Revision of 7 closely interrelated Safety Guides on the Operation of Nuclear Power Plants: NS-G-2.2 to 2.6, NS-G-2.8 and NS-G-2.14 (DPP DS497 indice 2)

NS-G-2.5: 136 comments / Accepted (fully or partially): 84 (61%) / Rejected: 53 (39%)

Some comments are multiple: one part can be accepted and another rejected; hence, total of "accepted" and "rejected" is not equal to number of comments

Country or Organization	Number of comments	Accepted	Rejected
Belgium	2	2	0
Egypt	4	3	1
ENISS	6	3	3
Finland	13	4	10
Germany	32	22	10
Hungary	21	17	4
Japan	3	1	2
Poland	43	26	17
Russian Federation	4	3	1
Pakistan	8	3	5

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: Country & Organization: Belgium - FANC			Page 2 Date: 28/05/2019	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	2.4.C Page 14	Suggestion: to add the "stretch-out" among the "operation mode" mentioned	To be the most comprehensive as possible	Yes			
2.	4.16.A Page 38	Suggestion: replace « By means of appropriate handling and storage of new fuel… » by « By means of appropriate handling and storage of fuel… »	What does "new" fuel mean? Does this mean "fresh" fuel, or "new type / design" fuel, or just any fuel that is not yet loaded / unloaded; in this last hypothesis, it is better to delete "new" in the sentence to avoid ambiguity	Yes			

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: Moustafa Aziz Country & Organization: Egypt - ENRRA			Page 2 Date: 29/05/2019	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	1.3 Page 11	… nuclear power…	Space between nuclear & power	Yes	Already corrected in the version sent to Member States.		
2.	2.4 Page 15	2.4.F.	After para 2.4.A to 2.4.E, the next is 2.4.F.	Yes	Fonts, paragraph numbering, spelling, etc. will be checked and corrected by IAEA staff in the final editing process.		
3.	2.13 Page 17	- Fuel burnup and irradiation records	Added this sentence to the list of items which should be taken into consideration at para 2.13	Yes			

4.	2.17 Page 20	Water level in reactor vessel and pressurizer	Added water level in the pressurizer to list of parameters which should be monitored			Yes	The list focuses on core conditions, not on all operational parameters at large.

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: M-L Järvinen Page 3 Country & Organization: Finland - STUK Date: 28/05/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	General	IAEA should consider developing a process for simultaneous development or revision of several safety guides. Lessons learned from the revision of the Safety Requirements after Fukushima Dai-ichi accident 2011 should be used in developing this process.		Yes	The team have been working like this. Lessons learned from the revision of the Safety Requirement were followed. DPP was developed based on this experience.		
2.	General	IAEA should consider presentation of the recommendations for maintenance only in one safety guide. The new safety guide for ageing management and LTO, SSG-48 presents current, updated recommendations for maintenance. The safety guide NS-G-2.6 and SSG-48 are overlapping.				Yes	Comment not relevant for NS-G-2.5.
3.	General	Development of procedures for accidents in NS-G-2.2 is overlapping and may be conflicting with SSG-54. The new accident management guide SSG-54 should be considered also in other relevant safety guides in this set. IAEA should consider presentation of the recommendations only in one safety guide.				Yes	Comment not relevant for NS-G-2.5.
4.	General	Core management section is overlapping in NS-G-2.5 and in DS488. IAEA should consider presentation of the recommendations only in one safety guide.				Yes Yes	This is out of the scope of the DPP. Presentation of recommendations

							only in one guide is not possible and not recommended.
5.	General	It is not clear from the guidance which safety requirements are covered by each safety guide. There should be a transparent and systematic way of presented the covered safety requirements in each safety guide. As a part the allocation of the requirements made for DPP DS497 should be utilized.		Yes	Reference to requirement 30 is now made in paragraph 1.3 according to the DPP.		
6.	General	Safety-security interface should be implemented to all of the safety guides in a systematic manner. Some guides do net even mention the word security. The set of safety guide demonstrate the need for guidance on the management of the safety-security interface. Presently the safety guides give references to security guides and vice versa. However, there is not always a suitable guide to reference for instance for safety-security interface in change management. The utilization of the synergies of implementation of safety security interface should be emphasized. There is need for a specific guidance on safety security interface management.				Yes	Addressed consistently with the DPP scope. In addition, it is in contrary with comments No. 2, 3, 4 and 5. Please, see answer in the resolution table of the NS-G-2.4 for this comment.
7.	General	The terminology should be harmonized. There are several examples of the harmonization needs in the safety guide specific comments. The examples concerning the term risk are collected for safety guide NS-G-2.6. However similar review should be made for all of the safety guides and the use of term risk should be systemized.				Yes	This is out of the scope of the DPP. The word “risk” (or risks) is used four times in the NS-G-2.5, all without any conflict with the interpretation of the term in the IAEA Safety Glossary. In the IAEA Safety

							Glossary, “risk” is mentioned 93 times! Words used have to the extent possible been checked against the IAEA Safety Glossary.
8.	General	Clarify the meaning of the term “Programme”	There seems to be many individual programmes, e.g.: - core management programme - core operation programme - reactivity management programme - core monitoring programme - refuelling programme - fuel integrity monitoring programme What is the difference between a programme versus plant procedures etc.? Is it compulsory to organize the processes related to operation to exactly these programmes?			Yes	This is out of the scope of the DPP. Programme and procedures are well understood. No specific meaning within this set of guides and no more within NS-G-2.5.
9.	General	Check against DS488 (Design of the Reactor Core for NPPs), section called “Core Management”. There seems to be some duplication.	Some paragraphs seem to be identical or close to identical, examples: DS497D vs. DS488 3.112 vs 2.1 3.113 vs 2.2 3.118 vs 2.4 C and D			Yes	This is out of the scope of the DPP. And no paragraphs 3.112-3.113-3.118-3.119 found in NS-G.2-5.

			3.119 vs. 2.4.E There may be more.				
10.	2.15.C		Why a specific independent review is required for reactivity management programme particularly?			Yes	Introduced because DiD concept as requested by DPP. Reactivity management is defined in 2.15.A.
11.	2.52	- Control rod drop (PWR) or hydraulic insertion (BWR) times	The control rods are not dropped in BWR scram	Yes			
12.	5.19	For some reactor types, such as LWRs, it is important for safety purposes to retain sufficient capacity in the storage facility for irradiated fuel to accommodate the fuel inventory of the reactor and one full set of control rods at any given time (see Ref.[15]).	This is required also true for BWRs (at least in Finland).			Yes	No need for BWR to keep space for full set of CRs.
13.	4.19 sixth item	…; in PWRs borated water with the specified boron concentration should be circulated and positive measures should be taken to prevent dilution.	Borated water is not used during refuelling in BWRs.	Yes	Error in the para. nr: 4.19 instead of 3.19.		

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: Page 6 Country & Organization: ENISS Date: 29/05/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	2.4.C	Reactor core analysis should be performed to cover the entire operating cycle for a variety of reactor core conditions, such as: — Full power, including representative power distributions; — Load following (as applicable); — Anticipated operation at reduced power;	An extended reduced power operation has an impact on core parameters. Especially when returning at full power, where they might be more limiting with respect to the design limits.			Yes	Covered by "power cycling" and: — Load following (as applicable) is the same principle as — Anticipated operation at reduced power
2.	2.4	In the analysis of core conditions, account should be taken of the fuel types in use.		Yes	Only applicable for PWRs.		

		Neutronic, thermal-hydraulic and mechanical analyses should be performed for detailed core analysis. It should include, but should not be limited to, the following core parameters for both steady state and transient conditions: — Variations in reactivity with burnup of the fuel and actions needed to maintain core reactivity, for example, by changes in control rod positions, neutron absorbers, coolant temperature and void content, or refuelling rate; — Variations in reactivity with burnup of the fuel and actions needed to maintain core reactivity, for example, by changes in control rod positions, neutron absorbers, coolant temperature and void content, or refuelling rate; — Location and reactivity worth of all control rods or rod groups; — <u>Minimum boron concentration ensuring the subcriticality margin in shutdown states</u>;					
3.	2.7	If there is significant discrepancy between measurements and calculations, the following actions should be taken in the order indicated: (1) Make the reactor safe (by shutting it down, if necessary); (2) Identify the root cause of the discrepancy; (3) Perform any necessary corrective actions (including those necessary to prevent recurrence). ~~Further information on the reactor core analysis can be found in Ref.[5].~~	This sentence seems to indicate, as it is below §2.7, that further guidance on discrepancy between measurements and calculations will be found in Ref.[5]. This is not the case.			Yes	[5] does not contain guidance on discrepancies, it contains " Further information on the reactor core analysis". The existing text is correct.
4.	2.52	Checks should be performed after a reload to provide assurance that the core has been	Differential rod worth measurement	Yes	Dynamic rod worth measurement is		

		correctly constituted. In addition, physics tests should be performed before or during startup after each reload to verify the constitution and characteristics of the core, and control rod reactivity worths and boron worths throughout their operating range. Tests should include, but should not be limited to, the following, as appropriate: — Withdrawal and insertion of each control rod to check for operability; — Control rod drop times; — Integral ~~and differential~~ rod worth measurement. — Demonstration that, if the control rod with the strongest	requirement should be clarified, indeed this requirement could exclude Dynamic rod worth measurement method.		considered acceptable equivalent alternative to the differential worth measurement. As the integral measurement is not enough alone; hence the text is modified as follows: " Integral, and differential or dynamic, rod worth measurement."		
5.	2.52	(…) — Demonstration (measurement and/or analytical approach) that, if the control rod with the strongest worth is in the fully withdrawn position, the core meets the specification for shutdown margins; (…) — Comparison of measured and calculated flux distributions and power distributions (axial and radial)	This demonstration may be a mix of measurement and analytical approach and by test only.	Yes	1st proposed addition: no need to specify. 2nd proposed addition: ok.		
6.	4.9	When a significant quantity of fuel is being loaded into a shut down reactor, the subcritical count rate should be monitored to prevent an unanticipated reduction in the shutdown margin or an inadvertent criticality. ~~Shutdown margin verification tests should be performed on the fully loaded core.~~	This is accounted in §2.52 by “Demonstration that, if the control rod with the strongest worth is in the fully withdrawn position, the core meets the specification for shutdown margins;”			Yes	These are 2 different expectations. Original text kept.

COMMENTS BY REVIEWER

Guide: NS-G-2.5

Reviewer: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) (with comments of State Government Schleswig-Holstein, RSK, Framatome and GRS)

Country & Organization: Germany

Date: 15/05/2019

RESOLUTION

Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	General	The structure of the draft allows doubling of contents and tasks, and, due to that, several duplications exist.	We suggest to change the structure of the draft according to a more systematic approach. If this is not possible, at least duplications should be removed/ minimized.			Yes	Too late to change the structure. No duplication found. The comment is not specific enough to be solved.
2.	General	Please correct page numbering	Page numbering is incorrect	Yes	Fonts, paragraph numbering, spelling, etc. will be checked and corrected by IAEA staff in the final editing process.		
3.	2.1.A	Defence in depth for core management should cover a number of operational precautions ~~levels of defence~~ …	The term “level of defence” should be used solely for the DiD levels (i.e. normal, operation, abnormal operation, DBA and DEC), not for precautions inside such a level.	Yes	Defence in depth for core management should cover a number of operational precautions within the levels of-defence.		
4.	2.3 Line 11	Unloading fuel when its specified burnup or dwell time limit has been reached, or if operating experience (like corrosion, leakage, bowing) necessitates an earlier discharge;	We suggest to add some openness for further results of operating experience for this case	Yes	"like" replaced by "such as".		
5.	2.3 Line 20	Updating plant operating strategies on the basis of fuel performance and operational experience gained with the plant and from other plants as well as further progress in science and technology;	Further progress in science and technology is also important issue by updating plant operating strategies	Yes			
6.	2.4.C	Anticipated operational occurrences	Operation at the stability	Yes			

	Line 10 Bullets 8+9	(including oOperation at and beyond the thermal-hydraulic stability boundary (for boiling water reactors (BWRs))).	boundary should not occur in normal operation (there should be a margin to the boundary), thus should be considered as abnormal (anticipated operational occurrence, AOO) and therefore is covered by the preceding bullet. Either bullet 9 should be integrated into the preceding bullet 8 (with operation at and beyond the instability region) or bullet 9 should be deleted.				
7.	2.4.C Line 13 New bullet	- … - Design basis accident and DEC without core melt	Add also conditions beyond "Anticipated operational occurrences" to the list, for DBA and DEC, these should not cause severe core damage (even DEC could to some extent) but should never result in reactivity increase or criticality.			Yes	List is non exhaustive.
8.	2.4.E	The reactor core analysis should include fuel element performance analysis based on average and local power levels and axial temperature or void distributions to demonstrate that the respective thermal and mechanical fuel design limits are met for all operational states and accident conditions without core melt.	Why only "for all operational states", we suggest to add accident conditions without core melt as well.			Yes	Some fuel design limits might not be met in some accidents without core melt.
9.	2.4 Line 2	… Neutronic, thermal hydraulic and,mechanical and chemical analysis should be performed…	Just for the use of new fuels it is decisive to assure that the cladding	Yes			

			material is resistant to the chemical core conditions.					
10.	2.4 Line 11 Bullet 4	- Reactivity feedback ~~coefficients~~ of temperature changes (for the fuel; moderator and coolant), power, pressure and void over the operating range and for anticipated transient conditions and design basis accident;	Coefficients are related to a specific computational method, guidance should be methodologically neutral. Why only for AOOs and not at least also for DBAs? See also 6.6 of IAEA SSR 2/1	Yes		Impact on reactivity of temperature (for the fuel; moderator and coolant), power, pressure and void over the operating range and for anticipated transient conditions and design basis accidents.		
11.	2.4 Line 17 Bullet 6	- Fuel and moderator temperatures, coolant flows, coolant chemical conditions, pressure drop, …	For the use of new fuels it is decisive to assure that the cladding material is resistant to the chemical core conditions.	Yes				
12.	2.4 Line 22 New bullet	- Changes in xenon concentration due to transients - Growth of cladding oxidation over the fuel cycle	A maximum oxidation layer thickness must not be exceeded to prevent systematic cladding failure during operation and to keep the core damage below certain limits during LOCA and RIA. We suggest to add a new bullet.	Yes				
13.	2.5	Changes in the parameters exemplified above and their effects should be predicted for both steady state and transient conditions. The results of such predictions should be compared with measured parameters as far as practicable, and should be used to confirm that there is sufficient capability for control at all times to ensure that the reactor will be shut down safely and will remain shut down following any normal, ~~or fault~~ abnormal or	“fault condition” is not defined in IAEA Safety Glossary, “severely abnormal” used in “cliff edge effect”	Yes		Any normal or abnormal condition, with.		

		severely abnormal condition, with limited failures taken into account.					
14.	2.8 and following	Please add guideline or requirement on the quality of the used codes.	The paragraph on computational methods for core calculation does not provide any guideline or requirement on the quality of the used codes like best estimate computer codes with uncertainty assessment.			Yes	This is out of the scope of the DPP.
15.	2.8 Line 5 Last sentence	The uncertainties in computational results and in measurement should be taken into account.	Uncertainties within computational models should also be taken into account, in particular in this subchapter on computational models.	Yes			
16.	2.13 New bullets	…. - Fission product activity in the primary coolant and the off-gas system - Degradation of fuel claddings due e.g. to oxidation or CRUD deposition - Degradation of thermomechanical properties of the fuel over burnup	Cladding oxidation and CRUD deposition have the potential to impede the heat transfer to the coolant leading to increased cladding temperatures. Moreover, for oxidic fuels it is known that heat conduction decreases with increasing burnup. That effect needs to be assessed to keep fuel temperature in the permissible range	Yes			
17.	2.14 First bullet	- Identification of the instruments and the calibration and assessment methods to be used by the operator, so that the relevant reactor parameters can be monitored within the range consistent with the design intents and safety analysis;	“design intent“ should be defined.			Yes	Design intent is not the same as design. Design intent means what has the design to achieve? What is the design defined

							for? Etc.
18.	2.14 Last bullet New Footnote	- Criteria for determining fuel failure and the actions to be taken when failure is indicated. Footnote: Fuel failure is a loss of gas tightness of fuel rod	"fuel failure" should be defined (footnote?), e.g. as "loss of gas tightness of fuel rod".			Yes	This is already indicated in other paragraphs of this guide.
19.	2.14.D	Reliable core cooling should be ensured under all conditions (normal, ~~and~~ abnormal, DBA and BDBA). Measurements and control room indications should clearly show the status of core cooling. ~~Operations personnel must have certainty regarding the status of core cooling.~~	Guide on core cooling is not inside this guide. Therefore, either remove this para. or rephrase it. The second sentence need rephrasing. There is no "must-statement" allowed to the personnel in this guide. Better wording; see also 2.16.A.			Yes	This proposed addition is not fully correct and does not foster clarity.
20.	2.15.A Line 10 Bullet 2	Control rods and the concentration of soluble absorbers should only be manipulated…	Changes in the concentration of soluble absorbers (e.g. B10) have an equally important influence on core reactivity as control rod manoeuvres and require appropriate control and monitoring.	Yes			
21.	2.15.A Line 16 New bullet	• Reactivity changes should be closely monitored to verify the expected magnitude, direction and effects. A sufficient shut down margin needs to be maintained to cope with inadvertent reactivity increase due to transients or inadvertant changes in coolant quality.	In some reactors and certain core conditions void that occurs during a transient may have a positive reactivity effect that needs to be compensated by control rod insertion or changes in soluble absorber concentration. Moreover, means have to be available to compensate			Yes	Covered in other paragraphs., e.g. 2.4

			for inadvertent changes in soluble absorber concentration (e.g. homogeneous or heterogeneous boron dilution).				
22.	2.25	Prior to insertion or reinsertion, the fuel should be inspected in accordance with established acceptance criteria to ensure that damaged or failed fuel is not loaded into the core. In addition, an inspection programme needs to be in place with regard to cladding oxidation, CRUD deposition and fuel element bowing to prevent fuel failure during the succeeding cycle.	OE showed that cladding, oxidation, CRUD deposition and fuel element bowing caused difficulties in operation. These effects should be included.	Yes	Introduced in paragraph 2.53 describing expected content of surveillance programme. (see comment 23 below).		
23.	2.53 Line 18 Bullet 5	- Degradation of fuel and other core components , such as bowing effects of fuel assemblies, oxidation of cladding, CRUD deposition and fretting, wear-out and swelling of control rods.	Clarification. See also explanation to paragraph 2.25	Yes			
24.	3.2.A	Specific ~~attention~~ procedures should be ~~taken~~ developed for handling fresh ~~mixed oxide (MOX)~~ fuel containing reprocessed materials since it has a higher radiation level and higher heat generation in comparison to fresh UO2 fuel.~~.~~ Shielding measures should be taken to reduce radiation exposure.	Handling of fresh fuel and MOX fuel is quite different, therefore just "specific attention" is too weak. There should be specific procedures for handling of MOX fuel. We suggest also to change "MOX fuel" into "fuel containing reprocessed materials" for adjustment of wording to § 3.13.	Yes	Specific attention should be put during handling fresh ~~mixed oxide (MOX)~~ fuel containing reprocessed materials since it has a higher radiation level and higher heat generation in comparison to fresh UO2 fuel.~~.~~ Shielding measures should be taken to reduce radiation exposure.		
25.	3.5	Any fuel suspected of being damaged during handling or storage should be inspected and, if necessary, treated in accordance with the	Correction of reference paragraph number	Yes			

		established procedures relating to damaged fuel (see paragraph ~~3.17~~ 3.16).					
26.	3.18	~~Inspections should neither damage the fuel nor introduce any foreign material into it. Inspectors should identify any foreign material already present in the fuel and should remove it.~~	We suggest to delete this para. First sentence is too obvious to be included in a guide. Second sentence might be misleading. In most cases inspectors should just inspect but never act. They should write a report (work order) and could initiated the removal of foreign material and start a root cause analysis, how the foreign material got in the fuel. But a spontaneous removal without specific procedures and care should not be asked for in a guide.	Yes	Fuel should be exempt from foreign material before use at the plant. Inspections should not introduce any foreign material into it. Inspections should allow identifying any foreign material already present in the fuel.		
27.	3.19 Line 1	If~~, following inspection,~~ fresh fuel assemblies have to be repaired, the fuel supplier should be involved …	Remove "following inspection" as this implies that inspectors frequently damage fresh fuel. See also comments to para. 3.18 above.	Yes			
28.	4.1	The refuelling programme described in paragraphs 2.43–2.52A should be implemented by means of refuelling plans that specify in detail the sequence of the operations to be carried out.	Consideration of new paragraph 2.52.A	Yes	Fonts, paragraph numbering, spelling, etc. will be checked and corrected by IAEA staff in the final editing process.		
29.	4.3	At least, reliable two-way communication should be available at all times between the fuel handling staff and the control room staff.	Footnote 3 seems to be missing.	Yes	Ref to footnote removed.		

					Reliable two-way communication means should be available at all times between the fuel handling staff and the control room staff.		
30.	5.3.A Line 14 New bullet	- Relevant radiation protection equipment - Relevant ventilation and filtering systems	In order to maintain the accessibility of the relevant building compartments even in case of fuel damage, e.g. duet to assembly dropping, the compartment atmosphere needs to be ventilated and filtered.	Yes			
31.	5.19	For some reactor types, such as ~~PWRs~~ pressurized water reactors, it is important for safety purposes to retain sufficient capacity in the storage facility for irradiated fuel to accommodate the fuel inventory of the reactor and one full set of control rods at any given time (see Ref.[15]).	Ease of reading			Yes	Acronym already introduced earlier in the guide.
32.	5.21.A	Please add which aspects are to be covered by inspection programme for irradiated fuel	This paragraph requires an inspection programme for irradiated fuel. However, it keeps open which aspects need to be covered by this programme.			Yes	Original text kept.

COMMENTS BY REVIEWER

Guide: NS-G-2.5

Reviewer: Bernadett Lente — Page 16

Country & Organization: Hungary / HAEA — Date: 15/04/2019

RESOLUTION

Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	2.4	Reactivity coefficients of temperature (for the	The list of the reactivity	Yes	Boron concentration		

		fuel; moderator and coolant), power, pressure, density, boron concentration, and void over the operating range and for anticipated transient conditions;	coefficients was not complete		added.		
2.	1.3	… nuclear power…	It was spelled without a space "nuclearpower"	Yes			
3.	2.53.A	… taking into account…	This is the correct form of the idiom and not "taking in account"	Yes			

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: Page 17 Country & Organization: Hungary / MVM Paks NPP Ltd. Date: 15/04/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	Table of Contents	Table of Contents shall be updated.	Most of the page numbers and some titles are not corresponding to the content of the document.	Yes	Fonts, paragraph numbering, spelling, etc. will be checked and corrected by IAEA staff in the final editing process.		
2.	3.7	It is recommended to replace 'casks and packing' with 'packaging'.	'Packaging' is a standard term - used in IAEA SSR-6 - for the equipment containing the radioactive material during the transport.	Yes			
3.	3.10	It is recommended to replace 'storage canisters or lifting devices' with 'containers'.	Fresh fuel is stored in racks or in transport equipment, generally called a 'container'. 'Racks and containers' cover all the equipment used for storage of fresh fuel.	Yes	Storage canisters, containers or lifting device.		
4.	4.5	It is recommended to delete 'referred to earlier in this section'.	There is no reference to the quality assurance	Yes			

			procedures earlier in the document.				
5.	4.6	It is recommended to extend the text 'initially using dummy fuel' with the text 'or using the fuel transfer machine in simulator mode'.	According to Paks NPP's practice it also provides sufficient practical experience.			Yes	Not as robust as the initial text.
6.	4.6	It is recommended to replace 'spent fuel pit' with 'spent fuel pool'.	It is supposed to be a mistake.	Yes			
7.	5.21	First bullet is recommended to be extended with the text 'if the safety analysis does not allow the storage together with those'.	According to Paks NPP's safety assessment for the spent fuel pool there is no reason to store the leaking fuel assemblies separately from other irradiated fuel. Only mechanically damaged fuel dispersing fragments of fuel pellets shall be stored in a special canister.	Yes	The team added "if the safety analysis does not allow the storage together with those".		
8.	7.6	It is recommended to delete the text '(such as opening the casks under water)'	According to Paks NPP's practice the expected inner activity of the casks returned from the Paks Interim Spent Fuel Storage does not require opening them under water. The continuity of knowledge for the content of the casks is ensured by the same refueling organization in both facilities.			Yes	Example given is only an example.

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: Page 19 Country & Organization: Hungary / Paks II NPP Date: 15/04/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	2.3	Add a new bullet: Ensure heat removal from the core in any design basis conditions	Heat removal from the core is a fundamental safety objective, which should be reflected in the basic core management tasks			Yes	Already covered in 2.14.B.
2.	2.4.C	Add a new bullet: Stretch-out operation	Stretch-out operation is a very common operational state at the end of the operating cycles (in case of PWRs)	Yes			
3.	2.4.D	Whenever the management of fuel in the core is changed or any characteristics of the core loading patterns or fuel elements (such as the fuel enrichment, fuel element dimensions, fuel element configuration, or the fuel cladding material) are changed, new ~~core~~ safety analysis (DBC1-4) should be performed and documented to prove the fulfilment of the acceptance criteria of the fuel.	Before every new fuel loading a core loading safety assessment report shall be submitted to the regulatory body to prove that the reactor physics frame parameters are not violated. In case of a serious change in the fuel cycle, the safety analysis should be recalculated to prove that the new strategy fulfils the nuclear safety acceptance criteria. The recent wording does not specify correctly what does this "core analysis" means.	Yes	"(DBC1-4)" removed.		
4.	2.4.E	Allowance should be made to account for the effects of changes in the geometry of the assembly on neutronic and thermal-hydraulic	If by "moderator thickness" the distance between fuel rods is	Yes	Changes as: e.g., changes due to bowing of the		

		performance (e.g., changes in the moderator ~~thickness~~ flow cross-section due to bowing of the assembly).	meant, then the suggested expression is better.		assembly.		
5.	2.4 Page 15	The numbering of the section should be increased	Section 2.4 starts on page 14. The section starting on page 15 should probably be the section 2.5	Yes	Fonts, paragraph numbering, spelling, etc. will be checked and corrected by IAEA staff in the final editing process.		
6.	2.4 Page 15	Second bullet from the bottom "Validity of the safety analysis is maintained" should be deleted	The bullet does not fit the context here. It has some reference to comment No. 3. If reactor physical frame parameters are not violated, then the validity of safety analysis is maintained.	Yes			
7.	2.4 Page 15	Add a new bullet: Changes in delayed neutron fraction	Delayed neutron fraction is an important parameter for core calculations.	Yes			
8.	2.14.B	The core power should be controlled globally and locally in such a way that the peak linear heat rate of each fuel element and minimum critical heat flux ratio are kept within the appropriate limits (depending on axial position and burnup) for the operational conditions anywhere in the core	Liner heat rate limit are dependent on the axial position in the core and on the burnup	Yes			
9.	2.14.E	A new point might be inserted: 2.14.E Recriticality temperature of the core during transition from hot shutdown state to cold shutdown state should be taken into account to ensure nuclear safety.	The recriticality temperature of the core can be an important factor when the primary circuit is cooled down.	Yes	With PWRs.		
10.	2.17 Page 21	A new point should be added: (g) margin of temperature to coolant boiling/saturation temperature	In some cases, the absolute value of temperature margin to the boiling temperature is given depending on the actual channel outlet			Yes	Good comment, but for operation (TMI…).

			temperature and pressure as the limiting parameter				

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: Page 21 Country & Organization: Japan / NRA Date: 09/05/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	2.2 2nd bullet	- To provide the means to perform core management functions effectively throughout the fuel cycle in order to ensure that core parameters remain within the approved operating limits. Core management functions include: core performance monitoring (including provision of redundancy for key instruments and procedures for dealing with loss of functions); thermal- mechanical evaluation; and making fuel depletion calculations, reactivity calculations, ~~neutronic calculations~~ and thermal-hydraulic state calculations;	Duplication Neutronic calculations include both fuel depletion calculations and reactivity calculations.			Yes	No harm to keep it, broader.
2.	2.14.A /L1	A With the aim of protecting fuel against pellet-clad~~ding~~ interaction, the vendors' recommendations on the power maneuvering should be complied with or exceptions justified in safety documentation.	Unification of terminology			Yes	The standard wording of PCI is Pellet-Cladding Interaction.
3.	2.17 1st bullet	- Axial, radial and azimuthal ~~neutron flux~~ power peaking factors;	Better wording	Yes	Neutron flux or power.		

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: Page 21 Country/Organization: Poland / PGE EJ1 Date: 15/04/2019				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1	2.4.A, 2.4.B,	~~2.4A~~ 2.4, ~~2.4B~~ 2.5, ~~2.4C~~ 2.6, etc.	This is issue of new safety guide edition. The	Yes	Fonts, paragraph numbering, spelling,		

	2.4.C, 2.4.D, etc.		numeration of sections and paragraphs should be consistent and continuous. The paragraphs of safety guide should be renumbered and corrected without usage of letters. All the cross references among paragraphs should be checked for conformity after correction.		etc. will be checked and corrected by IAEA staff in the final editing process.		
2	2.4.C	2.4.C Reactor core analysis should be performed to cover the entire operating cycle for a variety of reactor operational modes and core conditions, such as:	To ensure the consistency of terminology used in documents issued by the IAEA and by nuclear industry organizations. Please consider the terminology which is used in the utility requirement document EUR Rev. E, in particular the definitions of specific "operational modes" ("power operation" – including power ranges from "hot zero power" to full power, and "hot shutdown" and "cold shutdown" modes).	Yes	But "modes" changed by "states".		
3	2.4/12	— Reactivity coefficients of temperature (for the fuel; moderator and coolant), power, pressure, boron content in coolant and void over the operating range and for anticipated transient conditions;	The reactivity coefficient of soluble absorber (boron) content in coolant is needed to calculate the soluble absorber (boron) reactivity effect (in PWRs).	Yes			

4	2.4/20	— Validity of the safety analysis is maintained;	This item is not a core parameter – it should be added somewhere as a separate sentence. Appropriate editorial correction is needed.	Yes			
5	2.4 or 2.5 or 2.6	In addition, consideration of a decrease of the fuel enthalpy safety limit for reactivity transients and accidents due to fuel burnup should be addressed somewhere. This issue is relevant to the item “Validity of the safety analysis is maintained”.	As it was demonstrated by reactivity transient tests conducted in research reactors (in particular the TRIGA reactor in Japan) the fuel enthalpy limit should be reduced accordingly for irradiated fuel along with burnup values.			Yes	Too detailed. DPP establishes the limited scope of the revision.
6	2.8.A	Where possible, validation tests should be simulated without having any prior knowledge of the experimental results but considering real input data and initial conditions for experiment to preclude any deliberate tuning of code calculations to yield better agreement with experimental results.	This is true, but only validated with benchmarking experiments and certificated codes can be accepted to be used for core management at nuclear power plants. Even if codes simulation might be preferably done without prior knowledge of the experiment results, for the code validation exact initial conditions are required to be set as input data. Otherwise even simple nonconformity of initial data, like for example – coolant temperature, set in			Yes	This is obvious and implicit. The initial text is better.

			the code simulation will result in calculated and measured results discrepancy. This issue should be clarified in the safety guide, including the requirement of only validated and certificated codes usage for core management at the nuclear power plants.				
7	2.13/15	— Core stability (considering in particular permitted core operation ranges and possible xenon transients);	In particular for BWRs power/flow maps need to be considered (to avoid unstable operational conditions), and in large cores spatial xenon transients may also occur.	Yes			
8	2.13/20	— Fission and activation products activity in the primary coolant and the off-gas system.	Activation products (activation of structural material corrosion/erosion products and coolant compounds) should be also considered.			Yes	FP activity in the primary is more a health parameter of the fuel. Activation products in primary is more related to RP.
9	2.16/1	~~Deleted (R7.21)~~	"Deleted" paragraphs should be physically removed from new issue of the safety guide and all the following paragraphs should be renumbered accordingly. This comment is valid for all "Deleted" paragraphs in the guide.	Yes	Fonts, paragraph numbering, spelling, etc. will be checked and corrected by IAEA staff in the final editing process.		

10	2.16.A/2	2.16.A Key core parameters should be monitored in the control room continuously, with more detailed measurements taken at a suitable frequency during core operation (…).	The wording "with more detailed measurements" is unclear, more specific information is needed here. Which measurements are concerned?			Yes	Text is clear enough.
11	2.17/14	— Concentrations of soluble boron or B-10 content when enriched boron is used in the coolant and/or moderator (for PWRs);	In operational states soluble boron is used in PWRs only.	Yes			
12	2.17/15	— Water level in the reactor vessel (for LWRs);	This parameter is attributable to light water reactors only.			Yes	The list mentions: "as appropriate".
13	2.17/21	— Scram time, dump valve opening time, dump time and absorber injection time ~~following each reactor trip~~;	The wording "following each reactor trip" is misleading and improper: in operational states in principle there is no need for injection of liquid absorber after reactor trip (at least initiated automatically). This is needed in accident conditions such as ATWS, and is initiated automatically in the event when control rods insertion is not available.			Yes	Comment incorrect, "as appropriate".
14	2.17/28, 30, 31	(b) fuel element cladding and matrix temperatures; (d) minimum critical power ratio (for BWRs); (e) departure from nucleate boiling ratio (for PWRs and PHWRs);	Re. (b): More specific formulation is needed to address both fuel components and temperature distributions (radial and axial). Re. (d) and (e): applicable critical heat transfer	Yes	Changes to (d) and (e) accepted. "(d) minimum critical power ratio (BWRs); (e) departure from nucleate boiling ratio (PWRs);"		

			parameters should be attributed do relevant reactor types.				
15	2.17/38	— Isotopic composition of absorbers (?) in coolant and moderator.	1) It is unclear which absorbers and which isotopic composition is considered here. It should be noted, that soluble absorbers concentration in the coolant or moderator water should be controlled and monitored. This was already stated in the paragraph 2.17. 2) It is unclear, how at operating reactor isotopic composition of absorbers in coolant and moderator can be monitored (on-line, or off-line). What equipment and instrumentation would be necessary for this absorbers isotopic composition monitoring? Proper clarification regarding absorbers isotopic composition monitoring (on-line, or off-line) at the operating nuclear power plant should be provided.			Yes	Not needed.
16	2.18/5	— The pressure vessel or pressure tubes/channels and major structural components are performing normally;	This requirement should not be attributable to vessel type reactors only			Yes	Covered by "and major structural components" in the

			but should cover also channel type reactors.				sentence.
17	2.19	2.19. The instrumentation for monitoring the relevant parameters should normally be arranged so as: — To have adequate range overlap at all power levels from the source range to full power; — To have suitable sensitivity, range and calibration for all operational states and, where appropriate, for accident conditions; — To provide non-inertial or as low inertial as applicable measurements for neutron flux and power distribution in the reactor core; — To provide reliable and adequate signal fluctuation and background noise filtering; — To provide the necessary information on the spatial variation in values of the core parameters needed for evaluation of its state; — To facilitate the evaluation of core performance and the assessment of abnormal situations by the operators.	1) Measurements inertia is a serious issue when dealing with fast reactivity effects in the reactor core. The delay of neutron flux or power distribution changes detection may provide to the accident or nuclear fuel damage. Another issue is that there might be needed a well weighted decision between the choice of non-inertial but less sensitive instrumentation, or more sensitive instrumentation but with higher inertia. 2) Signal fluctuation and background noise is another issue, for example for coolant flow rate measurement in the reactor core or for core temperature measurement by thermoelectric methods. Proper background noise and random signal fluctuation filtering as well as signal processing algorithms should be used in order to exclude operating conditions and			Yes	Too detailed.

			limits exceedances by single fluctuated signal measurement. Safety guide should be supplemented with proper clarification regarding instrumentation inertia and signal measurements fluctuation effects.				
18	2.19.B	The core maneuvering characteristics and operational conditions such as stretch-out operation should be also discussed here, or under the subtitle REACTIVITY MANAGEMENT PROGRAMME.	These issues are of practical importance, for instance maneuvering constraints at the end of fuel campaign (cycle) that impact also load following operation.			Yes	Not planned in DPP, only limited scope revision.
19	2.29	2.29. Deleted (R7.24 and R7.25)	The reason for deleting this paragraph has not been provided.			Yes	Quoting from SSR-2/2 Revision 1 removed.
20	2.37/8	The fuel history should be recorded in order to consider all relevant aspects of fuel performance, such as: … — Nuclide inventory (?)	It is unclear what is considered here as fuel “Nuclide inventory” historical records and how nuclear fuel nuclide inventory can be monitored and recorded. Only fresh fuel initial nuclide inventory (isotopic composition) are known. There are no technical methods and technical means to monitor fuel nuclide inventory changes during fuel burnup in the reactor core. Nuclide inventory of	Yes			

			unloaded spent fuel can be determined by destructive or nondestructive methods only at specialized nuclear research laboratories, but not at nuclear power plants itself. Only calculation methods can be used to evaluate fuel nuclear inventory changes during fuel burnup, but: a) information about fuel nuclear inventory does not belong to operatively monitored and/or on-line controlled parameter; b) since this parameter is obtained by calculation methods there is no need to perform continuous historical recordings of nuclear inventory changes in the fuel as this parameter can be obtained at any time on request for any nuclear fuel operational moment or burnup level. Only historical recordings of input parameters for nuclear inventory calculations such as fuel operating history, burnup history, neutron flux and				

			burnup axial distribution history are necessary. But this was already mentioned in paragraph 3.37 Proper clarification regarding fuel nuclear inventory monitoring and nuclear inventory changes history recording should be provided in the guide.				
21	2.41	~~Experimental f~~Feedback from nuclear fuel designer and producer regarding experimental, ~~and~~ research and development programmes covering power ramp tests, reactivity initiated accident tests and loss of coolant accident tests (analytical or global) should be taken into consideration to demonstrate the behaviour of fuel of new designs under normal and accident conditions.	Performing such experiments covering power ramp tests, reactivity initiated accident test, loss of coolant tests, etc. is not the responsibility of nuclear power plant operator. Operator might not possess such information for new nuclear fuel designs. Nuclear fuel designer and producer is responsible for performing mentioned above tests, research and provision of all the necessary information for nuclear power plant operator. Proper clarification who is responsible for such test performance should be added in the guide.			Yes	We kept the original text because it is not written that the operators have to conduct such tests; they have to be done, full stop.
22	REFUEL	No provisions specifically related to the	The introduction of MOX			Yes	Not in this

	LING PROGRAMME	implications of the use of MOX fuel have been provided in this safety guide.	fuel may result in significant changes of core characteristics. Relevant precautions and limitations need to be addressed. The only mention on MOX fuel issue is in para. 3.2.A – but this is only in the context of fresh fuel handling and storage.				paragraph about "Handling fresh fuel" §1.3 modified as follows: "This Safety Guide deals with fuel management for all types of land based stationary nuclear power plants equipped with a thermal reactor, using all types of relevant fuel (including fuel with reprocessed materials)."
23	2.43/1	There should be strict control of ~~core discharge~~ fuel load, unload, reload, shuffle or on-load refueling operations…	1) Inappropriate term "core discharge" is used. According to IAEA glossary term "discharge" means: *"Planned and controlled release of (usually gaseous or liquid) radioactive substances to the environment"* For nuclear fuel removal from the reactor core operations the term "fuel unloading" is used. 2) Initial fuel load operations or fuel load after reactor vessel and core components refurbishment should be	Yes	There should be strict control of core ~~discharge~~ unloading, ~~re~~loading, shuffling or on-load refueling operations…		

			same strict controlled (see paragraph 4.5).				
24	2.43/2	"… and all core alterations should comply with predicted configurations."	This wording in unclear, "predicted configurations" need to be explained (when/where predicted? In the SAR?). How, and to what extent, core alternations are to comply with certain predicted configurations?			Yes	Predicted = expected by the established core map.
25	2.46/31	… (these necessitate consideration of control rod and absorber configurations, fuel burnup, neutron flux distribution and depletion of neutron absorbers);	Editorial: the closing bracket is missing.	Yes			
26	2.46/23	2.46. The aspects that should be considered in the establishment and use of a refuelling programme should include, as appropriate: … — Positioning of ~~unirradiated~~ fresh and irradiated fuel in the core, ~~its~~ fuel initial enrichment and burnable neutron absorber ~~levels~~ concentration as well as irradiated fuel burnup level being taken into consideration;	The remaining enrichment and remaining burnable neutron absorber levels in the irradiated fuel is unknown so cannot be directly taken into account during nuclear fuel positioning in the reactor core. Instead of these parameters for irradiated fuel nuclear fuel burnup level is considered, which can be directly estimated depending on fuel assembly power production. Nuclear fuel burnup level might be used as an input data for further irradiated fuel nuclear inventory, including remaining U^{235}			Yes	Comment partially incorrect. Existing text is good enough.

			enrichment and burnable absorber concentration calculations and relevant parameters dependences from fuel burnup level can be prepared in advance. Proper clarification should be provided in the guide how irradiated fuel enrichment and burnable absorber concentration can be used and considered for positioning irradiated fuel in the reactor core.				
27	2.6/3	— Variation in the reactivity worth of control rods due to irradiation, effects coolant/moderator temperature and boron content in coolant changes;	In LWRs the reactivity worth of control rods depend also on coolant/moderator temperature. For PWRs additionally the changes of dissolved boron content have a significant impact on the reactivity worth of control rods.	Yes	— Variation in the reactivity worth of control rods due to irradiation, temperature effects and boron concentration changes (PWRs);		
28	3.5	~~3.5.~~ 3.18 (?) Any fuel suspected of being damaged during handling or storage should be additionaly inspected and, if necessary, treated in accordance with the established procedures relating to damaged fuel (see paragraph 3.17).	Paragraph 3.5 is the first paragraph in section 3 where necessity of fuel inspections is mentioned. Problem is that paragraph 3.5 requires to perform inspection only for the fuel what is suspected of being damaged. But first of all, any fresh	Yes			

			fuel received at NPP shall be inspected after transportation (see paragraph 3.15). All the rest inspections, including if damage are suspected during handling or storage operations, are additional and subsequent. Due to this it is suggested to reconsider the place of the paragraph 3.5 in the guide, for example move it after referred paragraph 3.17 or any other relevant paragraph. To keep consistency of the guide first of all the description of fresh fuel inspections for all fuel assemblies (bundles) after fresh fuel reception at the nuclear power plant should be provided.				
29	3.11-3.12	3.11. The equipment used to check the physical dimensions of the fuel… ________________ 3.12. Emergency operating procedures and necessary equipment…	The purpose of the paragraph 3.11 and 3.12 dividing line is unclear. These paragraphs separating line should be deleted or new subsection title inserted instead of empty line.	Yes	There is no dividing line in the final version without track changes.		
30	3.18/3	Inspectors should identify any foreign material already present in the fuel and should remove it (?).	This foreign material might be a metal shavings stuck between fuel rods in distancing grattings and	Yes	See also German comment 26.		

			any attempt to remove it might damage fuel rods cladding. Proper clarification how to remove stuck foreign material and who should do that (who's personnel – operators or fuel suppliers) considering that this defect was detected during delivered fresh fuel inspection and fuel with defects can't be accepted from supplier.				
31	4.3/1	Reliable two-way[3] communication should be available at all times between the fuel handling staff and the control room staff.	There is a reference to missing footnote 3. Proper clarification / footnote regarding meaning of "two-way communication" should be provided. Also, it should be noted, that IAEA Safety Guide "Conduct of Operations at Nuclear Power Plants", NS-G-2.14, IAEA 2008 in order to reduce the likelihood of error in verbal communication recommends to use three-way communication. Proper clarification regarding alignment between various IAEA safety guide recommendations should	Yes	Two-way communication is correct in this particular case. Ghost reference to footnote removed.		

			be provided.				
32	4.5/3	"…the refuelling plans and the quality ~~assurance~~ management procedures referred to earlier in this section (?) should still be followed."	1) There is no any quality assurance procedures mentioned or referred earlier no in section 4, no in any other guide section prior to section 4. The correct reference should be provided for quality assurance (quality management) procedures, or missing clarification and definition regarding "quality assurance procedures" should be provided prior to paragraph 4.5. 2) According to IAEA glossary the term "quality assurance" is outdated and should be replaced by new term "quality management" or "management system": *"The terms quality management and management system have been adopted in the revised standards in place of the terms quality assurance and quality assurance programme"* The term "quality assurance" should be replaced by adopted new standard in the entire	Yes	QA replaced by QM (in all guides).		

			document. **This applies to the paragraphs 4.5, 4.7, 5.11, 8.2 and 8.8**				
33	4.5/8-9	Procedures, including documented procedures (?), should be followed to ensure that all unnecessary material has been removed from the reactor vessel before it is closed.	It is unclear what is mean by "including documented procedures" here. All the procedures should be documented. There can't be any verbal undocumented procedures at nuclear power plant. Maybe the operation "check lists" which might be the part of procedures was considered here? Proper clarification regarding "documented procedures" should be provided, as well as any explanation regarding usage of "undocumented procedures" should be provided in the quide.	Yes	Remove including documented procedures.		
34	4.5, 4.6	~~4.5~~ 4.6 … ~~4.6~~ 4.5 …	Editorial remark. It is proposed to replace the order of paragraphs 4.5 and 4.6. Paragraph 4.5 is related to the actions necessary to perform before fuel loading and reactor vessel closure, meanwhile paragraph 4.6 talks about personal training and refueling machine tests	Yes	Fonts, paragraph numbering, spelling, etc. will be checked and corrected by IAEA staff in the final editing process.		

			before fuel loading. Simple sequence of actions implies that actions mentioned in paragraph 4.5 cannot be done before actions described in paragraph 4.6 will be done.				
35	4.12/3	The identification of the fuel assemblies or core components should be checked against the provisions of the refuelling plan whenever practicable, during or following ~~discharge of~~ fuel removal from the core.	Inappropriate term "discharge" is used (see comment for paragraph 2.43/1) **The term "discharge" should be replaced by term "unload" or "removal" in the entire safety guide (see paragraphs 2.3, 2.43, 4.19, 4.20, 6.8)**.	Yes	During or following ~~discharge of~~ fuel unloading from the core.		
36	4.18	For off-load refuelled reactors, as well as for refueling on-load refueled reactors during shutdown period after maintenance prerequisites for ensuring that a critical configuration is not formed during fuel loading, such as nuclear startup instrumentation and protection system interlocks, should be checked before and, as appropriate, during the loading process. This is particularly important during the first core loading as for off-load refueled reactors as for on-load refueled reactors.	This requirement has the same importance for on-load refueled reactors as it has for off-load refueled reactors. During on-load refueled reactors core refurbishment maintenance a significant part of the nuclear fuel might be unloaded from the reactor core. Even if after the end of the core refurbishment nuclear fuel is loaded back in the core at the same positions, part of the	Yes	For better clarity, following sentence added at the end of the paragraph: "This is also applicable to on-load refueled reactors during shutdown period after maintenance."		

			burned out and all failed or damaged fuel assemblies will be replaced either by fresh fuel or by partially burned fuel unloaded at previous campaigns. This require the same prerequisites for ensuring that a critical configuration is not formed during fuel loading, including initial core load for on-load refueled reactors. Proper clarification should be added in the safety guide, or usage of the term “off-load refueled reactors” should be revised that it would be clear that requirement talks about the refueling operation at shutdown conditions, but not about the reactor type. **Same comment is valid for paragraph 4.19**				
37	4.18.B	Under abnormal fuel handling conditions, an urgent need may arise for defeating interlocks… An independent safety review of such actions should be performed before ~~suchthese~~ mentioned abnormal operations are commenced.	1) Editorial mistake “suchthese”. 2) It is unclear who and when should perform independent safety review of overriding of automatic safety systems and overload of interlocks if	Yes	"before ~~suchthese~~ these abnormal" (only typo corrected).		

			under abnormal conditions this might require urgent need to defeat interlocks. There might be simple no time for safety analysis and more over for independent safety review of proposed actions. Unless all the potential abnormal occurrences during fuel handling operations are predicted and analyzed in advance in the safety report. But is it possible to predict everything? Proper clarification regarding this issue with urgent actions and independent safety review before these actions can be applied should be provided in the safety guide.				
38	4.19	The following are examples of specific issues which should be taken into consideration ~~for reactors that are refuelled off-load~~ during refueling operations at the reactor core in shutdown condition. — Measures for radiological protection and supervision during the refuelling process should be established; — Containment or confinement integrity	1) See comment for paragraph 4.18 regarding inappropriate and misleading usage of the term "off-load refueled reactors". Practically all the specific issues mentioned in paragraph 4.19 for "off-line refueled reactors" except with boron	Yes	… ~~for reactors that are refuelled off-load~~ during refueling operations with reactor core in shutdown condition.		

		should be as specified for refuelling; — Air cleaning systems should be operable as specified; — A reliable power source should be available; …	concentration and water level above the vessel control are applicable and for "on-load refueled reactors" refueled during maintenance shutdown periods. Proper clarification should be provided in the guide or requirement should be written such a way, that it would be clear that it talks about the refueling operation at shutdown conditions, but not about the reactor type. 2) Part of the issues mentioned in paragraph 4.19 like radiological protection and supervision, air cleaning, reliable power source, etc. are also applicable to "on-load refueled reactors" refueling operations on load and **should be mentioned or referred in paragraph 4.20**				
39	5.11/4	In particular, conformance with approved configurations, with the requirements for permanently fixed and/or integrated solid neutron absorbers in the storage facility and, where appropriate, with the maximum capacity is necessary. ~~Specified neutron absorbers may be fixed absorbers or, for pool storage, boron in the water~~	High level comment Usage of soluble neutron absorbers, including boron, in spent fuel pool/storage water **are unacceptable and breach nuclear safety concept**.	Yes	5.11. In particular, conformance with approved configurations, with the requirements for neutron absorbers in the storage facility and, where appropriate, with the		

			The required level of sub-criticality for spent fuel pools shall be ensured exclusively by fuel racks geometry for maximal reactivity conditions depending from optimal water density. Only usage of solid neutron absorbers, permanently fixed and/or integrated in the racks or pool construction elements, might be acceptable if it is ensured that this neutron absorbers can't be removed during storage of spent fuel in the pool. The safety justification of the attempt to legalize allowance of the soluble neutron absorbers usage in spent fuel pool/storage water to ensure required level of sub-criticality is unknown and contradicts with historical nuclear safety practice.		maximum capacity is necessary. Specified neutron absorbers ~~may~~ should be fixed absorbers or, for pool storage, complemented by boron in the water.		
40	5.14/7, 14	For wet storage in water pools, water conditions should be maintained in accordance with specified values… so as: … ~~To avoid boron crystallization by maintaining pool temperatures above a minimum level;~~	High level comment Usage of soluble neutron absorbers, including boron, in spent fuel pool/storage water **are unacceptable and breach nuclear safety concept** (see comment for			Yes	Use of soluble boron in water is used to complement other fixed absorbers.

		… ~~— To prevent boron dilution in pools where soluble boron is used for criticality control.~~	paragraph 5.11). Soluble boron shall not be used for criticality control in spend fuel pools/storages at any normal operation conditions. Usage of soluble boron might be allowed as a temporally measure only in accident conditions, then spent fuel storage rack geometry is damaged or unknown. The safety justification of the attempt to legalize allowance of the soluble neutron absorbers usage in spent fuel pool/storage water for criticality control is unknown and contradicts with historical nuclear safety practice, including accidents with uncontrolled and undetected boron dilutions at nuclear facilities. 2nd and 5th listed items shall be removed from paragraph 5.14.				
41	5.18/1	For dry storage or storage under liquids other than water, (?) appropriate safety procedures should be established.	Clarification and explanation should be provided regarding which liquids other than water could be used for spent fuel wet storage.			Yes	Original text kept.

			It should be noted, that usage of borated water or water with other soluble neutron absorbers content shall be forbidden in spent fuel pools/storages.				
42	5.19/1	For ~~some reactor types, such as PWRs,~~ light water reactors it is important for safety purposes to retain sufficient capacity in the storage facility for irradiated fuel to accommodate the fuel inventory of the reactor and one full set of control rods at any given time (see Ref.[15]).	This is same important for BWRs as it is same important for PWRs. Even if most currently operated BWR has insufficient spent fuel pools capacities next to the reactor vessel to fulfill this recommendation, such recommendation for BWRs should be taken into account for any future BWR design. Also, since Ref.[15] is marked as “under revision” it is proposed to comply Ref[15] with proposed new redaction of paragraph 5.19 regarding BWRs.	Yes	For some reactor types, it is important for safety…		
43	5.23/2	Appropriate space should be provided to carry out the required inspection, identification, dismantling and reconstitution of fuel, <u>including burnup measurements</u>, (?) where necessary.	It is unclear how irradiated fuel burnup, or fuel assemblies axial distribution of burnup can be measured at nuclear power plant. There is no technical means for direct burnup level measurement at nuclear power plants.	Yes	Appropriate space should be provided to carry out the required inspection, identification, dismantling and reconstitution of fuel, if necessary.		

			What can be actually measured is irradiated fuel activity, based on which burnup level might be confirmed by comparing with estimated benchmarking burnup-activity relations. Proper clarification or note should be added in the guide regarding burnup measurements at nuclear power plants.				

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: Rogatov D., Sviridov D. Country & Organization: Russian Federation / SEC NRS			Page 45 Date: 29/04/2019	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	Add after 2.4.C	2.4.D. Safety analysis should be performed not only for the operational states of the reactor core within the nominal technological parameters but also within the area limited by safety limits. In particular, it should be shown that when the reactor is operated at a power level corresponding to the safety limit for thermal power for all accidents taken into account in the design of the installation, any radiological consequences would be below the relevant limits and would be kept as low as reasonably achievable. This may be also applied to other parameters such as axial offset, power-core rated flow, coolant activity for which safety limits are set. (Renumber the following items: 2.4.E, 2.4.F)	According to the IAEA Safety Glossary safety limits are the limits on operational parameters within which an authorized facility has been shown to be safe.			Yes	This is out of the scope of the DPP.
2.	2.4.E Line 4	For light water reactors (LWRS) fuel element performance analysis should take into	These characteristics have a great influence on the	Yes	"Fuel element performance analysis		

	Add after the words “all operational states.”	account the power and burnup distributions along the radius of fuel pellet as well as the RIM-effect.	temperature of the fuel and the reliability of the fuel element.		should take into account the power and burnup distributions along the radius of fuel pellet." There is no consensus that the RIM-effect (radiation damage to the fuel pellet microstructure) degrades the fuel performances. Some research results concludes that in some cases it improves the fuel performances.		
3.	2.46 Add another aspect	— Changes in the radiation characteristics of fuel assemblies, absorbing rods and neutron sources after irradiation in the reactor core.	This is important to ensure radiation safety during reloading.	Yes			
4.	3.2.A Line 1. Add in brackets	(MOX, recycled uranium fuel)	Recycled uranium fuel can also have a higher radiation level.	Yes			

COMMENTS BY REVIEWER **Guide: NS-G-2.5** Reviewer: Muhammad Rizwan, Obaidur Rehman Country & Organization: Pakistan / PAEC / K-2-K-3 project			Page 46 Date: 26/06/2019 Deadline: 31/05/2109	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for rejection
1.	2.46	Depletion of neutron absorbers in control rods of burnable absorbers and replacement with fresh control rod if required due to ageing.	Control rods have a certain life and should be replaced accordingly.			Yes	Already included in paragraphs 2.2 and 2.46.

2.	2.53	Add a line as "Arrange trainings for familiarization of FME programme".	Trained plant personnel can effectively participate in implementation of FME programme.			Yes	Already included in NS-G-2.6 and NS-G-2.8.
3.	4.16	Add this text: "All racks should be examined before placing unloaded / fresh fuel assembly in a rack to avoid any damage if the allocated rack already contains a fuel assembly".	It may be happened due to any error in fuel management record.	Yes	Before the rack locations in the storage facility receive unloaded and fresh fuel, they should be examined if it is suspected that there could be damage which could affect the integrity of the fuel or if the allocated rack already contains a fuel assembly or any core component, such as control rods.		
4.	4.10	A para may be added under heading "Unloading fuel core components" as "Verify control rods are completely disconnected with drive shafts with the aid of underwater visual inspection during lifting of upper internals".	It is the OEF of many plants in the world that control rods come with upper internals during their lifting.	Yes	4.11.A added as: "Before starting to unload the reactor, the complete disconnection during lifting of upper internals with control rods and fuel assemblies should be undertaken with the aid of underwater visual inspection".		
5.	5	Guidelines may be added for securing fuel in core and spent fuel when corrective maintenance have to perform during loading/unloading of fuel assemblies.	Fuel is vulnerable when corrective maintenance has to perform during loading/unloading.			Yes	Section 5 quite comprehensive in this regard, e.g. paragraph 5.15
6.	5	Guidelines may be added for repair of spent fuel pool liner in the presence of irradiated	Fuel cooling and cleaning and radiation workers are			Yes	To specific case even so it could happen.

		fuel in pool.	at risk when repair of steel liner irradiated fuel in pool has to perform.				
7.	3.11 4.18.B 4.9	Formatting, spelling and page numbering mistakes may be corrected on mentioned paras and after page 55.		Yes	Fonts, paragraph numbering, spelling, etc. will be checked and corrected by IAEA staff in the final editing process.		
8.	2.19	To have adequate range overlap between source range and intermediate range detectors, and between intermediated range and power range detectors at all power level.	Elaborating of overlapping of whole three detectors (Source range, Intermediate range and Power range was not clearly mentioned).			Yes	Original text clear, not necessary to add such details.