DS488 Design of the Reactor Core for Nuclear Power Plants

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	Canada	1	General		There appears to be no correlation between the paragraph numbering in SSR-2/1 and DS488 which is the guide for SSR-2/1				Requirements and closures in SSR-2/1 are referenced in DS488 as necessary.
2	Canada	2	General	Suggest to add "Glossary"	To clarify terminologies stated in this document, need "glossary"			X	Specific terms that are not defined in the IAEA Safety Glossary document but used in this Safety Guide are clarified in Annex II.
3	Germany	0	General		We did not find requirements with regard to "anticipated transients without scram, ATWS" (conditions which should be categorized as design extension conditions without significant fuel degradation). The related core design requirements (inherent neutronic feedbacks) and acceptance criteria should be added.			X	Design limits for DECs without significant fuel degradation are described in paras 3.54-3.59 of the current Safety Guide. These are general ones and apply to all accident scenarios categorized by DECs without significant fuel degradation (including ATWS) as well as DBAs. Analysis methods for DECs without significant fuel

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
									degradation and DBAs may not be the same each other, and are described in DS491 [Ref [5]].
4	Iran	1	General	It is suggested that a brief history to the reactor core design development and generation be added to the document as a separate section or annex.				X	Design description, technical description or design solution is out of the scope of IAEA Safety Guides.
5	Iran	2	General	It is suggested that valid simulation programs and codes for the reactor core design safety analysis, shall be defined in a separate annex.				X	Design description, technical description or design solution is out of the scope of IAEA Safety Guides.
6	Iran	3	General	It is recommended that a section related to neutronic and thermo-hydraulic parameters which lead to reactor trip shall be added.				X	This is out of the scope of this Safety Guide.
7	Iran	4	General	The other important neutronic parameters such as excess reactivity shutdown margin, power defect and temperature defect shall be considered for design of reactor core.				X	Typical nuclear key safety parameters are listed in para. 3.13. Bullet (a) includes temperature defect and power defect. Bullet (c) includes excess reactivity shutdown margin. Not necessary to describe in detail further.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
8	Iran	5	General	It is recommended that the following appendices in the previous version be added in the new one: 1. Reactivity coefficients 2. Fuel pellet-cladding interaction 3. Design consideration for core management 3.1. Key parameters for core design 4. High burnup fuel cores					Recommendations in appendices of the previous version are captured at various places in the main text and Annex II of this safety Guide as appropriate and as necessary. For example, Annex II, reactivity feedbacks are from Appendix I of the previous version.
9	Iran	6	General	It is suggested that decommissioning requirements and consideration which shall be considered in the reactor core design and material selection stages shall be added to this document as a new section. These requirements should include the following items: a. Easy dismounting, replacement and isolation of systems, b. Minimum interdependencies of systems, c. Facilitating decommissioning of systems, d. Select materials with minimum production				X	Decommissioning requirement is irrelevant to the reactor core design.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				of half-life radioisotopes and hazards against radiation, e. Space and handling requirements, f. Costs and personnel doses reduction requirement, g. Biological shield dismantling method requirement.					
10	Iran	7	General	A chart related to all design steps and methods of referring to documents and different standards shall be presented.				X	Design description, technical description or design solution is out of the scope of IAEA Safety Guides.
11	Iran	8	General	Considering lack of technologies such as fuel production technologies in some countries which are members of agency, parts and section related to tests and quality assurance shall be described more accurate.				X	Recommended fuel qualification tests are listed in paras 4.7-4.10. Testing methods and acceptance criteria are out of the scope of Safety Guide since they are considered as design solutions. Overview of design quality assurance is presented in para. 2.1. Detailed recommendations for QA are out of

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
									the scope of this safety Guide.
12	Japan	1	CONTENTS, subtitle	~~DESGN~~ DESIGN FOR SAFE OPERATION	Typo.	X			
13	USA	1	1.4 /2	The reactor core consists of ~~four~~ five basic systems and components (i.e. fuel, fuel assemblies, coolant, moderator, and control rods)	The fuel is held within the fuel rods and is constructed differently depending on reactor type.		The reactor core consists of four basic systems and components, i.e. fuel (including fuel rods and fuel assembly structure), coolant, moderator, and control rods) ….and control rods, ….		The term “fuel” is clarified by adding explanation that fuel implicitly includes both fuel rods and fuel assembly structure.
14	Switzer-land	1	1.4. (a) and many other instances	Fuel rods or fuel pins instead of fuel elements	At least for German speaking people, “fuel element”, verbally translated “Brennelement”, means “fuel assembly”. Even though “fuel element” is used in many other IAEA documents in the same way, it might be time to change to a term that is generally applied by everybody else.	X			Replaced “fuel element” to “fuel rod” throughout this Safety Guide.
15	France	1	1.4d	Calandria	Editorial	X			
16	USA	2	1.4(d), line 2	“(within the ~~Caladria~~ Calandria…”	This is a spelling error.	X			
17	Turkey	1	1.4/20	(within the **Calandria** in pressurized heavy water reactors), the structure for	Typo.	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				guiding the					
18	Germany	1	1.4 (d)	… and guide tubes for reactivity control devices (for pressurized water reactors);	Guide tubes in the fuel assemblies only exist for the PWR and not for BWR	X			
19	Turkey	2	1.8/7	Section 4 describes guidance on qualification and testing for the ~~core~~ structures, systems and		X			
20	Turkey	3	2.3/1 and subtitle above	**Satisfactory** design based on the concept of defence in depth 2.3. **Satisfactory** design (i.e., capable, reliable and robust design) of the reactor core, based on	Better expression			X	"Adequacy" or "adequate" is used in SSR-2/1.
21	Finland	1	2.4	… For normal operation and anticipated operational occurrences, fuel elements are required to be designed to maintain their structural integrity and a leaktight barrier (see Annex II for terminology clarification) to prevent fission product transport into the coolant (Requirement 43 of Ref. [1]).	The used term "are required to maintain" has a nuance of meaning when compared to the term "shall be designed to maintain" used in SSR-2/1		…. , fuel rods are required to be designed such that their structural integrity and a leaktight barrier (see Annex II, Cladding, for terminology clarification) are maintained to prevent ….		.
22	France	2	2.4	For design basis accidents and design extension conditions without significant fuel degradation, the reactor core is required to be coolable (Requirement 44 of Ref. [1]) and no significant fuel dispersal should occur.	Cf comment on article 3.25.		For design basis accidents and design extension conditions without significant fuel degradation, the reactor core is required to maintain a configuration such		Close to Comment #27 (Germany #2). Note: Significant fuel dispersal is only an example of events that could lead to loss of

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							that it can be shut down and remain coolable (derived from Requirement 44 of. [1]).		coolability and is not fully compatible with "without significant fuel degradation" statement.
23	Iran	14	2.4/1-3	The adequate design of the reactor core, based on the defense in depth, is 'fuel matrix, fuel cladding, reactor pressure vessel and containment. In this document the containment is not mentioned.	In safety series of atomic agency document.			X	Reactor core design is not affected by the containment. Para. 2.25 states that impact of hydrogen accumulation on the RCS boundary is considered for the core safety analysis. Note: Indeed inputs for the containment design are derived from the core behavior.
24	Russia	1	2.4/4	Physical barriers considered as part of or affecting the design of the reactor core include the fuel matrix (see Annex II for terminology clarification), the fuel cladding the primary heat transport.	Third physical barrier stopping radioactive material spreading after damage to fuel cladding is a whole of primary heat transport system – not only the pressure vessel. It is true for all reactor types.		Physical barriers considered as part of or affecting the design of the reactor core include the fuel matrix (see Annex II for terminology clarification), the fuel cladding and the boundary of the reactor coolant system.		See INSAG-10 for physical barriers.
25	Turkey	4	2.4/6	Barrier**, in accordance with the fuel design limits**, (see	Better expression. For NO and AOOs, structural		For normal operation and anticipated		Close to Comment #21 (Finland #1)

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				Annex II for terminology clarification) to prevent fission product transport into	integrity and leaktightness requirement for fuel elements is not absolute, some relaxation is permitted and quantified among fuel design limits.		operational occurrences, fuel rods are required to be designed such that their structural integrity and a leaktight barrier (see Annex II for terminology clarification) are maintained to prevent fission product transport into the coolant (Requirement 43 of [1]).		and Comment #29 (Japan #12).
26	France	3	2.4	Delete "the fuel matrix"	The fuel matrix is not considered as a physical barrier in France.			X	See INSAG-10 for physical barriers.
27	Germany	2	2.4, last sentence	(…) For design basis accidents and design extension conditions without significant fuel degradation, the reactor core is required to be coolable (Requirement 44 of Ref. [1]) <u>and to remain a configuration that can be shutdown</u>.	It may be implicitly the case, that a coolable core can also be shut-down safely, but this should explicitly be required. Or, it should be stated elsewhere, that coolable includes "able to be shut-down". See also para. 3.25 and 3.44		For design basis accidents and design extension conditions without significant fuel degradation, the reactor core is required to maintain a configuration such that it can be shut down and remain coolable (derived from Requirement 44 of [1]**Error! Reference source not found.**).		The suggested statement is reordered to have "shutdown" first and then "remain coolable".
28	Turkey	5	2.4/8	conditions without significant	Better compliance with		For design basis		Close to Comment

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				fuel degradation, the reactor core is required **to permit insertion of control rods and** be coolable	Requirement 44 of SSR-2/1 Rev 1.		accidents and design extension conditions without significant fuel degradation, the reactor core is required to maintain a configuration such that it can be shut down and remain coolable for both short term and long term (derived from Requirement 44 of [1]).		#27 (Germany #2).
29	Japan	12	Para 2.4/Line 5	fuel elements are required to be designed to maintain their structural integrity and a leaktight barrier…	The original texts give wrong impression that any leakage is not allowed in the operation. Leaktightness is a design requirement, but not an operational requirement. A certain level of leakage is accepted and managed as described in the section titled "Reactor operation with leaking fuel elements" on page 34.		…. fuel rods are required to be designed such that their structural integrity and a leaktight barrier (see Annex II, Cladding, for terminology clarification) are maintained to prevent ….		
30	Turkey	6	2.5/4 and throughout the text	applicable codes and standards (as indicated in paras §4.14 and 4.16 of Ref. [1]).	No such word as 'paras". Suggest to indicate paragraphs with a symbol like "§" (as in DS491)			X	Technical editing will be conducted.
31	Turkey	7	2.8/3	plant states (see §2.9) in order to meet the specific acceptance criteria.	Clearer expression if connection made with the definition of "applicable plant states".	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
32	France	4	2.9	Design extension conditions with core melt are not out of the scope of the reactor core design.	Severe accidents have to be taken into account now for the core design			X	Close to Comment #112 (France #25) - Only incipient melting of the fuel rod centerline is considered for DBAs and DECs without significant fuel degradation in this safety guide (refer to para. 3.28). Note that practical elimination of the core melt is dealt with in other Safety guide that is associated with reactor cooling systems.
33	Iran	15	2.9/3	It is suggested to use the “Beyond Design Basis Accident” in order to “design extension condition without significant fuel degradation”.	In most of the technical and safety documents.			X	See IAEA Safety Glossary for terminology.
34	Iran	16	2. 9	It is suggested to add the “severe accident” state in to all applicable plant states”.				X	Close to Comment #32 (France #4). Severe accidents indicate design extension conditions with the core melt. This is out of the scope of this Safety

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
									Guide as stated in para. 2.9.
35	Germany	3	2.11	Consequences of ~~earthquake~~ external hazards, especially earthquakes, should be taken into account…	Shouldn't "External Hazards" also include airplane crash and Tsunami??			X	Only earthquake is considered for the design of the reactor core. Other external hazards such as airplane crash and tsunami are considered in the design and layout of the reactor building.
36	Turkey	8	2.11/all	2.11. Consequences of earthquake **and aircraft crash** should be taken into account in the design of the reactor core. Seismic categorization of the structures, systems and components of the reactor core should be determined according to Ref.[8]. **Guidance on design against aircraft crash is provided in NS-G-1.15**.	Aircraft crash can also have an effect on reactor core. Reference to the relevant Safety Guide is added (to be included in the list at the end of the main text and referenced here accordingly).			X	Close to Comment #35 (Germany #3). Only earthquake is considered for the design of the reactor core. Other external hazards such as airplane crash and tsunami are considered in the design and layout of the reactor building.
37	Hungary	Page 2, 1	2.11	Consequences of earthquake and heavy aircraft crash should be taken into account in the design of the reactor core.	It is requested by most of the regulators and also by EUR to include the heavy aircraft crash as a postulated external hazard in the design. Although, the acceptance criteria set for design			X	Close to Comment #35 (Germany #3). Only earthquake is considered for the design of the reactor core. Other external

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
					extension conditions to be met.				hazards such as airplane crash and tsunami are considered in the design and layout of the reactor building.
38	Hungary	Page 2, 2	2.13-2.16.	Safety classification aspects of the reactor core.	This chapter could give more guidance upon the safety classification of SSCs other than fuel and control rode such as reactor internals and core support for example.			X	Ref [10] provides classification methods. Fuel and control rods are those related to physical barriers affecting the fundamental safety functions, and thus their safety classifications are stated in this Safety Guide. Safety classifications for other core components may be different from MS to MS, and therefore they should be determined according to [10] as stated in this safety Guide.
39	Japan	13	Para 2.14/Line 2	The design of fuel elements should assure the leaktightness and structural integrity to maintain …			Fuel rods and fuel assemblies should be identified as Safety Class 1 in Ref. [10], the highest safety		The commented sentence is deleted since it is a duplication of a sentence for

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							class, since they are essential to achieve the three fundamental safety functions in para. 2.2.		physical barriers in para. 2.4. A modified text (heighted yellow) is proposed.
40	Switzer-land	3	2.14./2nd sentence	Leaktightness and structural integrity … are required to prevent radioactive material from being spread.	Clumsy formulation		Fuel rods and fuel assemblies should be identified as Safety Class 1 in Ref. [10], the highest safety class, since they are essential to achieve the three fundamental safety functions in para. 2.2.		The commented sentence is deleted since it is a duplication of a sentence for physical barriers in para. 2.4. A modified text (heighted yellow) is proposed.
41	Turkey	9	2.14/3	maintain these barriers **(specifically the fuel matrix and the cladding)** to the release of radioactive materials. Structural integrity of fuel	Better expression		Fuel rods and fuel assemblies should be identified as Safety Class 1 in Ref. [10], the highest safety class, since they are essential to achieve the three fundamental safety functions in para. 2.2.		The commented sentence is deleted since it is a duplication of a sentence for physical barriers in para. 2.4. A modified text (heighted yellow) is proposed.
42	Germany	4	2.14, last sentence	(…) Structural integrity of fuel assemblies is required to maintain geometry compatible with design basis,	Clarification to exclude severe accidents.		Fuel rods and fuel assemblies should be identified as Safety Class 1 in Ref. [10],		The commented sentence is deleted since it is a duplication of a

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				in particular, to ensure a coolable geometry during DBA and DEC without core melt~~accidents~~, a geometry that can also be shutdown safely.	It may be implicitly the case, that a coolable core can also be shut-down safely, but this should explicitly be required. Or, it should be stated elsewhere, that coolable includes "able to be shut-down". See also para. 3.25 and 3.44		the highest safety class, since they are essential to achieve the three fundamental safety functions in para. 2.2.		sentence for physical barriers in para. 2.4. A modified text (heighted yellow) is proposed. The comment on "geometry for safe shutdown" is addressed in para. 2.4 - Close to Comment #27 (Germany #2).
43	Turkey	10	Subtitle above 2.17	Engineering design **rules**	Typo.	X			
44	Turkey	11	Subtitle above 2.20	**DESIGN** FOR SAFE OPERATION	Typo.	X			
45	Japan	2	2.20. subtitle	~~DESGN~~ DESIGN FOR SAFE OPERATION	Typo.	X			
46	France	5	2.20	Delete required					
47	Hungary	Page 3, 1	2.20	DESIGN FOR SAFE OPERATION	typing mistake	X			
48	France	6	Between 2.19 and 2.20	DESIGN FOR SAFE OPERATION	Editorial	X			
49	France	7	2.21	The design of the reactor core should be reviewed and modified when a significant configuration change occurs during the plant's operating lifetime, as a result of, for	Thermalhydraulic performance is 'spacer' dependent, therefore change in the spacer should be explicitly mentioned here		New (b) New fuel type or significant changes in fuel types (e.g., use of mixed-oxide or gadolinium fuel; new fuel rods or		The original bullet (a) is modified to be consistent with the original 2nd paragraph of para. 3.13, and also

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				example: (a) A significant change in fuel types (e.g., mixed-oxide fuel, design of the spacers, …)			new fuel assembly designs with modified geometrical or thermal hydraulic characteristics);		extended to address the comment statement (highlighted yellow). The resultant modified bullet (a) is now designated as bullet (b) in the revised para. 2.21.
50	France	8	2.21	(d) An increase in the rated power of the plant; ~~and~~ (e) A significant change in the operating domain (f) …	The list should be 'open' (it is written "as a result of , for example)	X			These modifications are captured and rearranged as bullet (a) in the revised para. 2.21.
51	Hungary	Page 1, 1	Paragraph 2.21., a new point shall be added	(f) Changes in structural dimensions and parameters of the fuel assemblies (e.g., lattice pitch, cladding thickness, fuel element dimensions)	These parameters can influence the behavior of the core during an accident, for example the cladding thickness is directly influencing the amount of hydrogen generated during an accident.		New (b) New fuel type or significant changes in fuel types (e.g., use of mixed-oxide or gadolinium fuel; new fuel rods or new fuel assembly designs with modified geometrical or thermal hydraulic characteristics);		The original bullet (a) is modified to be consistent with the original 2nd paragraph of para. 3.13, and also extended to address the comment statement (highlighted yellow). The resultant modified bullet (a) is now designated as bullet (b) in the revised para. 2.21.
52	Canada	3	2.23		Why deterministic approaches only? Need to confirm if need probabilistic approaches as well.		…. using deterministic approaches including uncertainties to the		Current practice for core safety analysis in most MS is to use DSA and some MS

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejecti on
							extent possible.		include variations of input by counting uncertainties.
53	Germany	5	2.24 (b)	(b) ~~Temperature coefficient of reactivity for the fuel~~ Reactivity feedback of fuel temperature changes (Doppler effect resp. coefficient);	The term “reactivity coefficient” is related to point-kinetics. The text should be methodological neutral.		Reworded to (b) Reactivity feedbacks. The detailed information on reactivity feedbacks (with incorporation of the commented statement) is provided in a new row in Annex II, reactivity feedbacks.		
54	Germany	6	2.24 (c)	(c) ~~Temperature coefficients of reactivity for the coolant and the moderator~~ Reactivity feedback of coolant and moderator temperature changes, including related density changes;	See line above.		Reworded to (b) Reactivity feedbacks. The detailed information on reactivity feedbacks (with incorporation of the commented statement) is provided in a new row in Annex II, reactivity feedbacks.		
55	Germany	7	2.24 (d)	(d) ~~Void coefficients of reactivity for the coolant and the moderator~~ Reactivity feedback due to changes in	See line above.		Reworded to (b) Reactivity feedbacks.		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				the void content in the coolant/moderator (void effect resp. coefficient);			The detailed information on reactivity feedbacks (with incorporation of the commented statement) is provided in a new row in Annex II, reactivity feedbacks.		
56	France	9	2.24	Position or rate of insertion of positive/negative reactivity caused by the reactivity control device(s) or changes in process parameters;	In safety analysis, the axial variation of flux should be taken into account; position of control rods and xenon (mentioned in (j)) are defining the axial variation	X			
57	Germany	8	2.24	(k) Kinetic parameters (l) Reactivity coefficient of boron concentration (m) Occurrence of nuclear-thermal-hydraulic instabilities (for boiling water reactors)	Missing safety-related parameters			X	Proposed (k) is covered by physical phenomena mentioned in bullets (e), (f) and (g) (new bullet numbers (c), (d) and (e)). Proposed (l) is covered by bullet (e) (new bullet number (c)). Proposed (m) is covered by bullet (h) (new bullet number (f)).
58	Hungary	Page	2.24	The following major factors			Proposed bullet (q) is		Suggested (k), (o) is

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejecti on
		4, 1		should be accounted for in the reactor core safety analysis: (k) Power peaking factors, maximum linear heat rate; and (l) Effective delayed fraction; and (m) Shut down margin taking account the feedback effects; and (n) Hot channel coolant characteristics taking into account the mixing effect; and (o) Rate of the increase of the linear heat rate at normal operation processes; and (p) Maximum pellet, pin and assembly burnup values justified by the acceptance criteria of the safety analyses related by active core and the fuel storage and transport devices; and (q) Core activity inventory.			added as a new bullet (i).		covered by (a). Suggested bullets (l), (m), (n) and (p) are examined for detailed information but are not treated as major factors depending on MS practices. These are not added.
59	France	10	2.25	…could threaten the integrity of the ~~reactor pressure vessel for light water reactors (of pressure tubes for pressurized heavy water reactors) and of~~ the containment for light water reactors and should be evaluated	To put emphasis on the essential safety concern			X	Impact of hydrogen accumulation on the RCS boundary should be assessed in the reactor core safety analysis. Containment analysis is out of the scope of this Safety

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
									Guide.
60	Russia	2	2.25/5-8	Accumulation of hydrogen, as a result of a metal–water reaction between the zirconium-based alloy cladding and water at high temperature, could threaten the integrity of the reactor pressure vessel for light water reactors (of pressure tubes for channel type water cooling reactors) and of the containment and should be evaluated.	Pressure tubes are used not only in pressurized heavy water reactors, as mentioned in para. 2.25, but also in water-graphite channel type reactors (e.g., RBMK), or in boiling heavy water reactor projects.		The effects of hydrogen accumulation (as a result of a metal–water reaction between the zirconium-based alloy cladding and water at high temperature) on the boundary of reactor coolant system should be evaluated.		
61	Germany	9	2.25	In the safety analysis calculation methods shall be used which are validated for the respective scope of application, and any uncertainties associated with the calculation shall be quantified or covered by suitable methods.	Missing requirements for validation and verification procedure of the nuclear analysis systems.		For clarification, the following sentence is added to para. 2.24: Guidance on safety analysis calculations is referenced to Ref. [5].		Safety analysis methods are described in DS491.
62	Hungary	Page 3, 2	3.2	The design of the reactor core should enable the fulfilment at all times of the fundamental safety functions (para.2.2) for…	wrong reference	X			
63	Canada	4	3.4	Suggest an additional bullet: (g) Structural stability under prolonged neutron irradiation	Radiation stability of fuel material appeared to be missing.			X	Bullet (d) addresses the comment.
64	Canada	5	3.5	Suggest an additional bullet: (h) Stability of thermal and	Radiation stability of clad material appeared to be			X	Bullet (a) addresses the comment. For

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				physical properties under prolonged neutron irradiation	missing.				clarification, bullet (a) is split into (a) and new (b). New bullet (b) captures the comment.
65	Germany	10	3.5	(h) adequate creep properties	Cladding creep is also one important property of the cladding		Added the following wordings to bullet (f): low creep rate in normal operation and high relaxation rate in transients.		
66	Russia	3	3.7/5-6	The coolant must also be comparable with constructional materials of the core and the primary circuit (low corrosiveness, weak erosion effect) and friendly to the environment (not flammable, not explosive, not toxic, not or low radiotoxicity). The reactor fuel and core design should also include the following safety considerations associated with the coolant …	Increased aggressiveness of the coolant in relation to constructional materials create an ongoing threat to the integrity of physical barriers. The possibility of combustion and explosion, toxicity and high radiotoxicity coolant significantly threaten the integrity of nuclear power plant, the health of the population and operational personnel. The proposed addition does not apply to water, but as stated in the para 1.4, this safety Guide may also be applied, with judgement, to other reactor types.		Added the following wordings as a new bullet (e): Ensuring that coolant chemical composition is compatible with materials which are present in the primary circuit (e.g., to avoid crud formation on fuel rods, to minimize corrosion and radioactive product generation, etc.).		“Friendly to the environment” is not included, since this Safety Guide is intended mainly for application to water cooled reactors.
67	Canada	6	3.7	Suggest inserting a sentence after the closing parenthesis :	Prevent degradation of heat transfer properties with		Added the following wordings as a new		Crud preferentially forms by chemical

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				The coolant material should be compatible with the cladding material in maintaining the heat transfer across the coolant/clad interface (avoid curd formation or surface corrosion) for long operation under high temperature, pressure and radiation fields.	operation.		bullet (e): Ensuring that coolant chemical composition is compatible with materials which are present in the primary circuit (e.g., to avoid crud formation on fuel rods, to minimize corrosion and radioactive product generation, etc.).		interaction with the primary circuit materials. Influence of crud on heat transfer is not significant and thus not necessarily addressed. The added statement is closed to Comment #66 (Russia #3).
68	France	11	3.7b	Maintaining the radionuclide activity in the coolant ~~at an acceptably low level~~ as low as reasonably achievable by means of purification systems, corrosion product minimization, or removal of defective fuel as appropriate;	To precise "acceptably low level"	X			
69	Iran	17	3.71	The statement ,(f) cumulative neutron absorbing by fission product should be replaced by cumulative poisoning by fission products	In most of the technical documents, the word of ''poison" is more applicable than neutron absorber.			X	Many MS suggest to use "neutron absorber" rather than "poison".
70	France	12	3.9	Depending on the reactor design, the moderator could contain a soluble neutron absorber, such as boron, to maintain adequate shutdown margins during operational states and to follow the	To mention "boron" at this para allows to speak about it in further para. The soluble neutron absorber plays a safety but also an operational role		Depending on the reactor design, the moderator could contain a soluble neutron absorber, such as boron in pressurized water		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				decrease in core reactivity throughout the fuel cycle.			reactors, to maintain adequate shutdown margins during operational states and to compensate the decrease in core reactivity throughout whole reloading cycle.		
71	Germany	11	3.9	The choice of moderator and the spacing of the fuel elements within it should meet engineering and safety requirements on the moderator temperature ~~coefficient~~ feedback of reactivity, while aiming at optimizing the neutron economy and hence fuel consumption. The prevalent thermal reactor types use either light water or heavy water as the moderating medium.	The term "reactivity coefficient" is related to point-kinetics. The text should be methodological neutral.		… on the reactivity feedbacks due to moderator temperature, density and void fraction changes, while aiming at optimizing …		Reworded to be consistent with Comments #53-55 (Germany #5-7).
72	Russia	4	3.9/1-4	The choice of moderator and the spacing of the fuel elements (fuel assemblies) within it should meet engineering and safety requirements to the moderator temperature and coolant density (or vapor content) coefficient of reactivity, while aiming at optimizing the neutron	Coolant density (or vapor content) coefficient of reactivity is very important for reactor safety. High positive coolant vapor content coefficient of reactivity became main physical cause of Chernobyl accident. The value of this reactivity coefficient depends on moderator and		The choice of moderator and of the spacing of the fuel rods and fuel assemblies within it should meet engineering and safety requirements on the reactivity feedbacks due to moderator		Reworded to be consistent with Comments #53-55 (Germany #5-7). Proposed "graphite" in the last sentence is not accepted, because graphite as a moderator does not apply to LWRs.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				economy and hence fuel consumption. The prevalent thermal reactor types use ~~either~~ light water, ~~or~~ heavy water and graphite.	coolant volumes in the core.		temperature, density and void fraction changes, while aiming at optimizing the neutron economy and hence fuel consumption. The prevalent thermal reactor types use either light water or heavy water as the moderating medium.		
73	France	13	3.10	In pressurized heavy or light water reactors, the reactor core design should assure the effectiveness of the shutdown and hold-down capability of the reactor during an absorber dilution accident.	Absorber dilution has to be taken into account also for pressurized light water reactors			X	The paragraphs addresses the case of dilution of SDS #2 effectiveness in PHWRs. “Absorber dilution” is not indicating boron dilution that can be imagined in PWRs.
74	Hungary	Page 1, 2	3.10	The last two sentences should be introduced as new points, each one.	Because paragraph 3.10. contains three different issues as is right now. And the last sentence in my opinion contains a consideration that is applicable to the containment rather than the moderator. “Measures should be provided to prevent deflagration or explosion of hydrogen generated by radiolysis in the moderator.”	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
					Also the beginning statement considers PHWRs whereas the paragraph can be applied to PWR/VVER technology as well where the coolant is the moderator.			X	The statement is specific to PHWRs where Gd is used as a means for shutdown.
75	Canada	7	3.13	Suggest modifying the second sentence as: Appropriate provisions should also be provided for the nuclear key safety parameters, such that they would remain valid throughout a fuel cycle for specific core reload designs.	Key safety parameter values change between BOC and EOC.		Appropriate provisions should also be provided when defining values of the nuclear key safety parameters, such that they would remain valid for specific core reload designs and throughout whole reloading cycle.		
76	Hungary	Page 1, 4	3.13, 2nd paragraph	Add: (e) Changes in structural dimensions and parameters of the fuel assemblies (e.g., lattice pitch, cladding thickness, fuel element dimensions)	I would like to refer to the first comment, I think it should be applicable here as well.		The comment is incorporated in the new bullet (b) of para. 2.21: (b) New fuel type or significant changes in fuel types (e.g., use of mixed-oxide or gadolinium fuel; new fuel rods or new fuel assembly designs with modified geometrical or thermal hydraulic characteristics)		Bullets in 2nd paragraph of para. 3.13 are merged and moved to para. 2.11, since these indicate the same “significant configuration change or major modification in core design”.
77	Japan	3	3.13.(f)	Radial and axial power	Unification of wording	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				peaking factors, including allowance for ~~Xe~~ xenon induced oscillation;	through the text.				
78	Germany	12	3.15, last sentence	Appropriate provisions should be included in the reactivity coefficients or other reactivity feedback modeling approaches used in the safety analysis for all applicable plant states.	The term "reactivity coefficient" is related to point-kinetics. The text should be methodological neutral.	X			
79	Germany	13	3.16, first sentence	The maximum reactivity worth of the reactivity control devices (e.g., control rods and/or soluble boron feeding systems)	Clarification		… chemical and volume control system …		
80	France	14	3.16	These reactivity limits should be determined via safety analyses to ensure that fuel design limits described in paras 3.49-3.59 are ~~met~~ not exceeded.	To clarify the term "are met"	X			
81	Canada	8	3.17	Suggest modifying the second and third sentences as: Variations in the power distribution caused by effects like xenon instability or other local effects (e.g., mixed core, crud induced power shifts or axial offset anomalies for pressurized water reactors, fuel assembly bow or distortion) should be addressed in the design of the power control system. Provision should be included	Reactivity is a global parameter and not local. Local effects are changes in neutron interactions from local changes to material composition or physical property.		Variations in the power distribution (e.g., caused by effects like xenon instability) or other local effects ….		The last proposed phrase is not accepted because "provisions" are not intended to be used as the only input to the control system.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				to account for measurement variations between flux detectors (e.g., due to operability, location, shadowing or ageing) used as inputs to control system.					
82	France	15	3.20	The thermalhydraulic design of the reactor core should include adequate margins and provisions to assure that (c) minimal and maximal values of flowrate (thermalhydraulic and mechanical) are consistent with design limits	Thermal hydraulic design is also needed to justify the values of flow rate		(c) Minimal and maximal values of core flow rate are consistent with thermalhydraulic and mechanical design limits.		
83	Iran	18	Chapter3-thermal-hydraulic design	Adding the sentence ‘‘Thermal-hydraulic performance of the core during an ATWS event should not exceed acceptable fuel design limits’’ is recommended.	according to NUREG-0800, chapter 4-4			X	Close to Comment #3 (Germany #0). Design limits for DECs without significant fuel degradation are described in paras 3.54-3.59 of the current Safety Guide. These are general ones and apply to all accident scenarios categorized by DECs without significant fuel degradation including ATWS.
84	Iran	19	Chapter3-	Adding the sentence ‘‘the	according to NUREG-0800,		The following		Values are not

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			thermal-hydraulic design	thermal-hydraulic design should account for the effects of crud in the CHF calculations in the core or in the pressure drop throughout the RCS. Process monitoring provisions should assure the capability to detect a 3-percent drop in the reactor coolant flow. The flow should be monitored every 24 hours'' is recommended.	chapter 4-4		statement is added to the end of 2nd paragraph of para. 3.22, where bullet (c) addresses the comment (highlighted yellow): …. As a consequence, adequate margins or provisions should be added to the minimum ratio to account for additional factors not considered in the correlation itself. Examples of these factors are: (a) the thermal hydraulic response to anticipated operational occurrences, (b) impacts resulting from the chosen loading pattern, and (c) impacts resulting from the potential presence of crud in the core.		recommended to be shown in the Safety Guide.
85	Iran	20	Chapter3-thermal-hydraulic	Adding the sentence ``Methods for calculating single-phase and two-phase	according to NUREG-0800, chapter 4-4			X	The comment is too specific to be included in the

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			design	fluid flow in the reactor vessel and other components should include classical fluid mechanics relationships and appropriate empirical correlations. For components of unusual geometry, these relationships should be confirmed empirically using representative databases from approved reports'' is recommended.					Safety Guide as design recommendations. Further, such fluid dynamics calculation is out of the scope of this Safety Guide.
86	Canada	9	3.22 First paragraph	Suggest modifying the second sentence of the paragraph as: In addition, for fuel channel type pressurized heavy water reactors, effects of fuel bundle string, appendages, gaps between fuel elements and pressure tube, anticipated shape change of pressure tubes with reactor ageing and junctions between neighboring endplates should be addressed in the design analyses.	Aging related shape change of the pressure tubes affects TH characteristics.	X			
87	France	16	3.22	The design should assure […] critical heat flux correlations have been developed from representative tests performed at steady state conditions.	The test should be representative of fuel assembly design features (length, grids, axial power distribution …)	X			
88	Switzer-land	19	3.22.	spacer grids?	… and what are braces?				Braces have been replaced with spacer

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
									grids in the previous draft revision. Not used any more.
89	USA	3	3.22 3rd paragraph 2nd sentence	As a consequence, adequate margin should be ~~provided to allow for anticipated operational occurrences~~ added to the minimum ratio to account for additional factors not considered in the correlation itself. Examples of these factors are: (a) the thermal hydraulic response to anticipated operational occurrences, (b) impacts resulting from the chosen loading pattern, (c) plant operational uncertainties, and (d) code uncertainties.	While the impacts of anticipated operational occurrences are accounted for, they are not the only impacts which need to be accounted for. This change provides additional examples from that list of impacts.		As a consequence, adequate margins or provisions should be added to the minimum ratio to account for additional factors not considered in the correlation itself. Examples of these factors are: (a) the thermal hydraulic response to anticipated operational occurrences, (b) impacts resulting from the chosen loading pattern, and (c) impacts resulting from the potential presence of crud in the core. In addition, uncertainties such as plant operational uncertainties and code uncertainties should be adequately taken into account in the safety analysis.		New bullet (c) is added according to Comment #84 (Iran #19). Proposed bullet (c) and (d) statements are rephrased as one sentence since they are not treated by margin factors but they are accounted for in safety analysis.
90	USA	4	3.22	In some reactor designs critical heat flux conditions	It is not accurate to say that CHF can be tolerated if		… that the cladding temperatures do not		To indicate fuel failure by dryout.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			4th paragraph	during transients can be tolerated if it can be shown using suitable analytical methods that the cladding temperatures do not exceed the ~~dryout~~ fuel failure limits.	cladding temperatures do not exceed fuel dryout limits. If CHF has occurred, the fuel temperatures should indicate dryout has occurred. Just because dryout occurs does not mean the fuel fails.		exceed the dryout induced fuel failure limits.		
91	Germany	14	3.22 / last para	In some reactor designs critical heat flux conditions during transients can be tolerated if it can be shown using suitable analytical methods that the cladding temperatures do not exceed the failure ~~dryout~~ limits.	This is a post-dryout criterion		… that the cladding temperatures do not exceed the dryout induced fuel failure limits.		To indicate fuel failure by dryout.
92	France	17	3.23	Experiments should be conducted with a representative fuel assembly design and over the range of expected operational conditions, especially various heat flux profiles, to provide data for defining the limiting values of the minimum ratios.	Fuel assembly design and heat flux profiles are important for CHF.		Experiments should be conducted on representative fuel assembly designs and over the range of expected operational states, including various axial heat flux profiles, to identify the limiting values of the minimum ratios		
93	France	18	3.23	~~These correlations may be overly conservative~~ For fast transients (e.g., rod ejection accidents), ~~and therefore,~~ these correlations may be reassessed as steady state conditions may be not	The original writing tend to say that systematical conservatism can exist ; neutral writing is preferable in this SAFETY guide	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				sufficiently representative ~~for these applications~~.					
94	USA	5	3.23 1st sentence	Experiments should be conducted over the range of expected operational ~~conditions~~ states to provide data for defining the limiting values of the minimum ratios.	Operational conditions could be misread to mean only normal operating conditions. TECDOC 1791 uses the term, "operational states."	X			
95	USA	6	3.23 2nd sentence	Correlations for predicting critical heat flux are continually being ~~revised~~ generated as a result of additional experimental data, changes in fuel assembly design, and improved calculation techniques involving coolant mixing and the effect of axial power distributions.	Revision may imply simply changing the coefficients of a correlation and not its form. While this has occurred (very rarely), it is much more common to simply see a new correlation in use.	X			
96	France	19	3.24 (a)	For departure from nucleate boiling ratio, critical heat flux ratio or critical power ratio correlations, there should be a 95-percent probability at the 95-percent confidence level that the hot element (see Annex II for terminology clarification) in the core does not experience boiling crisis ~~a departure from nucleate boiling or boiling transition condition~~ during normal operation or anticipated operational occurrences	More general and shorter		… hot rod (see Annex II for terminology clarification) in the core does not experience any heat transfer deterioration during normal operation or anticipated operational occurrences …		
97	France	20	3.24 (b)	~~The limiting (minimum)~~	This writing implicitly		For light water		Close to Comment

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				~~value of departure from nucleate boiling ratio, critical heat flux ratio, or critical power ratio correlations should be established such that the number of fuel elements that experience a departure from nucleate boiling or boiling transition during normal operation or in anticipated operational occurrence conditions does not exceed a limit, e.g., at least one element per thousand in the reactor core;~~ or	authorizes that during normal operation a given number of fuel elements (even low) can experience boiling crisis which is beyond safety requirements for LWR		reactors, the limiting (minimum) value of departure from nucleate boiling ratio, critical heat flux ratio, or critical power ratio correlations should be established such that the number of fuel rods that experience a departure from nucleate boiling or boiling transition during normal operation or in anticipated operational occurrence conditions does not exceed a specified limit, i.e., at most one fuel rod per thousand in the reactor core;		#100 (USA #7). Some MS allows boiling in a few fuel rods in LWRs. With the word “at most”, no boiling requirement also can be captured.
98	Germany	15	3.24.b	…does not ~~exceed~~exceed a limit, e.g., at ~~least~~most one element per thousand in the reactor core;	This is an *upper* limit. Thus, one rod at *most* may go into dryout.	X			
99	Turkey	12	3.24 (b)	does not **exceed** a limit, e.g., at least one element per thousand in the reactor core; or	Typo.	X			
100	USA	7	3.24	…does not exceed a limit,	As currently written,	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			Parag. (b), Line 5	~~e.g.,~~ i.e., at ~~least~~ most one element per thousand in the reactor core; or	paragraph (b) implies that 0.1% of fuel rod failure is only one example of a limit, and that there are others that could be chosen. To make this a bit stronger it should say 0.1% is the limit, (so people couldn't choose higher values like 1%, or 10%) if they wanted to. To state a conservative limit, the text should say "at most" (not more than) 1/1000.				
101	Sweden	1	3.24/(b)	*The limiting (minimum) value of departure from nucleate boiling ratio, critical heat flux ratio, or critical power ratio correlations should be established such that the number of **fuel elements** that experience a departure from nucleate boiling or boiling transition during normal operation or in anticipated operational occurrence conditions does not exceed a limit, e.g., at least **one element per thousand in the reactor core***	Consider whether *fuel elements* should not be replaced with *fuel pins* in this text (this depends on the type of reactor but would be true for LWRs)? Furthermore, we do not think that the criteria (e.g. 0,1% of the fuel pins) can be the same for normal operation as for anticipated transients. For normal operation the criteria must be much lower than 0,1 %, or interpreted in a different way.		…. the number of fuel rods that experience a departure from nucleate boiling or boiling transition during normal operation or in anticipated operational occurrence conditions does not exceed a specified limit, i.e., ., at most one fuel rod per thousand in the reactor core …		Close to Comment #100 (USA #7). Some MS allows boiling in a few fuel rods in LWRs. With the word "at most", no boiling requirement also can be captured.
102	Canada	10	3.24 (b)	Suggest modifying the last part of the sentence of the bullet as: " ….. during normal	Design specifications determine the limit	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				operation or in anticipated operational occurrence conditions does not exceed a specified limit, e.g., at least one element per thousand in the reactor core; or…”					
103	Canada	11	3.25	Suggest modifying the last sentence of the paragraph as: “Under these conditions, the level of radionuclide activity release should be assessed to confirm that the permissible limits for the release of fission products are met.”	The word release was missing.		Under these conditions, the level of radionuclide activity should be assessed to confirm that the permissible dose limits are met.		Close to Comment #106 (France #23). No limit for fission product release is used.
104	France	21	3.25	For accident conditions (design basis accidents and design extension conditions without significant fuel degradation) only a limited number of fuel failures should be allowed, depending on the frequency of the condition.	The higher the frequency the smaller should be the consequences.		For accident conditions (design basis accidents and design extension conditions without significant fuel degradation) only a limited number of fuel failures should be allowed. The allowable number of failed fuel rods may depend on the frequency and nature of the event.		
105	France	22	3.25	~~Long term~~ coolable geometry should be maintained for all design basis accident.	Short term coolable geometry should also be maintained, and it’s for all DBA’s.		Coolable geometry should be ensured by design for accident conditions.		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
106	France	23	3.25	Under these conditions, the level of radionuclide activity should be assessed to confirm that the ~~permissible limits for~~ the release of fission products remain acceptable ~~are met~~.	There are no regulatory limits to releases for accident conditions in France.		Under these conditions, the level of radionuclide activity should be assessed to confirm that the permissible dose limits are met.		
107	France	24	3.25	In accident conditions with cladding rupture, fuel dispersal shall be avoided. If not possible (for instance in the case of initially leaking fuel rods), consequences of fuel dispersal in accident conditions should be assessed.	Text to add at the end of 3.25 article.		In accident conditions that lead to cladding ballooning and rupture, fuel fragment dispersal in the coolant should be prevented.		Leaking rod is not included, because it should be
108	Turkey	13	3.26/8	Important items that are typically addressed in the design of fuel elements **and** fuel assemblies	The comma (,) needs to be replaced by the word :and”.				
109	Canada	12	3.27	Suggest modifying the first sentence of the paragraph as: “The design should assure that the geometry and the thermal and physical properties of the fuel elements and fuel assemblies are reliable …”	Reliability should have some requirement.			X	Reliability of fuel rod and assembly indicates degree (probability) of their meeting the minimum performance requirements (IAEA Safety Glossary) when required. Performance is the integral concept of sound behaviors of their components and design items.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
									Therefore, there seems no need to define more.
110	Spain	1	3.27 (c)	Control of in-reactor power changes to limit excessive pellet-cladding interaction		X			
111	Spain	2	3.28/3	… are considered. In certain basis accidents …			For design basis accidents (e.g., reactivity initiated accidents) and for design extension conditions without significant fuel degradation, ….		Incipient melting may happen for certain accidents but are applied to all accident conditions.
112	France	25	3.28	In infrequent design basis accidents (e.g., reactivity initiated accidents) and design extension conditions without significant fuel degradation, limited melting can be allowable locally. In more frequent design basis accidents, fuel melting shall be avoided.	For most frequent accident conditions, the structural integrity of fuel assembly and fuel elements has to be guaranteed (no melting of the fuel)		For design basis accidents (e.g., reactivity initiated accidents) and for design extension conditions without significant fuel degradation, incipient fuel melting can be allowed (e.g., fuel centerline melting is limited to a small fraction of fuel pellet volume).		No fuel melting is allowed for AOO (i.e., frequent DBA in the comment statement) as stated in para. 3.28. Incipient fuel melting is considered for accidents (i.e., less frequent DBAs in the comment statement). Note that infrequent DBA corresponds to AOO and more frequent DBA corresponds to DBA in the plant states stated in IAEA

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
									Safety Glossary.
113	Canada	13	3.28	Suggest modifying the last two sentences of the paragraph as: In design basis accidents (e.g., reactivity initiated accidents) and design extension conditions without significant fuel degradation, limited melting can be allowed locally. The design and safety assessments should account for burnup effects on the material composition and the thermal and physical properties of the fuel pellet (see Annex II for supplementary information).	Need to confirm if limited melting can be allowable locally in design basis accidents.		For design basis accidents (e.g., reactivity initiated accidents) and for design extension conditions without significant fuel degradation, incipient fuel melting can be allowed (e.g., fuel centerline melting is limited to a small fraction of fuel pellet volume). The design and safety assessments should account for burnup effects on the fuel rod and fuel assembly properties (see Annex II for supplementary information).		Refer to Annex II, fuel, for supplementary information on burnup effects.
114	Japan	4	3.28./3	In design basis accidents (e.g., reactivity initiated accidents) and design extension conditions without significant fuel degradation, limited melting which does not result in the loss of fuel rod geometry can be allowable locally.	Clarification. In order to make clear the definition of “limited melting” in this paragraph, the supplementary explanation should be added as shown.		For design basis accidents (e.g., reactivity initiated accidents) and for design extension conditions without significant fuel degradation, incipient fuel melting can be allowed (e.g., fuel centerline		Close to Comment #112 (France #25). Limitation of fuel centreline melting aims at limiting cladding strain and fuel rod geometry.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							melting is limited to a small fraction of fuel pellet volume).		
115	France	26	3.29	The design should assure that cladding stresses and strains are limited; limits for cladding stress, ~~long term~~ deformation and corrosion/hydriding should be specified for ~~different~~ normal operation~~al and accident~~ and anticipated operational occurences. ~~states.~~	In general, article 3.29 is not very clear. Mentioned criteria shall be met for normal operations and AOO.		The design should assure that cladding stresses and strains are limited; limits for cladding stress, accumulated cladding strain and cladding corrosion/hydriding should be specified for all applicable plant states and applied throughout whole reloading cycle.		
116	Spain	3	3.29	We propose to remove "during operational states".	It is not clear that ballooning could occur during operational states, even it must be precluded.	X			
117	France	27	3.29	The consequences of significant cladding deformation (e.g., cladding ballooning) ~~during operational states~~ should be evaluated in accident analyses to determine the potential for cladding failure (e.g., burst or rupture) and any resulting release of fission products from the fuel.	Significant cladding deformation is allowed only in accidents.		For accident conditions, cladding deformation should be evaluated to determine the potential ….		
118	Canada	14	3.30	Suggest modifying the first	The word "limited" in the		The design should		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				sentence of the paragraph as: The design should assure that the dimensional stability of light water reactor fuel assembly structures is maintained, so that contacts……	original text is giving a very different meaning to the clause.		assure that the dimensional changes of light water reactor fuel assembly structures are minimized so that ….		
119	Turkey	14	3.30/1	3.30. The design should assure that the dimensional **changes and movements** of light water reactor fuel assembly	Better expression.		The design should assure that the dimensional changes of light water reactor fuel assembly structures are minimized so that ….		
120	Germany	16	3.30	The design should assure that the dimensional stability of light water reactor fuel assembly structures ~~are limited~~is guaranteed, so that contacts or interactions between the fuel rods and the fuel assembly components (top and bottom fuel assembly nozzles) are avoided, and that fuel rod bow and assembly bow, as well as control rods swelling and any potential interaction with the assembly guide tubes do not affect the thermal hydraulic design limits, the structural integrity of fuel assemblies or the performance of control rod	Original text does not make sense Rod bow may affect DNBRs (due to neutronic feedback by enhanced water channels), see also para. 3.43 (b).		The design should assure that the dimensional changes of light water reactor fuel assembly structures are minimized so that contacts or interactions between fuel rods and fuel assembly ……, as well as control rods swelling and any potential interaction with the fuel assembly guide tubes, do not affect the structural integrity or the thermalhydraulic		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				safety functions.			performance of the fuel assemblies or the safety functions of the control rod.		
121	Switzer-land	23	3.30., 1st para.	… do not compromise (or endanger) structural integrity … and safety functions of …	clumsy formulation Do not replace "affect" with "compromise" because we added "thermalhydraulic characteristics of the fuel assemblies".	X			In the current draft, "affect" is used.
122	Canada	15	3.32	Suggest modifying the text inside the parenthesis as: (due to fuel assembly shuffling, to movements of control devices or to other causes of reactivity changes or cyclic power variations for load following operational strategy)	Load following operation adds to the stresses on the fuel.		(e.g., due to fuel assembly shuffling, to movements of control devices, to load following, to flexible operation or to other causes of reactivity changes).		
123	Switzer-land	27	3.33., 2nd para., 5th line	…, cladding creep behavior~~s~~ at low stress~~es~~…		X			
124	Korea	4	3.33	fuel gaseous swelling → fuel swelling	Fuel solid swelling is important deformation mechanism in normal operating condition. Therefore, the word has to be changed from fuel gaseous swelling to fuel swelling to cover solid and gaseous swelling.	X			
125	Korea	5	3.33	repositioning of fragments	Describe more specifically.		fuel pellet cracking,		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							fragmentation and its radial relocation within the fuel rod after a power change		
126	Hungary	Page 2, 3	3.33	The design should include analyses to assure that straining of the fuel cladding due to mechanical loads (e.g., coolant pressure, seismic loads, heavy aircraft crash) meet fuel design limits.	It is requested by most of the regulators and also by EUR to include heavy aircraft crash as a postulated external hazard in the design. Although, the acceptance criteria set for design extension conditions to be met.			X	Close to Comment #35 (Germany #3). Only earthquake is considered for the design of the reactor core. Other external hazards such as airplane crash and tsunami are considered in the design and layout of the reactor building.
127	Turkey	15	3.34/2	fission products should **be as low as reasonably achievable.**	More realistic requirement			X	The message is to minimize the presence of corrosive fission products that cause stress corrosion cracking (SCC).
128	Turkey	16	3.35/3	in the fuel element design, and hence those anomalies should be avoided **to the extent possible.**	More realistic requirement	X			
129	Germany	17	3.35	…. Anomalies should be avoided <u>or limited.</u>	Missing pellet surface for example cannot be avoided but can be limited.	X	…. should be avoided to the extent possible.		
130	Turkey	17	3.36/2	accommodate for the effects of any in-fuel burnable absorbers on fuel **pellets’**	Typo.	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				thermal					
131	Sweden	2	Section 3.37 page 15	For Swedish conditions the demand for hydrogen pick-up correlation is new and is not yet implemented.	Comment/Information		Hydrogen pick-up correlation should be specified for each cladding type ….		Close to Comment #132 (France #28). The modified phrase indicates that the pickup correlation is not always a recommendation for the cladding design.
132	France	28	3.37	The hydrogen correlation pick-up correlation should be specified…	Editorial simplification	X			
133	France	29	3.40	…for the degradation ~~in heat transfer~~ of the fuel element heat transfer due to…	Editorial	X			
134	Turkey	18	3.40/1	3.40. The design analyses should account for the degradation ~~in heat transfer~~ of the fuel	Typo.	X			
135	France	30	3.41	"characterized" instead of "demonstrated"	Editorial	X			
136	France	31	3.41 bis (added para)	Lift forces and consideration of assembly and fuel bow should be addressed primarily in the thermalhydraulic design of the fuel assembly	Listed in 3.42 for the mechanical aspects in (c) and (e) but being more specific for the hydraulic effect does not hurt		Hydraulic effects should be addressed primarily in the thermalhydraulic design of the fuel assembly, and in the evaluation of localized corrosion, erosion, flow-induced vibration, grid-to-rod fretting, fuel assembly lift-off, fuel assembly		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							distortion, etc.		
137	Turkey	19	3.41/6	temperature, cross-flows and end-of-life grid spring relaxation) **representing the actual operational states**.	Better expression			X	"prototypical test conditions" implies actual operating states.
138	Turkey	20	3.43/7	(b) Bowing of fuel elements or **distortion** of assemblies should be limited so that	Typo.	X			
139	Turkey	21	3.43/10	(c) Strain induced fatigue ~~**strain**~~ should not cause the failure of a fuel assembly;	Typo.		(c) Fatigue should not cause ….		
140	France	32	3.43	Strain induced fatigue strain should not cause the failure of a fuel assembly	Not very clear. Why is the word "strain" used twice in the sentence ? Does it refer to fuel rod fatigue damage or fuel assembly fatigue damage ?		New bullet (c) Fatigue should not cause the failure of any component of the fuel assembly.		
141	Spain	4	3.43 (c)	Strain induced fatigue strain should not cause the failure of a fuel element.			New bullet (c) Fatigue should not cause the failure of any component of the fuel assembly.		
142	Turkey	22	3.43/12	in-core cross-flows should be limited to a level which does not **significantly** impact the local critical	More realistic requirement.	X			
143	Turkey	23	3.43/14	the reactivity control cluster assembly (e.g., **increase** drop time in pressurized water reactors) to	Better expression	X			
144	France	33	3.43	(f) Hydraulic and mechanical loads resulting from a LOCA accident should not cause the failure of fuel assemblies	Proposal for a new sub-article.		New bullet (f) Hydraulic and mechanical loads (including those resulted from		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							accidents and design basis earthquake) should not cause the failure of any component of the fuel assembly		
145	Turkey	24	3.44/end	**(c) Limited breach of the barriers (i.e., the fuel matrix and cladding) against release of radioactive materials.**	The third safety function also needs to be addressed.			X	Para. 3.44 is those resulted from interaction between fuel rods or fuel assemblies and fuel assembly support structures for accident conditions. The proposed (c) is not a primary concern from this perspective.
146	Turkey	25	3.45/7	initiated accident), fuel cladding can **fail** due to excessive pellet-cladding mechanical	Typo.	X			
147	France	34	3.46 a	“improving” instead of “optimizing”	Editorial			X	Fuel vendors need to compromise (i.e., optimize) in terms of creep properties.
148	France	35	3.46 b	Delete “techniques”	Editorial	X			
149	France	36	3.47	Fuel performance analysis codes can be used to analyze and interpret the power-ramp database and define a failure threshold. The~~, where~~ evaluation parameter used to define this threshold is	Editorial (long sentence cut in two)	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				usually the maximum cladding stress but strain energy density can also be used. These same fuel performance analysis codes can be used to assess risk factors that cause this type of stress corrosion cracking of fuel elements in the reactor ~~commercial~~ core and to define adequate guidelines.					
150	Germany	18	3.47	Delete this entire paragraph.	It seems that this rule calls for power ramp tests (up to and including rod failure) in a "live" reactor. This is (a) technically not feasible and (b) is an antagonism to all other safety criterions.		The power-ramp failure threshold should be established, if applicable, in test reactors by means of power ramp tests, for each type of fuel or cladding …..		
151	Korea	6	3.47	Delete paragraph 3.47	Too specific. The fuel pellet-cladding interaction analysis performance code and design method are recently developing therefore, more time is needed to complete to the publication data in 2018. In addition, the world wide specific relating evaluation method and criteria are not established yet.		The power-ramp failure threshold should be established, if applicable, in test reactors by means of power ramp tests, for each type of fuel or cladding …..		
152	France	37	3.49	…at least the following limits, taking into account the intended burn-up of the fuel	Precision : limits are not independent on maximal burn-ups		…. the design of fuel rods should address throughout whole		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				…			reloading cycle at least the following limitations ….		
153	Spain	5	3.49	We propose to add some provision to control the amount of cladding wear.			New bullet (g) Cladding wall thickness reduction (e.g. wear, erosion) does not exceed specified allowable limits.		Total reduction in cladding wall thickness is controlled not for individual mechanisms.
154	Turkey	26	3.51/1	To maintain low probability of fuel cladding failures ~~**occurrences**~~ caused by pellet-	Typo.	X			
155	France	38	3.51	To ~~maintain low probability of~~ avoid fuel cladding failures occurrences	Consistency with 3.45		To prevent fuel cladding failure caused by pellet-cladding ….		Consistent with para. 3.45.
156	Turkey	27	3.54/2	degradation, fuel **element** design should be such that	Typo.	X			
157	Turkey	28	3.54/3-5	(a) The number of fuel element failures does not exceed a certain percentage of the total number of fuel elements in the reactor core to **keep** the radiological consequences of each accident under consideration ~~**to**~~ within the onsite and offsite release limitations	Better expression		(a) …. to minimize the radiological consequences of each accident under consideration.		
158	France	39	3.54 a)	The number of fuel element failures does not exceed a ~~certain~~ small percentage of the total number of fuel rods	"Certain" is too incertain. It cannot be considered as sufficient to meet the onsite and offsite release	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				in the reactor core to limit the radiological consequences of each accident; ~~under consideration to within the onsite and offsite release limitations;~~	limitations if lower radiological consequences levels can be reached				
159	Canada	16	3.54 (a)	Original text: *The number of fuel element failures does not exceed a certain percentage of the total number of fuel rods* in the reactor core to limit the radiological consequences of each accident under consideration to within the onsite and offsite release limitations;	Need to clarify what are “fuel element” and “fuel rod”.				Close to Comment #14 (Switzerland #1) - Fuel rod is used throughout this Safety Guide.
					Do we need the percentage criteria when already each accident sequence has to meet the onsite and offsite release limits?				Yes, for accident conditions some fuel rod failures are allowed but under the permissible dose limit. We cannot provide the percentage number here.
160	Turkey	29	3.54/20	determined based on representative experimental **test** results by appropriately	Typo.	X			
161	France	40	3.54 (d), 3.56 (c) and 3.58		For reactivity initiated accidents, these three articles don’t seem to be fully coherent.		Para 3.54 (d) is revised to be consistent with para. 3.56 (c) to read as: “Since cladding mechanical resistance changes with irradiation and may vary from one cladding type to		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							another, the reactivity initiated accident failure limit is expected to be dependent on the fuel rod burnup and on the cladding material." Para. 3.58 is revised to be consistent with other two paragraphs to read as: "This can be achieved by assuring that the radial average enthalpy at any axial location of any fuel rod should not exceed burnup dependent limits derived from, for example, the analysis of a prototypical experimental database."		
162	Turkey	30	3.55/1	3.55. **Core** coolability should not be endangered due to, for example**:**	Typo.	X			
163	Germany	19	3.55 (c)	Fuel core coolability should not be endangered due to, for example, (…) Flow blockage <u>or other consequences</u> due to fuel	Core coolability may be endangered not only by blockage effects under these conditions.	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				dispersal and fuel coolant interaction as a result of fuel cladding failure (e.g., in a reactivity initiated accident event).					
164	Turkey	31	3.55/8	The design **of** fuel elements should also be adequate to prevent undesired consequences of	Typo.	X			
165	Germany	20	3.56 (a)	Peak cladding temperature during the accident conditions should not exceed a level where cladding oxidation causes excessive cladding embrittlement or accelerates uncontrollably. In addition, for light water reactors, effects of fuel fragmentation and relocation <u>inside the fuel rod</u> on peak cladding temperature should be assessed as appropriate. Possible effects of fuel particles dispersal on dose consequences and core coolability should also be addressed;	For clarification.		(a) …. In addition, for light water reactors, effects on peak cladding temperature due to fuel fragmentation and its axial relocation within the ballooned area of the fuel rod should be assessed as appropriate. ….		Relocation implies axial relocation of fuel fragments within the ballooned area of the fuel rod.
166	USA	8	3.56 (b) / line 1	Replace first sentence with: Total cladding oxidation during accident conditions should remain low enough to ensure that cladding can still withstand accident induced loadings (e.g., loss-of-coolant accident quenching).	Clarity		(b) Total cladding oxidation should remain below limits such that the cladding can still withstand accident induced loadings (e.g., loss-of-coolant		Total cladding oxidation is explained in the next sentence to be a sum of pre and post accidents and of inner and outer surfaces.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							accident quenching phase).		
167	Germany	21	3.56 (b)	… oxidation (outer-side oxidation and possibly when the fuel rod is burst inner-side oxidation), as well …..	Only when the fuel rod is burst inner-oxidation is possible		(b) Total cladding oxidation should remain below limits such that the cladding can still withstand accident induced loadings (e.g., loss-of-coolant accident quenching phase).		Close to Comment #166 (USA comment #8).
168	Finland	2	3.56 (b)	… (b) The cladding should not be oxidized during an accident conditions to such a degree that it cannot withstand accident induced loadings …	Missing word in sentence		(b) Total cladding oxidation should remain below limits such that the cladding can still withstand accident induced loadings (e.g., loss-of-coolant accident quenching phase).		Close to Comment #166 (USA comment #8).
169	France	41	3.56 (b)	The cladding should not be affected during an accident conditions to such a degree that it cannot withstand accident induced loadings (e.g., loss-of-coolant accident quenching).	Clarification and editorial		(b) Total cladding oxidation should remain below limits such that the cladding can still withstand accident induced loadings (e.g., loss-of-coolant accident quenching phase).		Close to Comment #166 (USA comment #8).
170	Canada	17	3.56 (b)	Suggest modifying the first sentence of the bullet as: The cladding should not be	Edit to represent the reduction of clad strength was missing in the original		(b) Total cladding oxidation should remain below limits		Close to Comment #166 (USA comment #8).

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				weakened during an accident conditions to such a degree that it cannot withstand accident induced loadings (e.g., loss-of-coolant accident quenching).	text		such that the cladding can still withstand accident induced loadings (e.g., loss-of-coolant accident quenching phase).		
171	Korea	7	3.56	(b) The cladding should not be during (b) as well as chemical interactions between fuel pellets and cladding material	Incomplete sentence Need more precise and specific descriptions about "chemical interaction"		(b) Total cladding oxidation should remain below limits such that the cladding can still withstand accident induced loadings (e.g., loss-of-coolant accident quenching phase).		Close to Comment #166 (USA comment #8). "Chemical interaction" indicates oxygen provided by UO_2.
172	Turkey	32	3.56/9-10	(b) The cladding should not be **weakened** during ~~**an**~~ accident conditions to such a degree that it cannot withstand accident induced loadings (e.g., loss-of-coolant accident quenching).	Typo.		(b) Total cladding oxidation should remain below limits such that the cladding can still withstand accident induced loadings (e.g., loss-of-coolant accident quenching phase).		Close to Comment #166 (USA comment #8).
173	Germany	22	3.58	Dispersal of molten fuel particles in case of fuel element failure during a reactivity initiated accident	Add "element" for clarification (or cladding or element).		…. fuel cladding failure …		

Formatted: Right

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				transient should be prevented. This can be achieved by assuring that the radial average enthalpy at any axial location of any fuel element should not exceed a certain value derived from, for example, the analysis of a prototypical experimental database.	According to 3.56, integrity of the fuel element should be "ensured, reference should be made to this para.				
174	France	42	3.59	… remain limited so as to avoid	Clarification	X			
175	Turkey	33	3.59/2	internals should remain limited to avoid any impairment of control **rod** movements in the	Typo.	X			
176	France	43	3.60	The reactor core structures and components (see Annex II for clarification of the terminology) should be designed to maintain their structural integrity for all applicable plant states, under various damage mechanisms caused by, for example: vibration (mechanical or flow induced) and fatigue; debris; thermal, chemical, hydraulic and irradiation effects (including radiation induced growth); ~~and~~ seismic motions and hydraulic and mechanical loads resulting from LOCA.	Reactor core structures and components shall keep there integrity during LOCA in order to insure core coolability.		…. for example: vibration (mechanical or flow induced) and fatigue; debris effects; thermal, hydraulic, mechanical loads (e.g., loss-of-coolant accidents, seismic events); chemical and irradiation effects (including radiation induced growth).		
177	France	44	3.60	In addition, the design of solid reactivity control	Editorial	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				devices should also ensure withstanding handling loads during refueling operations, transport and storage ~~in addition to above~~.					
178	Hungary	Page 2, 4	3.60	The reactor core structures and components (see Annex II. for clarification of the terminology) should be deigned to maintain their structural integrity for all applicable plant states, under various damage mechanisms caused by, for example: vibration (mechanical or flow induced) and fatigue; debris; thermal, chemical, hydraulic and irradiation effects (including radiation induced growth); and seismic and heavy aircraft crash generated motions.	It is requested by most of the regulators and also by EUR to include heavy aircraft crash as a postulated external hazard in the design. Although, the acceptance criteria set for design extension conditions to be met.			X	Close to Comment #35 (Germany #3). Only earthquake is considered for the design of the reactor core. Other external hazards such as airplane crash and tsunami are considered in the design and layout of the reactor building.
179	France	45	3.62	Delete “necessary”	Somme necessities could not be obvious at the design stage	X			
180	Turkey	34	3.64/4	hydraulic forces due to coolant flow or movements of bulk moderator for **all** applicable plant states.	Typo.	X			
181	France	46	3.64	The structures and guide tubes for the shutdown and reactivity control devices and for instrumentation should be designed so that these devices and instrumentation ~~are~~	Somme necessities could not be obvious at the design stage	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				~~accurately located and~~ cannot be moved by inadvertent operator actions, strains on equipment, hydraulic forces due to coolant flow or movements of bulk moderator for each applicable plant states. The design should facilitate the replacement of these devices and instrumentation ~~whenever necessary~~.					
182	France	47	3.66	The design should facilitate the replacement of the reactivity control and shutdown devices ~~whenever necessary~~ without causing damage to other reactor core components, unacceptable insertion of reactivity, or ~~undue~~ excessive personnel radiation exposures.		X			
183	France	48	3.67	3.67. Depending on the reactor type, various other structures may be installed within the reactor vessel. These include, for example, feedwater spargers, steam separators, steam dryers, core baffles, reflectors, and thermal shields. The functions of these internals include flow distribution for the reactor coolant, separation of steam and moisture, or	Para 3.60 and 3.61 are also relevant for various structures	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				protection of the reactor vessel from the effects of gamma radiation heating and neutron irradiation. These structures should be designed in accordance to 3.60 and 3.61 and so that their mechanical performance does not jeopardize the performance of any reactor core safety functions throughout their service life.					
184	Hungary	Page 3, 3	3.68	3.68. The design should meet limits specified in the applicable codes and standards that are selected according to safety classification in paras 2.13-2.16.	wrong reference			X	2.15 is correct. Para. 2.16 is not related to the selection of safety classification.
185	Iran	9	3.69	The inherent feedback coefficients shall be mentioned in this section as one of the important reactor control systems. Also, same as the previous revision, it is recommended that an appendix with reactivity coefficient title be added.		X			Reactivity feedbacks are listed in Annex II, reactivity feedbacks.
186	Germany	23	3.71 (d)	Rate of flow of coolant or changes in coolant or moderator temperature <u>or density</u>;	Clarification		…. coolant/moderator temperature and density.		
187	France	49	3.72	Reactivity control devices should be used to maintain the reactor in a subcritical	Precision		Reactivity control devices should be capable of		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				condition when it is not in power operation, with consideration given to design basis accidents and their consequences.			maintaining the reactor in a subcritical condition, with consideration ….		
188	Germany	24	3.74	~~The maximum degree of positive reactivity and its rate of increase by insertion in all applicable plant states are required…~~ The maximum amount of positive reactivity inserted into the reactor core should be limited…	Clarification			X	The proposed statement is degrading the requirement statement.
189	France	50	3.75	The arrangement, grouping, speed of withdrawal and withdrawal sequence of the reactivity control devices, used in conjunction with an interlock system, should be designed to ensure that any ~~credible~~ abnormal withdrawal of the devices~~s~~ which has to be dealt with in the safety assessment does not cause the specified fuel limits to be exceeded.	precision	X			
190	Germany	25	3.76	The concentrations of the soluble absorber in all storage tanks should be monitored. Whenever boron is used the ~~enriched~~ B-10 concentration should be monitored.	Clarification	X			
191	Turkey	35	3.76/2	unanticipated decrease in the	Better expression.	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				concentration of absorber in the **core that** could cause					
192	France	51	3.81	In particular, the design should ensure the necessary independence between plant processes, control and protection systems.	editorial	X			
193	Iran	10	3.84/4	It is recommended that statement, (c) location of the shutdown devices for the chosen reactor core design be replaced by statement, (c) The location of the shutdown devices corresponding to different reactor core designs. The rate of shutdown is sensitive to: — the distance of the shutdown devices from the active region of the core prior to insertion; in previous section — the locations of the injection nozzles for the soluble absorber, which should be such that the absorber may be quickly dispersed in the active region of the core.	This item is described with more details in the previous version.		(c) Location of the shutdown devices (depending on the chosen reactor core designs);		The description on rate of shutdown in terms of distance and location is not included, since this is too much descriptive for education.
194	France	52	3.85	Means of checking the insertion speed of shutdown devices should be provided. The insertion time should be checked ~~regularly, for example,~~ at the beginning of	The insertion time should be checked systematically prior to increasing the power In France, additional insertion time checks are performed when assembly		…. The insertion time should be checked regularly (typically at the beginning of each cycle) and possibly		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				each cycle and possibly during the cycle if the margin to the limit is not sufficient.	deformations are observed		during the cycle if the margins to the limits are not sufficient.		
195	Sweden	3	Section 3.87 page 25	In Swedish ABB BWR plant there are two independent systems for control rod insertion. This is an additional diversify-cation.	Comment/Information			X	Comment is noted. We do not include this comment since it is too specific to ABB BWR design.
196	Canada	18	3.87 Table 1 (Hafnium in zirconium alloy guide tubes)	A better example would be : cadmium elements sandwiched and sealed between stainless steel tubes moving in zirconium alloy guide tubes		X			
197	France	53	3.88 (c)	Using a fail-safe design as far as practicable (see Annex II for supplementa~~ta~~ry information).	Editorial	X			
198	Hungary	Page 2, 5	3.88	(j) Designing to function under extreme conditions (eg., seismic, heavy aircraft crash).	It is requested by most of the regulators and also by EUR to include heavy aircraft crash as a postulated external hazard in the design. Although, the acceptance criteria set for design extension conditions to be met.		(j) Designing to function under extreme conditions (e.g., seismic).		Close to Comment #35 (Germany #3). Only earthquake is considered for the design of the reactor core. Other external hazards such as airplane crash and tsunami are considered in the design and layout of the reactor building.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
199	France	54	3.88 (k)	Priority should be given to automatic activation instead of manual activation.	Proposal to add this sentence. While it goes without writing, it would go even better if it is written		Added to bullet (a): (a) Adopting systems with uncomplicated design and simple operation, and with automatic activation;		This Safety Guide mainly aims at new reactors.
200	Turkey	36	3.89/3	as burnup, changes in physical properties and production of helium gases. The **items (a) – (c)** in	Better expression		The items (a) – (d) in …		
201	Germany	26	3.90	As indicated in para. 6.11 of Ref. [1], the means of shutdown is required to be adequate to ~~prevent~~ <u>compensate</u> any foreseeable increase in reactivity leading to	Some increases in reactivity cannot be prevented, e.g. decay of Xenon, but they can be compensated by having a large enough shutdown margin.	X			
202	Germany	27	3.91 (c)	Necessary <u>and required</u> margin of subcriticality;	"necessary" is interpreted as what is needed for the planned operational processed, but there is also an additional "required" margin (as acceptance criteria for sufficient subcriticality, usually 1 %).	X			
203	Turkey	37	3.91/12	boron concentration) that will occur during the intended fuel cycle, including	There needs to be a space between "the" and "intended".	X			
204	France	55	3.91 (g)	The most reactive core configuration (and where appropriate the	Editorial		… during whole reloading cycle …		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				corresponding boron concentration) that will occur during the intended fuel cycle, including during refueling;					
205	USA	9	3.92	The effectiveness of shutdown and ~~reactivity hold-down~~ shutdown margin should be demonstrated via:	"Reactivity hold-down" is unclear. Define the term, or replace it with "shutdown margin."		The effectiveness of shutdown system should be …		
206	Turkey	38	3.98/4	Limits and set points should consider impacts of the fuel burnup**,** shadowing effects and	A comma (,) needs to be placed between "fuel burnup" and "shadowing effects".	X			
207	Turkey	39	3.101/2	Excessive **control** rod worths or reactivity insertion rates. Their capability should be demonstrated.		X			
208	France	56	3.102	The design limits, uncertainties, operating limits, instrument requirements, and setpoints should be taken into account in ~~translated into~~ the technical specifications for the facility.	Clarification		…. setpoints should be stated in technical specifications to be used by facility operators.		
209	France	57	3.103	The rapidity of the variation in a parameter should determine whether the actuation of the reactor control systems has to be ~~is~~ automatic or could be manual.	Clarification		The commented line is deleted.		Close to Comment #199 (France #54).
210	Turkey	40	3.103/6-7	order to enable any required modification of core parameters **(e.g., control rod**	Better expression	X	…. core parameters (e.g., control rod insertion position,		Reworded with monitoring parameters.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				insertion amount, main coolant flow rate) within their defined operating ranges. The rapidity of the variation in a **monitored** parameter should determine whether the actuation of			neutron flux, reactor coolant temperature and pressure) within their defined operating ranges. The 2nd sentence is deleted – close to Comment #209 (France #57).		
211	Germany	28	3.104	The core monitoring parameters ~~such as the following examples to be measured~~ should be adequately selected, which will depend on the reactor type. The following are examples of parameters to be measured for the purposes of core monitoring:	Delete. Repeated in second sentence.	X			
212	Iran	21	3.104	Propose this phrase instead : (b) coolant temperature for each level of core height			(b) Coolant temperature (e.g., inlet temperature, outlet temperature)		Coolant temperature at each level of the height cannot be monitored.
213	Iran	22	3.104	(f) Radionuclide activity in the coolant (see Annex II for supplementary information); there was no clarification in annex II for radionuclides.			(f) Radionuclide activity in the coolant (see Annex II, Coolant, for supplementary information on reactor coolant activity)		
214	Spain	6	3.104 (h)		Measurement of B-10 could be appropriate when it is used as enrichment (see		(h) Concentration of soluble boron or B-10 content when		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
					3.76), otherwise its measurement is too cumbersome.		enriched boron is used (for a pressurized water reactor).		
215	France	58	3.107	Detectors should be distributed ~~strategically~~ in the core to detect reliably the local changes in power density.			Detectors should be adequately distributed ….		
216	Iran	11	3.107	The statement “the thermal power of a reactor could also be calculated by thermo-hydraulic methods” shall be added in this section.	In practice, the thermal power of a reactor is calculated by thermo-hydraulic methods.	X			The comment is incorporated in the revised bullet (e) of para.3.104 2nd paragraph: (e) Thermalhydraulic core parameters (e.g., core thermal power, liner heat generation rate, reactor coolant flow rate, the departure from nucleate boiling ratio or the critical power ratio).
217	USA	10	3.108	A computerized core monitoring system should be used to ensure that the status of the core is within the operating limits assumed in the safety analysis. The core monitoring system should	This should be extended to include qualification if the core monitoring system (CMS) is utilized in the calibration of reactor protection system (RPS) components. For example, if			X	The original statement well clarifies the intention of the comment.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				have the same qualification level as that of the ~~system should be ensured wherever it is coupled~~ ~~to a~~ reactor protection system (see Ref. [13]).	the CMS is used to establish calibration parameters for incore/excore detectors that provide inputs to RPS trip functions, then the CMS should have qualification level of the RPS. The CMS is used to validate that the reactor is being operated within the boundary conditions assumed in the safety analysis. Therefore, the CMS should, at a minimum, have the same qualification level as those safety analysis methods used to license the reactor for operation.				
218	Sweden	4	Section 3.108 page 30	The use of "*core monitoring system*" and the meaning of the paragraph is unclear.	The statement "*A computerized core monitoring system should be used to ensure that the status of the core is within the operating limits assumed in the safety analysis.*" is unclear. What is the balance of the monitoring/ instrumentation (data) and the software part (calculations, interpolations?) of such a system?				Para. 3.104 lists core monitoring parameters and also derived parameters from the measured parameters.
219	France	59	3.109	At least one means of	During reactor shutdown,		The commented		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				shutdown should be available to assure core subcriticality under cold conditions during all design basis accidents.	subcriticality should be fulfilled in normal operation and during accidents transient		sentence is deleted, since it is irrelevant to the intention of this paragraph.		
220	France	60	3.112	The primary objective of core management is to ensure the safe, reliable and optimum use of the nuclear fuel in the reactor, while remaining within operational ~~design~~ limits imposed imposed by thermalhydraulics and neutronics analyses to the design of fuel elements and fuel assemblies.			…. while remaining within operational limits and conditions.		
221	France	61	3.113 (b)	Core operating strategies that permit ~~maximum~~ operating flexibility for reactor utilization and ~~optimum~~ good fuel utilization while remaining within core management design limits.	Maximum and optimum are not really safety concerns	X			
222	France	62	3.114	To achieve the desired core reactivity and power distribution for reactor operation, ~~the core management strategies should provide~~ the operating organization should be provided with the following information:	Clarification	X			
223	Iran	26	Core design	Optimization between heat production of core and cost of it could be discussed in a paragraph as an item for				X	Economics is not a safety concern.

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				designing core.					
224	Iran	23	3.115, line 5	It is recommended that control rod positions be included in reactor start-up conditions		X			
225	Iran	24	3.115, line 6	It is suggested Using control rod differential and integral worth instead of control rod worth			…. control rod and bank worths ….		
226	Iran	25	3.115, line 6	It is suggested that "all other field parameters of core" be added to the end of the paragraph			…. (e.g., critical boron and control rod positions, reactor kinetics, fuel temperature coefficients, moderator temperature coefficients, control rod and bank worths, power peaking factors, etc.).		These are provided as examples.
227	France	63	3.116	The design of the reactor core should include analyses to demonstrate that the fuel management strategy and the established limitations on operation do not change in any manner that would cause ~~nuclear~~ design limits to be violated throughout the reactor operating cycle or			…. would cause nuclear design limits and hence fuel design limits to be violated throughout whole reloading cycle.		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				lifetime.					
228	Iran	12	3.116	It is recommended that the statement "the bounding data shall be considered for reactor core design" be added in this section.	The bounding data shall be considered for conservative design of the reactor core,.			X	Close to Comment #61 (Germany #9) - The comment is not applicable to para. 3.116. The comment is related to safety analysis method, and it is described in in DS491. For clarification, the following sentence is added to para. 2.24: Guidance on safety analysis calculations is referenced to Ref. [5].
229	Germany	29	3.117, last sentence	In reactor core analyses, multi-dimensional and multi-scale physics codes and system thermalhydraulic codes are preferentially used for realistic analysis of the reactor core for all applicable plant states. Uncertainties should be adequately incorporated in the analyses.	And a reference to the IAEA Guide that addresses adequate consideration of uncertainties (e.g. DS491 in its final format) should be given.	X			
230	France	65	3.119	The reactor core analysis should include fuel element performance analyses based on average and local power levels and axial temperature distributions to demonstrate that the respective thermal	Editorial		…. For light water reactors, the reactor core analysis should include peak channel power and peak linear power rates for normal full power		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				and mechanical fuel design limits are met for all operational states. For light water reactors, the reactor core analysis should include peak channel power and peak linear power rates for normal full power operation and steady state power distributions, radially at each assembly location and axially all along the fuel assembly(s).			operation and steady state radial and axial power distributions in each fuel assembly.		
231	Hungary	Page 1, 3	3.119. Paragraph, 8. line	Instead of "moderator thickness" "gap between fuel assemblies"	I think, the expression "moderator thickness" is not precise enough.		…. changes in the moderator gap thickness due to bowing of the assemblies.		
232	France	64	3.122	The fuel loading pattern should be validated through the use of in-core flux distribution measurements. Material and organizational means should prevent a misloaded fuel assembly.	The feasibility of such a validation has not yet been reached in France. The fuel loading pattern is validated through a core cartography film (see para 4.6)		The fuel loading sequence should be monitored through the use of in-core (for boiling water reactors) or ex-core flux distribution measurements, or of special organizational measures. The fuel reload pattern after reloading should be validated through the use of in-core flux distribution measurements.		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
233	Germany	30	3.123	The light water reactor core should be designed such that the consequences of the worst misloaded fuel assembly, if any, remain within nuclear and fuel design limits. If a misloaded fuel assembly can be prevented by special measures and equipment it shall be demonstrated that the requirements for the effectiveness and reliability of these precautionary measures are fulfilled. Computational analysis are required only if it cannot be demonstrated that the specified precautionary measures have been met.	Clarification		…. If a misloaded fuel assembly can be prevented by special measures and equipment, the effectiveness and reliability of these precautionary measures should be demonstrated. Computational analyses should be performed if it cannot be demonstrated that the specified precautionary measures are sufficient.		
234	Germany	31	New para	The licensee shall have available a systematic, complete, qualified and up-to-date documentation of the state of the nuclear core components and the nuclear safety analysis system.	Requirements regarding documentation are missing.		Added in a new paragraph, para. 2.26: 2.26 A systematic, complete, qualified and up-to-date documentation of the state of the structures, systems and components of the reactor core should be available in order to be able to perform the safety analysis on the actual plant configuration.		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
235	Japan	5	3.123	~~2.123~~ → 3.123	Typo.	X			
236	France	66	3.125	For practical reasons and simplicity, for light water reactors, a system that develops and monitors the nuclear key safety parameters (e. g xxxxxx) can be used to verify the suitability of the reload core design.	Examples of nuclear key safety parameters should be provided		…. nuclear key safety parameters (refer to para. 3.104) ….		
237	France	67	3.126	When fuel assemblies of different types are loaded into the core (~~a~~ so-called mixed core), the fuel assembly types in the mixed core should be assessed in such a manner to demonstrate that the resulting mixed core meets ~~nuclear~~ all safety design limits for both the initial and subsequent reload mixed cores, and that the fuel assemblies in the mixed core meet fuel design limits for all applicable plant states. These assessments include: dimensional, mechanical and thermalhydraulic response of the fuel types (e.g. in terms of the pressure drop characteristics through the fuel assembly(s) and flow rate), compatibility with the hydraulic and nuclear characteristics of the original	Editorial Hydraulic compatibility (lift forces, bow, local flow rate)		When fuel assemblies of different types are loaded into the core (so-called mixed core), all fuel assembly types should meet the fuel design limits for all applicable plant states. The assessment should be performed for the initial and subsequent mixed core reloads. It should include: the dimensional, mechanical and thermalhydraulic response of the various fuel types (e.g. in terms of pressure drop characteristics		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				core and with related safety analyses.			through the fuel assembly(s) and flow rate), the compatibility with neutronic and thermalhydraulic characteristics of the original core and with the related safety analyses.		
238	USA	11	3.126	At the end of 3.126, add: The critical heat flux or critical power correlation used in the core monitoring system should be validated for each fuel type in the mixed core.		X			
239	Germany	32	3.127	Relevant nuclear parameters such as reactivity, reactivity coefficients, control rod worth and power distributions should be evaluated for the different fuel assembly designs. The compatibility evaluation may be developed based on single fuel assembly calculations in an infinite medium. The combined effects on the related core-wide parameters have to be determined.	Knowledge on fuel assembly related parameters is not sufficient, the effects on the core-wide parameters have to be determined.	X			
240	Japan	6	3.128.(c)/l 4	…; thus, there is less time for control rod insertion or boron system injection to provide ~~reactor~~ reactivity	Completeness. RIEs are included conditions of AOO and DBA in plant	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				control. This should be addressed in the core design and safety analyses for all applicable plant states (e.g., reactivity initiated events as anticipated operating occurrences and design basis accidents ~~transients~~); and	states.				
241	Korea	8	Subtile before 3.129	Load following (as applicable) and power maneuvering	More specific expression as same as paragraph 3.118			X	Not necessary to modify the title. The intention of the comment is addressed in Comment #242 (France #68).
242	France	68	3.129	whenever specified ~~necessary~~, be superimposed	Depends of the desired flexibility fixed by the operator (see 3.130)	X			
243	Korea	1	3.129	The effects of operating conditions such as load following (see Annex II for supplementary information), power cycling, reactor startup, and refueling man~~o~~euvers should	Editorial change	X			
244	France	69	3.133	Fuel failures can affect ease of access, work scheduling and worker dose for plant operations personnel and should be avoided as far as reasonably practicable. In any case, reactor core operation with defective fuel elements should stay within the	Precision relative to the safety objective		Fuel rod failures can affect ease of access, work scheduling and worker dose for plant operations personnel. Reactor core operation with defective fuel rods should stay within		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				radiochemical requirements			the radiochemical requirements (see Annex II, Defective fuel, for supplementary information) as defined by the limit on coolant radionuclide activity included in the Technical Specifications document.		
245	France	70	3.134	… radioactive doses limits are not exceeded ~~met~~ for plant personnel.	Clarification	X			
246	Turkey	41	3.134/2	operating the core with defective fuel assemblies while assuring radioactive **dose** limits are	Typo.	X			
247	USA	12	3.134, parag. 2	Shutdown and replacement of leaking fuel assemblies should be done if the defective fuel is expected to degrade with continued reactor operation. In boiling water reactors…		X	In light water reactors, shutdown should be done if the operating radiochemical limits are exceeded, and all defective fuel assemblies are replaced according to procedures after the outage. In pressurized heavy water reactors, fission product release ….		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
248	Sweden	5	Section 3.134 page 34	The *flux tilting method* for BWR discussed in Annex II should be used with caution. The risk of causing a secondary defect during flux tilting must be evaluated	This should be commented on in the text.		The 1st line in Annex II, Defective fuel, item 2 is revised: In boiling water reactors, it might be possible to locate the region or regions in the core that contain defective fuel by using the flux tilting method.		Small defects may not be detected by the flux tilting methods, and thus we use "might be possible to locate" in the Annex text.
249	Switzer-land	50	3.~~134~~137. (d)	re-edit	"fuel isotopic vector degradation": it should be more precisely stated what is meant. at least delete "degradation". The effect is explained in the following sentence	X			
250	Japan	7	3.137. Sub-title and others	Impact of fuel design and core management on fuel handling, shipment, storage, reprocessing and disposal	Completeness in accordance with para. 3.137.	X			
251	France	71	3.137	remain intact as far as necessary in the back-end phases after the assemblies are discharged from the core:	Fuel assemblies and fuel elements do not remain intact when processed		…. fuel rods and fuel assemblies remain intact (when applicable) or do not degrade further (in case of leaking fuel rods) in the back-end phases after the assemblies are discharged from the		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
							core.		
252	Turkey	42	3.137/16	Localized hydriding (e.g., due to corrosion layer spalling or due to axial pellet-pellet gaps)	The comma (,) at the end (after the closing parenthesis) needs to be removed.	X			
253	Korea	2	3.137 (b)	~ post-irradiation handling or shipment or storage ~	Item (b) importantly impacts the fuel cladding tube under handling, the shipment dynamic loads, and the consistency to aforementioned words.			X	Delayed hydride cracking is long-term event that does not take place during shipment.
254	Japan	8	3.137. (c)	(c) Grid/spacer-to-fuel element fretting wear Localized wear is usually undetected unless it wears through the complete cladding ~~wall~~ thickness and creates a leakage pathway. Some fuel elements affected by excessive wear may exhibit localized weakness that may lead to long term creep failures or other mechanical failures in the event of shipment accidents.	Better wording.			X	We would like to stick to wordings that are used generally, e.g., cladding wall thickness, grid-to-fuel rod fretting.
255	Finland	3	3.137 (d)	Fuel design, core management and the resultant discharge burnup affect the fuel isotopic vector degradation, which in turn will impact the economy of fuel reprocessing or disposal.	ADD: or disposal. Effects to final disposal as an alternative to reprocessing should be taken into account as well.	X			
256	Finland	4	3.137 (e)	For new fuel element or new	ADD:		….. .), should		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				fuel assembly designs proposed by the fuel vendors to address in-reactor issues (e.g., stress corrosion cracking of fuel cladding, fission gas release and fuel assembly distortion) should remain compatible with industrial requirements for reprocessing or disposal.	or disposal. Effects to final disposal as an alternative to reprocessing should be taken into account as well.		remain compatible with back-end related requirements (back-end phases include handling, shipment, storage, disposal or reprocessing if applicable).		
257	Japan	9	3.137. (d)	(d) Discharge burnup Fuel design, core management and the resultant discharge burnup affect the fuel isotopic vector degradation, which in turn will impact the economy of fuel reprocessing. High discharge burnups degrade ~~spent~~ fuel isotopic compositions and therefore its reactivity ~~energetic quality~~. In mixed-oxide fuel, Pu content should be adjusted to maintain parity with reactivity of UO_2 fuel at discharge burnup. ~~As a result Pu content in mixed-oxide fuel should be increased to maintain parity with UO2 enrichment.~~	Clarification. In design, the discharge burnup is adjusted to maintain almost the same reactivity between UO_2 fuel and MOX fuel. This is the "parity" concept design.	X			
258	Korea	3	3.137 (e)	~ compatible with industrial requirements for back-end cycle (storage, reprocessing,	For more general description including all of back-end items.		…. compatible with back-end related requirements (back-		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				etc.)			end phases include handling, shipment, storage, disposal or reprocessing if applicable).		
259	Canada	19	4.1	"Safe operation of the reactor core ~~design~~ throughout the lifetime…"	Wording	X			
260	Turkey	43	4.2/2	systems and components to perform **their** function, for the relevant time period, with account	Typo.	X			
261	France	72	4.3	The characteristics of certain postulated initiating events may preclude the performance of realistic commissioning tests and recurrent tests that could confirm that structures, systems and components would perform their intended safety functions when called upon to do so, for example in case of ~~an~~ earthquake. For the structures, systems and components concerned and the events considered, a suitable qualification program should be planned and performed prior to their installation	Editorial	X			
262	Germany	33	4.5	…. such as fretting wear, oxidation, hydriding, crud buildup, fuel assembly bow etc.	Clarification	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
263	France	73	4.8	Add Seismic qualification tests and Critical heat flux tests for light water reactors	Add (e) Seismic qualification tests and (f) Critical heat flux tests for light water reactors		(a) Spacer grid tests (including pressure drop tests, crush strength tests and other structural tests such as seismic resistance tests); New (e) Fuel assembly thermalhydraulic tests including critical heat flux correlation determination.		Seismic resistance test is captured in bullet (a) – Close to Comment #264 (France #74). Seismic qualification tests using fuel length fuel assembly are not included.
264	France	74	4.8 (a)	(a) Spacer grid pressure drop, CHF performance, seismic resistance (crush strength) and structural tests;	Ref to TECDOC 1454 is also suggested		(a) Spacer grid tests (including pressure drop tests, crush strength tests and other structural tests such as seismic resistence tests);		CHF test is included as a new bullet (e) – Close Comment #263 (France #73).
265	Spain	7	4.9 (i)	We propose to remove crud formation	Crud is only, related with operating conditions, it is difficult to relate crud with burnup or fluence limit for new design fuel elements.	X			
266	Germany	34	4.9 (m)	~~Guide tube wear characteristics~~ Control rod integrity (pressurized water reactor)	Clarification		(l) Control rod and guide tube wear (for pressurized water reactors).		
267	Finland	5	Reference list	INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Design, IAEA	Typo SSR-2/1 Rev.1 has been published in 2016	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				Safety Standards Series No. SSR-2/1 (Rev. 1), IAEA, Vienna (2016).					
268	Finland	6	Reference list	INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection, 2016 Edition, IAEA, Vienna (2016);	Updated glossary 2016 has been published.	X			
269	Japan	10	RFERENCES, [1]	[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Design, IAEA Safety Standards Series No. SSR-2/1 (Rev. 1), IAEA, Vienna ~~(2015)~~ (2016).	Typo.	X			
270	Japan	11	RFERENCES, [13]	[13] INTERNATIONAL ATOMIC ENERGY AGENCY, Design of Instrumentation and Control Systems for Nuclear Power Plants, Safety Standards Series, Safety Guide No. SSG-39, IAEA, Vienna ~~(2015)~~ (2016).	Typo.	X			
271	Turkey	44	I-1/under subheading "Fuel element	(a) Pellet and cladding temperatures and **temperature** distributions	Typo.	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			performance"						
272	Turkey	45	I-1/last paragraph, line 3	plants (lead **test** fuel rods or lead test fuel assemblies). The models are generally burnup	Typo.	X			
273	France	75	Annex I – I.2 FUEL ASSEMBLY	(f) Avoidance of boiling crisis	Boiling crisis is an "item to be addressed within the design of fuel assembly" as the mixing grid is one of its key component.		(c) Thermalhydraulic limits (e.g., critical heat flux);		
274	Turkey	46	Annex II/Title	ANNEX II: SUPPLEMENTARY **TECHNICIAL** INFORMATION	Typo.	X			
275	France	76	Annex II-1	in this Safety Guide~~s~~	editorial	X			
276	Finland	7	Annex II-2 "Burnable absorber"	Burnable absorber can be used to flatten the power distribution and to reduce variations in reactivity during fuel burnup. For pressurized water reactors <u>and boiling water reactors</u>, in order to maintain a negative moderator temperature coefficient, the designer could choose to reduce the required concentration of the burnable absorber in the moderator by adding fixed burnable absorber to the fuel pellet or to the fuel assembly	ADD: <u>and boiling water reactors</u>, The clarification as presented in the current version gives the impression that burnable absorbers are only used for pressurized water reactors which is not the case. Minimum change is to interchange the sentences as burnable absorbers are used in BWRs too.		Reworded "pressurized water reactors" to read as "light water reactors".		

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				in the form of burnable absorber rods.					
277	France	77	Annex II-2 cladding	“cladding structural integrity” is required to prevent the release of (parts of) fuel pellets and solid fission products to coolant.	Experience feedback	X	…. “cladding structural integrity” is required to prevent the release of solid fuel particles to coolant.		
278	Finland	8	II-2 “Control” supplement to 3.17 (a)	Arranging control rod banks so as to avoid large radial and axial distortions of the power distribution ~~(pressurized water reactors)~~;	REMOVE limitation to PWR. Isn’t this possible also in BWRs? They too use control rod banks.	X			
279	Iran	13	Annex 2/3.19	The statement “For pressurized water reactors, in order to maintain a negative moderator temperature coefficient, the designer could choose to reduce the required concentration of the burnable absorber in the moderator by adding fixed burnable absorber to the fuel pellet or to the fuel assembly in the form of burnable absorber rods “shall be replaced by “For pressurized water reactors, in order to maintain a negative moderator temperature coefficient, the designer could choose fixed burnable absorber added to the fuel pellet or fuel assembly in the form of burnable absorber		X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				rods to reduce the required concentration of the burnable absorber in the moderator .					
280	Finland	9	II-2 “Control” , supplement to 3.72, (b) 3rd item	Use of fuel with distributed or discrete burnable absorber ~~poison~~;	Instead of burnable poison we would prefer burnable absorber in conjunction with doped fuel. The motivation for this is that poison is in general something harmful and thus something to avoid. However, in the case of e.g. Gd-doped fuel (or other similar materials) the Gd is put on purpose to avoid excess reactivity at the beginning of the lifecycle. Consequently, it is something wanted and useful. Thus, burnable absorber would be better.	X			
281	Turkey	47	Annex II/Core components, line 1-2	In the IAEA Safety Glossary [9], “core components” **refer** to the elements of a reactor core, other than fuel	Typo.	X			
282	France	78	Annex II-2 - Defective fuel	For example, loss-of-coolant accident margins are not affected by the presence of leaking fuel because conservative assumptions are specified as requirements for radiological consequence evaluation.	This question is under investigation in France		For example, loss-of-coolant accident margins may not be affected by the presence of leaking fuel ….		
283	France	79	Annex II-	Reactivity initiated accident	Fuel coolant interaction		Reactivity initiated		Not necessary to

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			2 - Defective fuel	design limits need not be affected in case of the presence of leaking fuel, although it is recognized that leaking fuel has lower capability in withstanding reactivity initiated accident and consequently a higher probability to cause fuel coolant interaction which requires a dedicated analysis.	requires specific analyses if it cannot be excluded.		accident design limits may not be affected by the presence of a limited number of leaking fuel rod(s), although it is recognized that a leaking fuel rod has lower capability in withstanding reactivity initiated accident loadings and consequently have a higher probability to cause limited fuel coolant interaction.		indicate that dedicated analysis is required.
284	Turkey	48	Annex II/Fuel, item 7	The hot element **refers** to the fuel element with the highest relative power, considering the conservative radial core power distribution.	Typo.	X			
285	Iran	27	Annex II – load following	It is recommended that this clarification/definition refer to a IAEA doc –as its done in other clarifications				X	Not defined in IAEA Safety Glossary. IAEA TECDOCs cannot be used as references to Safety Guides.
286	Turkey	49	Annex II/Margin, item 1, line 3	physical parameter and the **extremum (minimum or maximum)** value of this physical	Better expression	X			
287	Turkey	50	Annex II/Margin,	The term "shutdown margin"	Better expression			X	The original statement clarifies

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			item 2	is not defined in the IAEA Safety Glossary [9]; however, it is generally accepted as the **amount of negative reactivity that the reactor can attain when** all full-length rod cluster assemblies are fully inserted except for the single rod cluster assembly of highest reactivity worth that is assumed to be fully withdrawn					the definition of shutdown margin.
288	Finland	10	II-2 "Margin" supplement to 3.18	The term "shutdown margin" is not defined in the IAEA Safety Glossary [9]; however, it is generally accepted as the instantaneous amount of reactivity by which a reactor remains subcritical from its present conditions assuming all full-length ~~rod cluster assemblies~~ control rods are fully inserted except for the single ~~rod cluster assembly~~ control rod of highest reactivity worth that is assumed to be fully withdrawn.	Delete: ~~rod cluster assemblies~~ ~~rod cluster assembly~~ Rod cluster assembly refers to PWR. However, shutdown margin is also used in BWRs. Consequently, a more general term control rod would be preferred.		Reworded to "control rod assembly".		
289	Russia	5	Annex II, "Margin"/ 4-10	The difference between the design limit defined for a specific physical parameter and the maximum value of this physical parameter is called "safety margin". In	The term "design limits" is absent in IAEA Safety Glossary [9]. Terms "design limits", "safety limits" and "acceptance criteria" are not at all interchangeable.	X			

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				accordance with IAEA Safety Glossary [9], the safety limits are limits on operational parameters within which an authorized facility has been shown to be safe. According to requirement 15 [1], a set of ‘design limits” consistent with the key physical parameters for each item important to safety for the nuclear power plant shall be specified for all operational states and for accident conditions. Part “design limits” are “operational limits”, which include (a) safety limits, (b) limiting settings for safety system and (c) operational limits for operational states (para 5.44 [1]). The “design limits” also include the “acceptance criteria”, which are used in analysis of accidents. These criteria characterize as a rule the maximum value parameters in which physical barriers retain their integrity (maximum temperature of the fuel and cladding, the maximum pressure in the primary circuit, etc.).					
290	Switzer-land	60	p. 41	ABBRE~~B~~VIATIONS	Rather poor list; why not extend it under the heading			X	Abbreviations are not used in this

COMMENTS						RESOLUTION			
NO.	MS	Com. No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
					“Abbreviations and acronyms”?				Safety Guide according to technical editing rules for Safety Standards.
291	Switzer-land	61	Annex II	Burnable absorber	Burnable poison is still used twice in the annex II	X			All are corrected.
292	Iran	28	Editorial a. Contents/24 b. 3.24/36 c. 3.43/22	a. "DESGN" shall be modified to "DESIGN" b. "excced" shall be modified to "exceed" c. "distorsion" shall be modified to "distortion"		X			
	Tajikistan			No comments					
	Panama			No comments					
	Thailand			No comments					