water bearing strata. 3. If underground supply sources are located close to nuclear power plant territory, some wells are placed between the power plant facility and the source of groundwater supply for assessment of the sources on the hydrological condition of the site.	Geotechnical monitoring will be quite helpful in excavation, backfilling and building construction where the behavior of soil and groundwater should be monitored during each of these phases.			x	The details provided in the proposed paragraph are appreciated. However, we consider them too detailed for this level of publication (high level consensus document) which provides recommendations. Additionally, no actual recommendation is proposed, and only details of wells and their applicability is listed.
SWITZERLAND	60	6,1	For nuclear installations other than nuclear power plants, a graded approach based on the risk associated with the nuclear installation and the complexity of the site is required to be applied (see Requirement 3 and para. 4.3 of SSR-1 [1]).	It is not evident to us, why para. 4.3. is cited, while Requirement 3 of SSR-1 is not. We propose to shorten the paragraph.		x The title of Section 6 is changed into: Applying a Graded Approach to Geotechnical Aspects in Siting and Design of Nuclear Installations other than high radiological hazard facilities Paragraph 6.1 is rephrased as: *For nuclear installations other than high radiological hazard facilities, a graded approach based on the risk associated with the nuclear installation and the complexity of the site should be applied (see Requirement 3 and para. 4.3 of SSR-1 [1]).*		
CANADA	8	Para 6.3	"However, for a particular nuclear installation, the radiological consequences of failures might be so small that reliability levels lower than those in currently operational nuclear power plants could be accepted without compromising the safety objective."	Some NPPs, especially some new SMR designs, may have relatively low radiological consequences of failure for certain scenarios or in general, so the generic reference to NPPs may need to be changed as it seems that it is made with the existing NPPs in service in mind - PWRs, BWRs, CANDU.		x Sentence is rewritten as: *However, for a particular nuclear installation, the radiological consequences of failures might be so small that reliability levels lower than those required for high radiological hazard facilities could be accepted without compromising the safety objective.*		
GERMANY	73	6,3	The risk associated with a nuclear installation depends on the potential hazards associated with the installation ~~failures of the installation and on the consequences of such failures (also see Section 9 of SSG-67 [3])~~. The overall safety objective in site evaluation, as established by Requirement 1 of SSR-1 [1], is the same for all nuclear installations. ~~However, for a particular nuclear installation, the radiological consequences of failures might be so small that reliability levels lower than those in nuclear power plants could be accepted without compromising the safety objective.~~	Risk, associated with a nuclear installation, depends on the hazards, associated with the facility, not with possible failures of the installation.		Yes, the risk depends on the hazards, which in turn are the cause of failures. The idea is that risk depends both on failures and on the consequences of those failures. For the same risk goal, small consequences of failures will lead to acceptance of larger frequencies of failure. Wording is changed to make this idea clearer to the reader. Paragraph is rephrased as: *The risk associated with a nuclear installation depends both on the potential failures within the installation and on the in-site and off-site consequences of such failures. The overall safety objective in site evaluation, as established by Requirement 1 of SSR-1 [1], is the same for all nuclear installations. However, for a particular nuclear installation, the radiological consequences of failures might be so small that reliability levels lower than those required for high radiological hazard facilities could be accepted without compromising the safety objective.*		

CANADA	9	Para 6.4, Table 5, Remark for Hazard category "High"	"Hazard category of nuclear power plants. Graded approach is usually not applicable."	Radiological hazard categorization seems to be made based on existing NPPs. Some new SMR designs may have relatively low radiological consequences of failure for certain scenarios or in general, so the generic reference to NPPs may need to be changed as it seems that it is made with the existing NPPs in service in mind - PWRs, BWRs, CANDU.		Remark in Table 5 is left as: *Graded approach is not applicable.* First sentence of the remark is deleted.		
GERMANY	74	6,4	RADIOLOGICAL HAZARD CATEGORIZATION OF SITES FOR NUCLEAR INSTALLATIONS BASED ON POTENTIAL HAZARDS ASSOCIATED WITH THE INSTALLATION The application of a graded approach to the geotechnical site investigation should be based on a site specific consequence analysis (simplified, as appropriate) that categorizes the installation in terms of potential hazards associated with the installation. ~~the radiological hazard. Four radiological hazard categories are defined in Table 5, from 'high', which corresponds to large nuclear power plants, to 'conventional', which corresponds to conventional industrial facilities, with a negligible or no radiological hazard.~~ Qualitative categorization of the nuclear installation should be performed based on the potential radiological hazards, as follows: a) Nuclear installations with significant potential for an off site radiological hazard: such installations include reactors with high operating power, a large radioactive inventory or high pressure experimental devices. These installations are categorized as a high potential hazard. b) Nuclear installations with potential for an on site radiological hazard only: such installations include reactors with an operating power up to a few megawatts, a limited radioactive inventory or with no high pressure experimental devices. These installations are categorized as a medium potential hazard. d) Nuclear installations with no potential radiological hazard beyond the facility hall, associated beam tubes or connected experimental facility areas: such nuclear installations include facilities with low operating power, not requiring heat removal systems or with a small radioactive inventory. These installations are categorized as a low potential hazard. One more category might be nuclear installations with no potential radiological hazard, one can call them 'conventional' hazard category.	We would like to suggest, in order to avoid all possi-ble misunderstandings and misinterpretations, to stick to "qualitative categoriza-tion of the facilities on the basis of the potential haz-ards associated with the facilities", as it was recent-ly done for research reac-tors in SSG-22 (Rev.1). See comment "General 3".			x	Please, note that "categorization", as mentioned in Para. 6.4 and given in Table 5 refers to the radiological hazard posed by the nuclear installation to workers, public and environment. The categorization provided in Table 5 is consistent with SSG-67 (Seismic Design, Chapter 9), Safety Report no. 94, specifically written for Research Reactors, and Safety Report no. 103. In addition, in our opinion, it is fully consisten with the qualitative categorization of research reactors given in Para. 2.8 of SSG-22 (Rev. 1).
GERMANY	76	6,5	~~The radiological consequences of potential failures depend on the nature of the nuclear installation and the characteristics of the site. The following factors should be considered (see also para. 9.5 of SSG-9 (Rev. 1) [2]):~~ ~~(a) The radioactive inventory at the site, including the distribution of radioactive sources in the installation;~~ ~~(b) The hazard associated with physical and chemical processes at the installation;~~ ~~(c) The thermal power of the nuclear installation, if applicable;~~ ~~(d) The configuration or operating status of the installation for different kinds of activity;~~ ~~(e) The distribution of radioactive sources in the installation~~ ~~(f) The design of safety systems for the prevention of accidents and for mitigation of their consequences;~~ ~~(g) The characteristics of structures, and the means of confinement of radioactive material;~~ ~~(h) The characteristics of processes or of engineered features that might show a cliff edge effect in the event of an accident;~~ ~~(i) Characteristics of the site that are relevant to the dispersion of radioactive material (e.g. topography, dominant winds, water masses, demography of the region);~~ ~~(j) The potential for on-site and off-site contamination.~~ For siting of nuclear installations other than nuclear power plants, the following shall be taken into consideration in the application of a graded approach (para. 4.5 of SSR-1): (a) The amount, type and status of the radioactive inventory at the site (e.g. whether the radioactive material on the site is in solid, liquid and/or gaseous form, and whether the radioactive material is being processed in the nuclear installation or is being stored on the site) (b) The intrinsic hazards associated with the physical and chemical processes that take place at the nuclear installations; (c) For research reactors, the thermal power; (d) The distribution and location of radioactive sources in the nuclear installation; (e) The configuration and layout of installations designed for experiments, and how these might change in future; (f) The need for active systems and/or operator actions for the prevention of accidents and for the mitigation of the consequences of accidents; (g) The potential for on-site and off-site consequences in the event of accident	Lists provided in para. 9.5 of SSG-9 (Rev. 1), para 6.4 of SSG-35) are almost the same and similar to para. 4.5 of SSR-1). Actually para 4.5 of SSR-1 is the most well-balanced, why not stick to it? Please compare this with next comment, for same para. We decided to post both of them.	x			

GERMANY	77	6,5	The radiological consequences of potential failures depend on the nature of the nuclear installation and the characteristics of the site. The following factors should be considered (see also para. 9.5 of SSG-9 (Rev. 1) [2] and para 6.4 of SSG-35): (a) The radioactive inventory at the site, including the distribution of radioactive sources in the installation as well as the physical and chemical characteristics of the radioactive material; (b) The hazards associated with physical and chemical processes at the installation; (c) The thermal power of the nuclear installation, if applicable; (d) The configuration or operating status of the installation for different kinds of activity; ~~(e) The distribution of radioactive sources in the installation~~ ~~(f) The design of safety systems for the prevention of accidents and for mitigation of their consequences;~~ ~~(g) The characteristics of structures, and the means of confinement of radioactive material;~~ ~~(h) The characteristics of processes or of engineered features that might show a cliff edge effect in the event of an accident;~~ (i) Characteristics of the site that are relevant to the dispersion of radioactive material (e.g. topography, dominant winds, water masses, demography of the region); (j) The potential for on-site and off-site contamination.	1. Reference should also be made to para 6.4 of SSG-35. 2. It is also to question if it is necessary to have three different diverging lists with characterizing factors of a site for a graded ap-proach in three SSGs (in SSG-9 (Rev.1), SSG-35 and this one). Maybe one could simply copy the bul-let points of the list from SSG-35, para. 6.4 3. Statement of (e) is al-ready included in (a), we suggest to delete it. 4. Delete items (f), (g), and (h). The items (f), (g), and (h) refer to design features of the installation. If such design features are credited in grading / determining the hazard category, also some types of NPPs might fall into lower hazard catego-ries (e.g. if passive safety systems, strong contain-ment, etc. are implement-ed). Therefore, it seems more appropriate to base the grading on "unmitigat-ed" potential radioactive releases as described in Para 6.6.			x	For points 1, 2 and 3, see answer to previous comment (Germany, no. 76). List is changed into the list provided in SSR-1, Para. 4.5.. In addition, the reference to Para. 6.4 of SSG-35 is added. For point 4, grading based on unmitigated release of the full radioactive inventory could be very conservative. The spirit of the present guide is that crediting design features in grading is a valid possibility, as far as the robustness of those features it is properly justified (see para. 6.7). This is an accepted practice in some Member States (e.g. see ANSI/ANS 2.26). As the commenter says, the result could be that some types of advanced reactors fall into lower radiological hazard categories.
GERMANY	78	6,8	For nuclear installations categorized as high potential hazard ~~in the 'high' hazard category (see Table 5)~~, the scope of the geotechnical site inves-tigation and characterization should be the same as for large nuclear power plants.	We would like to suggest to stick to "qualitative cat-egorization of the facilities on the basis of the poten-tial hazard associated with the facilities", as it was recently done for research reactors in SSG-22 (Rev.1). See comment "General 3".		Sentence is reworded: *For nuclear installations categorized as posing a high radiological hazard, no grading of the site investigation and characterization is possible. Scope should be the same as described before in sections 2 through 5.* See answer to comment no. (Germany) 74		
GERMANY	79	6,9	For nuclear installations in the 'conventional' hazard category ~~(see Table 5)~~, the scope of the geotechnical site investigation and characterization should be the same as for non-nuclear industrial facilities.	Please delete. Please see comment "General 3"		Sentence is reworded: *6.10.The geotechnical site investigation and characterization for installations that do not have on-site or off-site radiological consequences will normally follow the applicable industry standards.* See answer to comment no. (Germany) 74		
SWITZERLAND	61	6,9	For nuclear installations in the 'conventional' hazard category (see Table 5), the scope of the geotechnical site investigation and characterization should be the same as for a conventional industrial facility, however, based on its potential non-nuclear (e.g. physical and/or chemical) hazard.	The term "non-nuclear industrial facility" could be misunderstood, as such a facility might cover a large range between an industrial facility of very little potential hazard to the environment up to e.g., a very large chemical plant, dealing with material of chemical hazard much worse than from a nuclear power plant. We therefore suggest rephrasing the end of the paragraph.		Sentence is reworded: *6.10.The geotechnical site investigation and characterization for installations that do not have on-site or off-site radiological consequences will normally follow the applicable industry standards.*		
GERMANY	80	6.10.	For nuclear installations categorized as medium or as low potential hazard ~~in the 'medium' or 'low' hazard categories (see Table 5)~~, the application of a graded approach to the geotechnical site investigation and characterization should be considered. Typically, for a 'medium' hazard category installation, a narrower scope compared to that used for a 'high' hazard category installation should be considered; for a 'low' hazard category installation, an increased scope compared to that used for a 'conventional' hazard category installation should be considered.	Please delete. Please see comment "General 3"			x	See answer to comment no. (Germany) 74

GERMANY	81	6,11	The amount to which a graded approach is applied to the geotechnical site investigation and characterization depends on the foundation requirements for the nuclear installation and on the complexity of the subsurface conditions. The appropriate approach should be determined based on the judgment of qualified geologists~~, and~~ geotechnical engineers and nuclear engineers. ~~At a minimum, a~~ A graded geotechnical site investigation and characterization should address, at a minimum, the following items	As the potential for radioactive releases and the consequences of certain types of ground failures / geotechnical hazards depend (also) on the design of the installation, geolo-gists and geotechnical engineers should consult with nuclear engineers when specifying the necessary extent of geotechnical investigations.		Paragraph is rewritten as follows: *The amount to which a graded approach is applied to the geotechnical site investigation and characterization depends on the foundation requirements for the nuclear installation and on the complexity of the subsurface conditions. The appropriate approach should be determined based on the available information and the judgment of qualified geologists, geotechnical engineers and nuclear engineers. A graded geotechnical site investigation and characterization should address, at a minimum, the following items:* Comment is accepted. Paragraph is reworded to accomodate comments by several Member States.		
RUSSIAN FEDERATION	34	6.11 (d)	It is necessary to list the recorded hydrogeological parameters (including filtration coefficient, conductivity, elastic and gravitational water loss, overflow, migration characteristics of aquifers: distribution coefficient, dispersion).	The enumeration of the recorded hydrogeological parameters and their justification (by field and laboratory methods) is necessary to take them into account during monitoring and confirmation of forecast calculations.		A footnote is added to point 6.11(d) as follows: *Hydrological parameters important to characterize hydrological conditions are permeabilities, conductivities, elastic and gravitational water losses, overflows and migration characteristics of aquifers (distribution coefficient, dispersion). Those parameters are determined by field and laboratory methods and are used to feed groundwater flow models.* Comment is accepted. Paragraph is reworded to accomodate comments by several Member States.		
SWITZERLAND	62	6,11	The appropriate approach should be determined based on already available information and the judgment of qualified geologists and geotechnical engineers.	For some sites, previous investigations may have gathered valuable information that is available. The extent and quality of such information has an influence on the appropriate approach.		Paragraph is rewritten as follows: *The amount to which a graded approach is applied to the geotechnical site investigation and characterization depends on the foundation requirements for the nuclear installation and on the complexity of the subsurface conditions. The appropriate approach should be determined based on the available information and the judgment of qualified geologists, geotechnical engineers and nuclear engineers. A graded geotechnical site investigation and characterization should address, at a minimum, the following items:* Agree, the appropriate approach should be determined based on the judgement of qualified geologists and geotechnical engineers, with consideration of the already available information. Comment is accepted. Paragraph is reworded to accommodate comments by several Member States.		
SWITZERLAND	63	6.11d	Hydrogeological conditions at the site, including the presence and thickness of aquifers, the groundwater regime, minimum and maximum groundwater levels, the amplitude of fluctuations, as well as the chemical composition of groundwater and the potential effects on the materials of underground structures.	We recommend to better specify the information to be gathered for the groundwater levels.		A footnote is added to point 6.11(d), after "groundwater levels" as follows: *The information of interest is usually the time-evolution of groundwater levels at different positions around the site, during a long enough period of time. This information is a key ingredient for calibration of the groundwater models to be used for prediction of groundwater conditions at the site.* Agree, but a Safety Guide cannot go into much detail. The information of interest is usually the time-evolution of ground water levels at different positions around the site, during a long enough period of time. This information is a key ingredient for calibration of the groundwater models to be used for prediction of groundwater conditions at the site.		

SWITZERLAND	64	6.12, 6.13		Not text changes, but we suggest the paragraph 6.12 to be either deleted (there is no new issue with respect to 6.1-6.11) or to be merged with previous paras. Paragraph 6.13 also makes a general statement, which should be included in some of the first paragraphs in chapter 6. Such deleting/merging would result in the total deletion of the chapter "GEOTECHNICAL EVALUATION OF SITES FOR NUCLEAR INSTALLATIONS".			x	These two paragraphs correspond to the geotechnical evaluation of the site, required by SSR-1 to establish site suitability. Geotechnical evaluation is a distinct phase with respect to site investigation and chararacterization, described in previous paragraphs. Hence, the subsection "Geotechnical evaluation of sites for nuclear installations" cannot be eliminated.
SWITZERLAND	65	6.14, 6.15		No text changes, but we note that these two paragraphs are nearly identical to para. 6.2. Any additional issues can be added to para. 6.2. and the entire chapter "DESIGN BASIS OF NUCLEAR INSTALLA-TIONS DERIVED FROM GEOTECHN-ICAL SITE CHARAC-TERIZATION" may be deleted.			x	These paragraphs were introduced to reproduce the sequence in practice: geotechnical evaluation of the sites, followed by derivation of the design basis. They contain some information which is redundant with th idea brought up during introduction the Section 6 (Para. 6.2), but the context is different.
RUSSIAN FEDERATION	35	6,15	When justifying the size of the territory to be studied by hydrogeological conditions and hydrogeological monitoring, it is necessary to take into account the areal and planned variability of hydrogeological conditions and the predicted impact based on preliminary calculations.	The variability of hydrogeological conditions (areas of nutrition, unloading, migration and filtration properties, etc.) on the plan and in the context does not allow for an effective study of hydrogeological conditions and conducting hydrogeological monitoring using a regular drilling and testing grid.			x	Agree with the commenter, but the paragraph refers to a much broader concept. The idea is that a graded approach in site investigation and characterization may lead to an increased level of uncertainty, which needs to be taken into account when deriving design basis parameters.
RUSSIAN FEDERATION	36	7,10	Expert evaluation of hydrogeological research and monitoring programs should be carried out.	An expert assessment of hydrogeological research and monitoring programs is necessary to take into account the set goals and objectives of all processes related to groundwater that can have an impact on safety, the environment and the population.			x	Expert evaluation of hydrogeological programs is included in Para. 7.10 (Expert evaluation of studies, evaluations and analyses). Specific fields of study are not identified and the text is inclusive of all as written.
SWITZERLAND	66	7,1	A management system applicable to the organization in charge with geotechnical investigation, site characterization and evaluation is required to be established before the start of the programme. The management system has to assure that any other involved organisations also have implemented management systems suited to act along quality standards as required by the organisation in charge.	The first sentence seems misleading to us. The different organisations involved in site characterisation have to apply safety and quality standards, which however may be implemented by their own management system. These management systems are established for the individual organisation only (there is, in our opinion, no "management system applicable to all organizations"). Regulations in Switzerland are in line with para. 7.2. We have therefore slightly modified the text to avoid misunderstanding.		The first sentence is reworded as follows: *An overarching management system applicable to all organizations involved in the site geotechnical investigation, characterization and evaluation is required to be established before the start of the programme (see Requirement 2 of SSR-1 [1]).* Yes, that was the idea. Please, read this paragraph in connection with the following paragraph.		
GERMANY	82	7,2	Organizations in the supply chain[14] are required to ~~either~~ have their own arrangements for managing safety (see Requirement 11 of GSR Part 2 [11]). ***Alternative:*** Organizations in the supply chain are required to either have their own arrangements for managing safety (see Requirement 11 of GSR Part 2 [11])~~. They may have their own management system~~ approved by the main contractor, or else adhere to the management system of the main contractor.	Clarification and editorial. We decided to propose 2 alternative formulations here.	x			
PAKISTAN	6	7,2	Following lines are suggested for addition: **The management system shall include arrangements for qualification, selection, evaluation, procurement and oversight of the supply chain**	To identify the areas that shall be covered in the management system		The following sentence is added at the end of the paragraph: *The management system of the main contractor should include arrangements for qualification, selection, evaluation, procurement and oversight of the supply chain.*		
PAKISTAN	7	7.3/ f	It may be changed as following: f. Calculation **and Interpretation**	Calculation (manual and computerized) require data analysis and interpretation for further design/safety assessment input	x			
SWITZERLAND	67	7,3	Following a graded approach, this includes the following: (a) …	Some of the points listed in (a) to (i) may not be needed for all nuclear installations. If "following a graded approach" is entered, it will show that the list is not the minimum programme required for all nuclear installations.			x	The list is for all nuclear installations, but it is not intended to be exhaustive. Note that the list is introduced by the sentence: "This includes the following:". Considerations for application of a graded approach to the Management System are provided in paras. 7.24 to 7.26.

SWITZERLAND	68	7.4 - 7.23		No specific text changes. We note that the following paragraphs are rather general and not specific with respect to site characterisation. We suggest revising these paragraphs with respect to their site characterisation- specific content and for the more general requirements (as e.g., listed in 7.4 and 7.7) rather refer to the existing IAEA safety guide GSR Part 2.			x	The paragraphs are intended to be an application of IAEA GSR Part 2 to site characterization activities. Note that some guidance is specific to these activities. Our idea is not to force the regular reader (a geologist or a geotechnical engineer) to go into IAEA GSR Part 2. Yes, the paragraphs are rather general because we cannot go into deeper detail within a Safety Guide.
PAKISTAN	8	7.6/1-2	Text may be corrected as following: ..analysis to be performed ~~in site geotechnical siting activities~~ ***during site geotechnical investigation activities*** .. technical procedures and instructions should be developed ..	Text may be corrected to bring clarity		Text was rephrased as '..in relation to geotechnical siting activities…'		
PAKISTAN	9	7,7	Following may be added to ensure in procedures: **Pre-requisite** to identify conditions to be ensured before starting the first step **Precaution** to clearly specify the precautions and safety measures that will bge necessary to protect equipment, personnel, the public and environment or to avoid any abnormal or an emergency situation. **Limitation** to identify any limitation regarding the parameter being controlled during activity. **Verification and Acceptance criteria**	The contents of procedures and instructions that should be necessarily added and followed for achieving the purpose efficiently		Item (a) in the list is reworded to mention the points suggested by the commenter. (a) Purpose and scope of the procedure, including prerequisites, precautions and limitations, if applicable.		
PAKISTAN	10	7.8/1-2	Following text may be added : Procedures should be prepared and reviewed by personnel with sufficient experience in the subject area. ***Procedures and Documents should be periodically reviewed and kept up to date. Application of Human performance tools may be ensured in procedures where possible to minimize error***	Procedures and documents shall be periodically reviewed and kept up to date as equipment, information, technology, industrial practices, and regulatory requirements evolves. Procedures may take into account human performance and error reduction tools.		Paragraph is rephrased as: *7.8 Procedures should be prepared and reviewed by personnel with sufficient experience in the subject area. These procedures should be revised periodically, to keep them up-to-date, as equipment, information, technology, industrial practices, and regulatory requirements may evolve.* Revision of procedures is important for activities expected to be developed over a long period of time (e.g. one decade). However, this section of the safety guide is more intended for site characterization and geotechnical evaluation activities, which typically last for less than two-three years. It is true that the guide also covers geotechnical parameter monitoring, which may be a long-term activity.		
TURKIYE	5	7.10.	Studies, evaluations and analyses should be peer-reviewed by qualified individuals who have not participated in their specification or in their development, with the purpose of ensuring that the intended scope has been met, the technical approach and method of analysis are valid, and the results are correct. **In addition, the raw data obtained with recording/measurement instruments should be kept and should be accessible for reviewers.** Evidence of the review work should be produced and kept as a quality management record in the project archives. The qualifications of the reviewers should be such that they could have competently performed the study, evaluation or analyses that they are reviewing.	Reviewers need the raw data to be able to evaluate the study results. Otherwise they will need to re- measure in the field. Depending on the progress of the project, it may not be possible to collect this data again.		x …should be kept and made available to reviewers, as necessary.		
ENISS	11	7,13	The preservation of representative cores from subsurface characterization boreholes may be necessary for a long period of time, since they may need to be available for inspections by the regulatory body. The period of time during which the cores need to be preserved should be agreed in advance with the regulatory body and specified in the procedures.	It is not always possible to pre-serve all the cores coming from investigations because that could represent a huge quantity of cores and because some of them may have been used for laboratory tests. Nevertheless, it is important to preserve (at least) a set of representative cores.	x			
SWITZERLAND	69	7,13	The preservation of cores from subsurface characterization boreholes may be necessary for a long period of time, since the planned nuclear installation may undergo substantial changes on the basis of the site characterization results, so that additional site characterization investigations may be needed on existing material.	The argument that a “long period of time” is required for preservation because they cores have to be available for inspection by the regulator is not convincing. The regulator may even be on site during drilling or later core case opening, so that no delay is caused. We suggest another argument to preserve the cores for an extended period of time.		Paragraph is reworded as: *7.13 Preservation of representative cores from subsurface characterization boreholes may be necessary for a long period of time, to allow for additional investigations or interpretations. The period of time during which the cores need to be preserved should be agreed in advance with the regulatory body and specified in the procedures. Preservation conditions and methods should also be agreed and ~~they should be~~ defined in the procedures.* Agree. Sentence is reworded to include other arguments and to address comments by ENISS (no. 11) and Turkiye (no. 8).		

TURKIYE	8	7,13	The preservation of cores from subsurface characterization boreholes may be necessary for a long period of time, since they may need to be available for inspections by the regulatory body. The period of time during which the cores need to be preserved should be agreed in advance with the regulatory body and specified in the procedures. **The preservation conditions and methods of cores should also be agreed and specified in the procedures.**	Defining the conditions and methods to preserve and maintain properties of cores is important for reviewing and controls of the regulatory body during the all authorization period.		Added sentence with modification…agreed and defined…		
PAKISTAN	11	7.14/1	Text may be changed as following: Specified testing should be performed by ~~registered~~ ***accredited*** ~~laboratories that have been assessed as competent by natio nal~~ authorities	Accredited maybe more appropriate to be used here as it means Endorsed authoritatively as having et certain requirements	x			
SWITZERLAND	70	7,14	Specified testing should be performed by registered laboratories that have been assessed as competent by the organization in charge of site characterization.	According to para. 7.2, there is a main organisation (with a management system) who has to approve the management systems of the sub-contractors. Accordingly, the assessment of the laboratories working for the main organisation is also in the duty of the main organisation. The main organization is also responsible for keeping the records. There is no doubt that the national authorities are in charge to assure that such assessment has taken place, however, main responsibility remains with the organisation in charge of site characterisation. Accordingly, we have modified the text.		Paragraph is reworded as: *7.14 Specified testing should be performed by registered laboratories that have been assessed as competent by the organization in charge of site characterization. Such an assessment will normally be based on certificates of qualification issued by an independent organization. Certificates should be kept as quality management records in the project archives.* Agree. The idea is that laboratories should be officially qualified to perform the tests. Qualification is usually performed by a National or International entity, but it could be performed directly by the organization in charge of site characterization.		
GERMANY	83	7,16	Commercial software developers should be considered as part of the supply chain to the site geotechnical investigation, characterization and evaluation, and the ~~requirements provided in para. 7.2~~ Requirement 11 of GSR Part 2 [11] should be met (see also para. 7.2).	The original sentence sounds as if DS531 would provide requirements. However, IAEA Safety Guides do not establish any requirements. Thus,the wording needs to be modified	x			
PAKISTAN	12	7,21	Text may added as following: Periodic audits by a team that is independent from the development team should be performed, to verify compliance with the procedures for geotechnical siting activities and to check the effectiveness, ***Measurement, Assessment and Improvement*** of the management system.	Nomenclature as per GSR Part 2		Paragraph is reworded as: *7.21 Periodic audits by a team that is independent from the development team should be performed, to verify compliance with the procedures for geotechnical siting activities and to assess the effectiveness of the management system, in order to identify potential improvements.*		
PAKISTAN	13	7,21	Text may added as following: Periodic audits by a team that is independent from the development team should be performed, to verify compliance with the procedures for geotechnical siting activities and to check the effectiveness of the management system. ***The effectiveness of management system shall be monitored and measured to conform the ability of the organization to achieve the results intended and to identify opportunities for improvement (see Requirements 13 of GSR Part 2)***	More appropriate as per established requirement of GSR Part 2			x	We tried to avoid the use a QA language that may obscure the meaning for a geology/geotechnical practitioner. Changes introduced to address the previous comment are considered to meet the intent of the commenter.
SWITZERLAND	71	7,25	For example, the application of a graded approach may result in the following: … (f) the frequency of the audits is reduced.	Since there are three paragraphs 7.21 - 7.23 dealing with audits, it would be natural to also give an example on how to apply a graded approach for the audits.	x			
FINLAND	1	Whole document	In general, the document seems to meet the requirements of the Specific Safety Requirements SSR-1 "Site Evaluation for Nuclear Installations", and its requirements 21 and 22.		x			
GERMANY	1	General 1	The current revision (Step 8) of DS51 is very well written from a technical as well as a linguistic point of view. It was a pleasure to read and comment it.		x			

GERMANY	2	General 2	The term “Undesirable soil conditions” is unclear and needs preci-sion. Requirement 22 of SSG-1 defines following geotechnical and geo-logical hazards: - Slope instability - Collapse, subsidence or uplift of the site surface - Soil liquefaction. The hazard named “Collapse, subsidence or uplift of the site sur-face” is not mentioned in the current Safety Guide. Is the term “Undesirable soil conditions” used instead? If yes, please, for consistency, attach these two terms, providing explanations. Additionally, please decide, if “undesirable soil conditions” or “undesirable subsurface conditions” shall be used: one term should be used all over the text to make it reader friendly.			x Undesirable subsurface condition to be used Add clarifying statement about what is addressed		
GERMANY	3	General 3	Radiological hazard categorization of sites for nuclear installa-tions, presented in Chapter 6 and its summarisation in Table 5 of this Draft does not seem to be an official IAEA categorisation. GRS Part 7, Table 1, is dealing with EMERGENCY PREPARED-NESS CATEGORIES. Is it reasonable to use this consolidated classification for the purposes of the current Safety Guide? If not, we would like to suggest, in order to avoid all possible mis-understandings and misinterpretations, to stick to “qualitative cat-egorization of the facilities on the basis of the potential hazard associated with the facilities”, as it was recently done for research reactors in SSG-22 (Rev.1). Additionally we suggest to use “categorization of sites for nuclear installations based on potential hazards associated with the nuclear installation” instead of “radiological hazard categorization of sites for nuclear installations”. The wording “Radiological Hazard Categorization” needs discus-sion with RASSC and EPReSC, which are unfortunately not in-volved in the drafting of the current Safety Guide.					x The presented categorization is consistent with the radiological hazard categorization presented in SSG-67 and SSG-89. Some of the language has been updated to address other comments - please refer to updated text. No changes made to the document as a result of this comment.
IRAN	7	N/A	It is suggested that an item to be added somewhere to the draft document for determining the number and depth of geotechnical boreholes and/or to discuss around the conditions of its feasibility or impossibility.	There is no discussion stated regarding the number and depth of geotechnical boreholes in this draft safety guide, while it seems this technical information necessary to be included in the guide.				x This is a high-level document, and no consensus can be achieved on quantitative guidance. Some information is being developed in the Handbook on siting (and is typically included in lower level publications).
IRAN	8	N/A	It is suggested the draft document to be updated with providing examples such as the minimum level of suitability/adequacy of studies, determining the number anddepthofgeotechnical boreholes, the number of surface and deep sampling of soil and rockforgeochemicaland geomechanical analyses.	Since based on the types of environmental conditions and the degree of complexity of the engineering geology, and geotechnical conditions of the site, and also considering the types of nuclear facilities, the level of studies will vary, the proposed examples will clarify the situation.				x This is a high-level document, and no consensus can be achieved on quantitative guidance. Some information is being developed in the Handbook on siting (and is typically included in lower level publications).
PAKISTAN	1	Title	Title of the draft series may be changes as following: Geotechnical Aspects in **<u>Site Evaluation</u>** and Design of Nuclear Installation	According to IAEA Standard definition, Siting covers site survey and selection. Whereas, Site Evaluation Process covers all the stages including site selection, confirmation, characterization, pre-operational, Operational stages and Decommissioning			x	The guide is intended to cover the entire life cycle, as specified in your comment. The term 'Siting' in the title was not intended to imply just the 'siting' process, but the verb 'Siting' - encompassing all activities related to selecting, characterizing, evaluating, constructing and operating a site. Title will be upadated to 'Site Evaluation' instead of 'Siting'. The draft DS531 document, covers all nuclear installations, and provides information and guidance on how to deal with nuclear installations that are of lower hazard categories (other than NPPs).

RUSSIAN FEDERATION	10	Cover page and text of the safety guide		The title of the draft guide does not fully reflect the contents of the whole document. The title includes siting and design of nuclear installations, although the guide text presents geotechnical fundamentals related to the whole life cycle, including construction and operation. Taking into account that this draft has been developed to supersede NS-G-3.6, terminology change from Nuclear Power Plant to Nuclear Installation is not clear, while maintaining the essence of NS-G-3.6. We believe that title of NS-G-3.6 Guide and its sections and contents reflects the stated scope of the subject matter to the fullest extent.			x	The guide is intended to cover the entire life cycle, as specified in your comment. The term 'Siting' in the title was not intended to imply just the 'siting' process, but the verb 'Siting' - encompassing all activities related to selecting, characterizing, evaluating, constructing and operating a site. Title will be upadated to 'Site Evaluation' instead of 'Siting'. The draft DS531 document, covers all nuclear installations, and provides information and guidance on how to deal with nuclear installations that are of lower radiological hazard categories (other than conventional large NPPs).
ARMENIA	1		Add Chapters for Definitions and Abbreviations				x	Abbreviations not needed (there currently aren't any abbreviations in the text Definitions are standard in industry & consistent with IAEA Glossary
ARMENIA	21			It is recommended to show the place of DS531 in the overall chain of standards, from SSG-21 (Volcanic hazard) to SSG-67 and SSG-89 “Seismic design”.			x	This is not information typically included in Safety Standards. The chain of standards and their relationships can be found on NSS-OUI.
ARMENIA	22			It is desirable to use in DS531generally recognized terminology in the field of SSI analysis.			x	The terminology used is in line with recognized terminology in the field of SSI analysis
GERMANY	84	List of references, new Ref. [X]	INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Nuclear Safety and Security Glossary: Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response, 2022 (Interim) Edition, IAEA, Vienna (2022).	Please add IAEA Nuclear Safety and Security Glossary as a new reference.			x	The IAEA Glossary is referenced and mentioned in the front matter of the document. This text does not need to be repeated in Section 1 and added as a reference in the Safety Guide.
GERMANY	85	List of references, Ref. [11]	“INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety, ~~General Safety Requirements~~ IAEA Safety Standards Series No. GSR Part 2, IAEA, Vienna (2016).”	Editorial.	x			
GERMANY	86	List of references, Ref. [12]	INTERNATIONAL ATOMIC EN-ERGY AGENCY, Application of the Management System for Facilities and Activities, ~~Safety Guide~~ IAEA Safety Standards Series No. GS-G-3.1, IAEA, Vienna (2006).	Editorial.	x			
CANADA	7	Page 57, Table 4	Add to Table: •Type of Device: Soil electrical resistivity monitors •Principle: Electrical resistance or conductivity •Location: {soil, details to be filled by SME} •Parameter Measured: Electrical resistance or conductivity of soil •Purpose: Monitor changes in soil conditions and characteristics over time	To ensure that changes in soil conditions are known, and directly comparable to ranges considered during siting investigations to support the design and implementation of cathodic protection systems.	x			
GERMANY	33	2.53 Table 1 Row 7 (Type of test: Micro-gravimetry)	Residual anomaly (~~µGals~~m/s2) Acceleration due to gravity	The unit microgal has been superseded by SI-unit m/s2.		x deleted unit		
GERMANY	34	2.53 Table 1, line 8 (Mi-crogravim-etry), col-umn 3	Sinkholes, heterogeneities, including faults, domes, intrusions, cavities, buried valleys (remark: detected via by measured anomalies).	Do you mean “detection by measured anomalies”? Then it should be a “Remark” rather than an “Area of application”. Same for “Electrical resistivity“	x			
GERMANY	35	2.53 Table 1 Row 7 and row 8	Remarks „Undesirable subsurface features“	Term “Undesirable subsurface features” is unclear. Is there connection with “Undesirable soil conditions”? Explanation will be helpful. Please see comment “General 2”.		x Undesirable subsurface features deleted		
INDIA	6	Page 21/~~Para~~ Table 1/Line 1 *“Techniques for geophysical investigations of soil and* rock samples”	Table 1: Techniques for geophysical investigations **in soil and rock for siting nuclear installations**	The title should be modified deleting the phrase “*of soil and rock **samples***”. The tests are not carried out in **samples** but in soil and rock **media**		x Replace 'samples' with 'media'		
INDIA	7	Page 22/~~Para~~ Table 2/Line 1 *“Techniques for in-situ geotechnical investigations of soil and* rock samples”	Table 1: Techniques for in-situ geotechnical investigations **in soil and rock for siting nuclear installations**	The title should be modified deleting the phrase “*of soil and rock **samples***”. The tests are not carried out in **samples** but in soil and rock **media**		x Replace 'samples' with 'media'		
GERMANY	36	Table 2, Type of test: Dilatome-ter or Goodman Jack	Column “Parameter”: “~~Measures E~~ Thermal expansion coefficient in lateral direction”	The symbol ‘E’ is nowhere introduced and not further used in this Safety Guide; it should be replaced by the respective physical quantity (full term).		x 'E' expanded to 'Young's modulus'		

SWITZERLAND	22	Table 2, line 6	Type of test: Hydro tests (pumping test, injection test, slug test, pulse test) Type of material: soil and (fractured) rock Parameter: Field permeability Area of application: Transmissivity of soil/rock, settlement Remarks: Needs a preliminary hole and piezometers	Instead of the row "Pumping test" we suggest adding a line with more general terms. A "pumping test" is only one specific hydro test.	x			
SWITZERLAND	23	Table 2, line 14	Type of test: Rock coring Type of material: Rock Parameter: Lithology, discontinuity density, discontinuity orientations, discontinuity properties, measure rock quality designation (RQD) used for empirical correlations Area of application: Detailed information on stratigraphy, rock structure and integrity, slope stability, foundations Remarks: Can be further used for laboratory tests, lithological and structural characterization and in classification of rock masses (e.g., Q-value)	Rock coring provides way more information than currently stated in Table 2 and such information may be important for siting.	x			
GERMANY	37	Table 3, Dietrich-Frühling apparatus	1) Column "Type of test": Dietrich-Frühling ~~apparatus~~ gasometer Alternative: Dietrich-Frühling ~~apparatus~~ calcimeter 2) Column "Parameter": Carbonates ~~and sulphates~~ content	More common designations of this test in the scientific community are 'gasometer' or 'calcimeter' instead of 'apparatus'. This test is not designed for determining the sulphate content of soils, please change to "carbonate content".	x			
INDIA	8	Page 24/~~Para~~ Table 3/after ~~Line~~ Row 4 insertion of one more row suggested	Inclusion of the following in table 3: Type of Test: **Petrological (thin section) study of rocks;** Type of material: **Rock;** Parameter: **Identification of undesirable constituents in the rock**. Characteristics investigated: **Identification Mineral, their texture, any other special features;** Purpose: **Identifying compositional and micro-structural variation for suitable treatment of foundation**	Presence of undesirable material in the rock matrix can have adverse effect on the foundation. For example, presence of strained quartz need to suitably addressed in order to arrest dissolution, thereby weakening the foundation at a later stage.	x			
RUSSIAN FEDERATION	9	Table 3	Resonant column tests at dynamic loading shall be added (in addition to dynamic triaxial compression testing)	Obtaining of G/G0=f(γ) and D=f(γ) dependencies in wide range of shear strains		Added to Cyclic simple shear (4 up from bottom)		
RUSSIAN FEDERATION	24	Table 4 (GEOTECHNCIAL MONITORING DEVICES FOR SITES FOR NUCLEAR INSTALLATIONS), "Type of Device" column, page 63 Table 4, page 66, "Type of Device" column	Optical, digital leveling instruments (instead of "Settlement monuments") Total station (tacheometer) (instead of "tachymeter")	Technical error: monument is not a device		x 'settlement monuments' changed to 'survey reflectors' 'tacheometer' added		
RUSSIAN FEDERATION	25	Table 4	It is necessary to list the requirements for equipment for perfoming all types of hydrogeological studies (including monitoring and routine observations).	The established requirements for equipment for performing all types of hydrogeological studies (including monitoring and routine observations) will make it possible to establish the possiblity of registering the necessary parameters.		x add a non exhaustive note to Table 4		
SWITZERLAND	59	Table 4	Type of device: Borehole Seismometer Principle: Accelerometers Location: Borehole Parameter measured: Acceleration time histories Purpose: underground seismicity	We suggest adding a new line including the elements as indicated (each column separated by "/"). Site effects are key in PSHA. To reduce uncertainties, they should be measured as early as possible (e.g., before or during siting, baseline) to provide site specific data for the initial PSHA. If possible, measurements should be continued over the period of the operation to provide a solid data basis for updating the PSHA.		x Added to seismometer (4 up from bottom), Location: Borehole, Purpose: Seismic behavior of structure AND SITES		
GERMANY	75	After para. 6.4 Table 5	~~TABLE 5. RADIOLOGICAL HAZARD CATEGORIES BASED ON THE CONSEQUENCES OF FAILURES IN A NUCLEAR INSTALLATION~~	Please delete. Please see comment "General 3" Such categorization is not comprehensive, not clearly defined, leaves much room for interpretation.			x	See response to GERMANY comment 74