DS407
CRITICALITY SAFETY IN THE HANDLING OF FISSILE MATERIAL IN FACILITIES AND ACTIVITIES

RESOLUTION OF SAFETY COMMITTEE MEMBERS

COMMENTS

on

DS407 Version 7

CONTENTS

DS407

CRITICALITY SAFETY IN THE HANDLING OF FISSILE MATERIAL IN FACILITIES AND ACTIVITIES

COMMENTS BY REVIEWER Reviewer: Christian Kennes Country/Organization: Belgium/Bel V			Page 1 of 2 Date: May 22nd , 2012	RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	3.12 (page 15)	o andSafety measures provided by …	editorial mistake	Y			
2	4.7 (page 26)	All margins adopted in setting safety limits should be justified and document with sufficient detail and clarity to allow an independent review of the ~~judgements made~~ chosen margins	Wording		Retained the reference to “judgments made” and added the proposed text. The judgments made will include any assumptions made in choosing the margins.		
3	5.32 (page 36)	*“and can be applied instead of the peak k_{eff} approach”, for which an assessment is required whenever k_{eff} could increase due to irradiation”*	k_{eff} increasing because of irradiation, outside a reactor i.e. for fuel assemblies which have been placed in a storage, is not obvious at first sight and can only occur in some special cases. For sake of clarity it should be worth to explain in a few words how such a		An explanation for peak keff added to para and the concept of burn up credit is explained in para 5.32.		

DS407
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			phenomenon occurs. In another hand as a term like "peak k_{eff} approach" is not well known outside a bunch of specialists it would be useful to establish a short glossary putting together and defining these special terms (burnup credit, peak k_{eff} approach …).				
4	5.41 (page 38)	• The need for moderator control during furnace operations ~~causingcondensation~~ causing condensation.	editorial mistake	Y			
5	5.63 (page 43)	Last sentence. "*are likely to be more significant than the immediate effects of direct radiation from a criticality event*"	Wording	Y			
6	5.65 (page 43)	Last sentence "*If an integrated risk approach is used, consideration should be given to*	*These* other hazards are not mentioned.	Y			

DS407
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		the balance of risk between the criticality hazard and ~~these~~ the other hazards".					
7	5.71 (page 44)	Last line: *"…to be conducted solely on the basis of a deterministic ~~system~~ approach "*	Wording	Y			

COMMENTS BY REVIEWER Reviewer: Nuclear Criticality Safety Staff Page... 5 of 93 Country/Organization: Canada/Canadian Nuclear Safety Commission Date: 2012/05/03				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	Generic	Additional review/comment cycle is needed in order to allow member states to address potentially significant changes to the technical contents introduced in Rev. 7 of DS407	The draft DS407 (Version 7) which contains the 'Technical Editor's Comments with Track Changes and Clean' was uploaded on NUSSC website on 26 April 2012 –i.e. in the middle of the comment period. Some seemingly non-technical changes appear to change technical contents and those changes should be validated with technical experts to ensure that the technical contents remain valid.			Y	Please provide the specific changes so that they can be reviewed for their technical impact.
2	5.26/1	In some spent fuel storage ponds one component of criticality safety *measures* ~~control~~ may be the inclusion	Inconsistent terminology has been mostly eliminated from version 6 of DS407; this is one of few remaining inconsistencies.		In some storage ponds for spent fuel one criticality safety measure may be the …..		
3	5.27/1;	In some facilities the presence of high radiation fields can lead to detrimental changes in the physical and chemical form of the fixed absorber materials used *as* ~~for~~ criticality safety *measure* ~~control~~	Inconsistent terminology has been mostly eliminated from version 6 of DS407; this is one of the few remaining inconsistencies.		In some facilities, the presence of high radiation fields can lead to detrimental changes in the physical and chemical form		

COMMENTS BY REVIEWER Reviewer: Nuclear Criticality Safety Staff Page... 5 of 93 Country/Organization: Canada/Canadian Nuclear Safety Commission Date: 2012/05/03				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
					of the fixed absorber materials used as a criticality safety measure.		
4	5.28/6	Where soluble boron is used *as* ~~for~~ criticality safety *measure* ~~control~~, operational controls should be implemented …	Inconsistent terminology has been mostly eliminated from version 6 of DS407; this is one of the few remaining inconsistencies.		Where soluble boron is used as a criticality safety measure,		
5	5.31/3	…features and requiring different criticality safety ~~controls~~ *measures*. .	Inconsistent terminology has been mostly eliminated from version 6 of DS407; this is one of the few remaining inconsistencies.	Y			
6	5.41/1	The following issues are of particular importance and should be considered for criticality safety ~~control~~ in reprocessing facilities:	Inconsistent terminology has been mostly eliminated from version 6 of DS407; this is one of the few remaining inconsistencies.	Y			
7	5.62/1	Criticality safety ~~control~~ of waste operations should be based on the application of appropriate limits on the waste package contents. Other criticality safety *measures* ~~controls~~ may include	Inconsistent terminology has been mostly eliminated from version 6 of DS407; this is one of the few remaining inconsistencies.		Comment is referring to 5.61. Criticality safety for		

COMMENTS BY REVIEWER Reviewer: Nuclear Criticality Safety Staff Page... 5 of 93 Country/Organization: Canada/Canadian Nuclear Safety Commission Date: 2012/05/03				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
					waste operations should be based on the application of appropriate limits on the waste package contents. Criticality safety measures may include		
8	5.79/1	Due to the significant flexibility in operations, criticality safety *measures* ~~controls~~ on	Inconsistent terminology has been mostly eliminated from version 6 of DS407; this is one of the few remaining inconsistencies.		This comment is referring to 5.78.		
9	3.2/7	Replace “criticality event” by “criticality accident”.	Inconsistent terminology is used throughout the document. It appears that “event” is not meant to be an “accident”.			Y	There is no reference to event in 3.2
10	6.14/3, 6.22/1, 6.52/1	Replace “credible” by “reasonably foreseeable”.	Term “possible” was replaced by “credible” in response to Canada – CNSC comment No 29. However, this comment may have been misunderstood.	Y			

COMMENTS BY REVIEWER Reviewer: Nuclear Criticality Safety Staff Page... 5 of 93 Country/Organization: Canada/Canadian Nuclear Safety Commission Date: 2012/05/03				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			Essentially, the Canadian comment is the same as that of the UK comment no 127. Namely, different terms are to be used in safety analyses and in emergency response because the emergency response, by its virtue, deals with a wider range of conditions including less likely conditions. Since, term “credible” is used consistently in the safety analysis sections of DS407, the term “reasonably foreseeable”, proposed in UK comment no 127, fits the intent of the emergency response section.				

DS407

CRITICALITY SAFETY IN THE HANDLING OF FISSILE MATERIAL IN FACILITIES AND ACTIVITIES

<table>
<tr><td colspan="4">COMMENTS BY REVIEWER
Reviewer: Mr/ Moustafa Aziz
Page.... of....
Country/Organization: Egypt (Nuclear and Radiological Regulatory Authority) Date:</td><td colspan="4">RESOLUTION</td></tr>
<tr><td>Comment No.</td><td>Para/Line No.</td><td>Proposed new text</td><td>Reason</td><td>Accepted</td><td>Accepted, but modified as follows</td><td>Rejected</td><td>Reason for modification/rejection</td></tr>
<tr><td>1</td><td>Page 7 para 1.1 line 1</td><td>Nuclear criticality can theoretically be caused under certain conditions by most fissionable ……..</td><td>Under certain conditions is inserted in the first line.</td><td>Y</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Page 7 para 1.1 line 3</td><td>Neutron energy flux.</td><td>The word neutron is removed from the third line , neutron is repeated two times at this line</td><td>Y</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Page 7 para 1.3 line 2</td><td>Example , mass, concentration , geometry , volume , enrichment or density,…</td><td>Volume is added among words because volume is important factor that determine the criticality</td><td>Y</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Para 3.6 page 15</td><td>Bracket should be deleted at the end of para 3.6</td><td></td><td>Y</td><td></td><td></td><td></td></tr>
</table>

COMMENTS BY REVIEWER Reviewer: Mr/ Moustafa Aziz Page.... of.... Country/Organization: Egypt (Nuclear and Radiological Regulatory Authority) Date:				RESOLUTION			
	last line						
5	Page 28 para 4.11 last line	The fissile material characteristics (e.g. mass ,volume , moderation , isotopic compositions , enrichment , <u>burnup ,….</u>	Burn up is used instead of absorber depletion , because the word" burnup" is widely used to represent the degree for which fissile isotopes is depleted .			Y	Burn covers more than absorber depletion. Note that fission product production is also included in the list.

DS407
CRITICALITY SAFETY IN THE HANDLING OF FISSILE MATERIAL IN FACILITIES AND ACTIVITIES

COMMENTS BY REVIEWER Reviewer: ENISS Page. 1 of 7 Country/Organization: ENISS Date: 27th May 2012				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	1.2	Nuclear facilities and activities containing fissile material or in which fissile material is handled are required to be managed in such a way as to ensure subcriticality, as far as reasonably practicable, in normal operation, anticipated operational occurrences and ~~in~~ during and after design basis accidents (or the equivalent) [1]. This requirement applies to large commercial facilities, such as nuclear facilities that deal with the supply of fresh fuel, with the management of spent fuel and with radioactive waste containing fissile nuclides, including the handling, processing, use, storage and disposal of such waste. This requirement also applies to research and development facilities and activities that use fissile material and to the transport of packages containing fissile materials.	Post-accident operations should also be addressed, e.g. restart after accident (e.g. earthquake) may cause specific criticality problems (especially automatic restart of active engineered devices). Same comment as for 4.6	Y			
2.	3.6	The design should take account of fault tolerance in order to replace or complement passive safety (if any). The double contingency principle is required to be the preferred means of ensuring fault tolerance [1]. By virtue of this principle, a criticality accident cannot occur unless at least two unlikely, independent and concurrent changes in process conditions have occurred.	There cannot be passive safety everywhere, even if it is the preferred choice. See also Para 3.15, where it is explicitly stated.	Y			
3.	3.6	*Although NS-R-5 simply mentions “changes”, consider reverting to former formulation: “…concurrent events… resulting in changes.…”*	The DCP, as defined in 3.7, refers to “two events”, not “two changes”. Moreover, if the two events are the opening of two redundant		Text made consistent with NS-R-5, referring to changes in process conditions.		

			valves, the two changes in characteristics and conditions are not that clear (is the opening of the first valve, which does not lead to any flow, a change in itself?).				
4.	3.8	*Include (as was the case in version 4), the Para 3.8 as a third bullet of Para 3.7*	It is its proper place. Moreover, the sentence "each event can be detected" has no meaning if not referring to one of the two events of the DCP (we are not expected to detect all events, as they are not necessarily relevant to criticality safety).			Y	Continue to agree with UK comment no 28 on Version 4 that: *"The double contingency principle (Para II-5 NS-R-5) does not say this. This is a further step in the analysis process."*
5.	3.11	The safety measures for ensuring subcriticality should be determined and the safety functions they perform should be defined. The definition and substantiation of the safety functions should be based on an analysis of all initiating or aggravating events relevant to criticality safety arising from credible abnormal conditions, including; human error, internal and external hazards, loss or failure of structures, systems and components important to safety in operational states and during design basis accidents (or the equivalent).	Events that do not initiate but do worsen the situation have to be considered also (especially operator or active components behavior, in a counter-intuitive situation).	Y			
6.	3.12	*Second Bullet point:* "<u>Automatically initiated</u> active engineered safety measure"	This terminology is not used afterwards: only "active engineered safety measure" is quoted in Paras 3.32 & 3.33. Use consistent terminology (or explain somewhere the identification or difference)			Y	An active engineered safety measure can be initiated either automatically (bullet 2) or manually (part of bullet 3). Terminology is consistently used.
7.	3.12	*Third Bullet point:* An "Active engineered safety measure" initiated by operating personnel is said to be an "Administrative safety measure".	This is <u>not consistent</u> with Para 3.31, which states that "Any engineered component that is not a passive component is an active component, though it may be part of <u>either an active engineered</u>			Y	The text in Para 3.12 & 3.31 is consistent.

			safety measure or an administrative safety measure. Use consistent terminology (for example active component like in Para 3.31.				
8.	3.17	*Third Bullet point:* "Limitation on the concentration of fissile nuclide ~~within a solution~~"	In fact concentration may be applied to solids (plutonium in concrete for instance). Note that it may also be applied to - non homogeneous material; what matters is not the homogeneity per se, but the fact that the concentration is lower than the limit at each point (i.e. that the maximum value for a heterogeneous material is lower than the limit) - non hydrogenous materials (carbon in graphite for example) Concentration control definition should therefore not be too stringent		Text amended as suggested with reference to mixture and solid given as an example.		
9.	3.19	- The compound to be used cannot change to become a more reactive compound; - mixture of different types or different compounds resulting in a higher effective neutron multiplication factor, cannot occur. As the last two events, could in specific situations nevertheless occur, they should be taken into account in the criticality safety assessment, and proven to be subcritical.	Precipitation of a U-Pu nitrate solution cannot always be prevented. But it should be taken into account into the assessment (for instance, by showing that in can only occur when there the fissile mass remains under the safe value). (it's easier for isotopic composition, that does not change with chemical reactions)		Propose text added as a new para with the precipitation of the U-Pu nitrate solution added as an example.		
10.	3.29	Passive engineered safety is the highest ranked means of ensuring subcriticality (see para. 3.12). Passive engineered safety measures use passive	While oppose "moving" to passive? Electronic devices used for safety do not especially		Reference to moving parts deleted. But retained the proposed		

		components ~~rather than moving parts~~. Such measures are highly preferred because they provide high reliability, cover a broad range of criticality accident scenarios, and require little operational support to maintain their effectiveness. Human intervention is not necessary. Advantage may be taken of natural forces, such as gravity, rather than relying on electrical, mechanical or hydraulic action. ~~In addition, certain components that function with very high reliability based on irreversible action or change may be assigned to this category.~~	"move" (especially if they forbid a movement). A "self-priming siphon" is a moving passive device (or if considered "active", should be clearer). Confusing sentence. Active components are not "passive". If they are grouped with passive components, it is because we consider a "reliability" criterion, not because they become "passive" in any sense. Passive system may be less reliable (ageing may affect material, overflows may clogg if not inspected).		deleted text as some Member States apply this criterion.		
11.	3.30	In addition, certain components that function with very high reliability based on irreversible action or change may be designated as passive components. Examples of passive components are geometrically favourable ~~heat exchangers~~, pipes, vessels and structures, solid neutron absorbing materials, and the form of fissile materials. *Examples only deal with "static" calculation model. It may be interesting to add other passive design: "vessel overflows, self-priming siphons…"* *Specific problems may be mentioned (clogging, jamming…)*	Needs a flow (usually not passive, except for natural convection) Diversification (overflows are always passive, if self-priming siphons were not considered as such, they should probably be given as an example of active safety)		Reference to heat exchanges deleted.		
12.	3.31	Certain components, such as rupture discs, check valves, safety valves~~,~~ and injectors ~~and some solid state electronic devices~~, have	It is not at all clear how an electronic device be passive. Recommend that this is removed..	Y			

		characteristics that require special consideration before designation as an active or passive component. Any engineered component that is not a passive component is designated an active component, though it may be part of either an active engineered safety measure or an administrative safety measure.					
13.	3.33	Examples of active components are neutron or gamma monitors, computer controlled systems for the movement of fissile material, electronic weighing scales, trips based on process parameters (e.g. conductivity, flow rate, pressure and temperature), pumps, fans, relays and transistors. Active components that require human action in response to an engineered stimulus, (e.g. response to an alarm or to a value on a weighing scale) are administrative safety measures, though they contain active engineered components.	A scale in itself is not necessarily active, some use gravity only (then, either the movement to the scale, or the action after weighing is active) Recommended that either "weighing scales" is removed or it is made clearer, i.e. "electronic weighing scales"		Reference to weighing scales deleted.		
14.	3.37	*Third Bullet:* Should include mandatory operations, advice and guidance for anticipated operational occurrences and accident conditions;	Abnormal operations may be strictly addressed in the written procedures.	Y			
15.	3.45	*Third Bullet:* If there is a potential for unsafe conditions to occur in the event of a deviation from normal operations, stopping work in a safe way and reporting the event as required.	It may be worse to simply stop working than continuing operation.	Y			
16.	4.4	A criticality safety assessment should be performed prior to the commencement of any new or modified activity involving fissile material. A criticality safety assessment should be carried out during the design, prior to ~~the~~ and during construction, commissioning and operation of a facility or activity, and also prior to ~~the~~ and during decommissioning of the facility and the post-operational clean-out, transport and storage of fissile materials.	Compliance with safety criteria is included in the assessment, according to Par 4.5: for geometry control, compliance may only be ensured after construction (spacing…). See also comment on Para 4.8. For decommissioning, the material samples are commonly taken during the decommissioning phase for analysis and are necessary for compliance with assumptions.	Y			

17.	4.6	The criticality safety assessment should include a criticality safety analysis, which should evaluate subcriticality in for all operational states, i.e. normal operation and, anticipated operational occurrences and also during ~~for~~ and after design basis accidents (or the equivalent). The criticality safety analysis should be used to identify hazards, both internal and external, and to determine their consequences.	Post-accident operations should also be addressed. E.g. restart after accident (e.g. earthquake) may cause specific criticality problems (especially automatic restart of active engineered devices). Same comment as for 1.2.	Y			
18.	4.15	The criticality safety assessment should identify all credible initiating events, i.e. all incidents that could lead to an anticipated operational occurrence or a design basis accident (or the equivalent). These should then be analysed and documented taking into account possible aggravating events . The following should be considered when performing the analysis:	See comment on Para 3.11	Y			
19.	5.5	In conversion facilities typically natural uranium ore concentrate is purified and converted to the chemical forms required for the manufacture of nuclear fuel, i.e. uranium metal, uranium oxides, uranium tetrafluride or uranium hexafluoride, in preparation for enrichment.	There are several oxide encountered (UO_2, U_3O_8) and UF_4 is also industrially produced.	Y			
20.	5.10	Such facilities can be characterized by the 235U content, for uranium fuel fabrication, or, for facilities mixing powders of uranium and plutonium (i.e. MOX fuel fabrication facilities), by the isotopic composition of the Pu in the mixture (principally 239Pu, 240Pu and 241Pu) and by the 235U content in the uranium.	The corrections need to be implemented as proposed as the Pu/U ratio is really important for MOX.			Y	Could not identify the proposed corrections? The proposed text is the same as the original text.
21.	5.17	The storage area for fresh fuel should meet the requirements specified in the ~~design~~criticality safety assessment and should be such that the stored fresh fuel will remain subcritical at all times, even in the event of credible internal or external flooding or any other event considered credible in the design safety assessment. Engineered and/or administrative measures	Design values may not be the relevant ones and the limitations may change, depending on new analyses (and the acceptance of new fuels for instance).	Y			

		should be taken to ensure that fuel is handled and stored only in authorized locations in order to prevent a critical configuration from occurring. It should be verified that the fuel's enrichment level complies with the ~~design~~ criticality limitations of the storage area.					
22.	5.36	*Third bullet (burnable poison) should be introduced outside BUC.* *Not taking into account the poison as a bounding solution may be referred to.*	Not specific to BUC			Y	Including burnable poisons within a BUC analysis is possible. Ref to IAEA TECDOC 1547.
23.	5.57	*Furnace operations will rather use "safe geometry" (if "favourable geometry" involves another controlled parameter other than the material characteristics per se)*	See comment on Para 3.5			Y	Do not intend to use the term "safe geometry" as some other fissile material in the furnace may constitute a critical mass.
24.	5.76	Laboratories are dedicated to the research and development…	Industrial laboratories are missing. This is too restrictive: Facilities also have laboratories, to control the characteristics (and ensure criticality characteristics are OK). Enlarge the scope Or change the title to R&D laboratories.		Title changed.		
25.	6.54	*5th Bullet:* ~~It should continue to alarm until evacuation is complete;~~ It should last a time sufficient to allow a complete evacuation;	It is difficult to know exactly, when the evacuation is complete. Typically alarms last a tenth of minutes.		It should continue to alarm for a time sufficient to allow a complete until evacuation is complete;		

CRITICALITY SAFETY FOR FACILITIES AND ACTIVITIES HANDLING FISSIONABLE MATERIAL (DS407)

COMMENTS BY REVIEWER Reviewer: F. Féron Page Country/Organization: France / ASN+IRSN Date: 16 May 2012				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	References		Several references (e.g. [10], [28] [29], …) – not in the bibliography – are not IAEA or ISO documents. Taking into account the “change” of the Bibliography into an annex, which is a good idea, these references should be transferred in this annex.			Y	Technical Editor confirms current approach acceptable.
2.	Title	<u>Criticality safety in facilities and activities handling fissile material</u>	“…in the handling of fissile material…” gives the impression that the guide deals with only a particular operation (i.e. “handling”).			Y	Technical Editor proposed the change to the original title to ensure clarity and to ensure that it can be translated correctly.
3.	Moving the definitions to footnotes.		Some of the definitions are not specific to this guide (management, credible, fault tolerance, legacy waste…). Transferring them to footnote is better than keeping the glossary. The IAEA should however verify in other Safety standards if these “definitions” are adequate and worth being incorporated in the Safety Glossary.		Technical Editor will consider the suggestion for definitions to be incorporated into the Glossary.		

4.	§ 1.2/4, § 2.9/5 § 3.4/ table § 3.11/5 § 4.6/3 § 4.15/2 § 4.16/4 § 5.2/6 § 5.24/3	Design basis accident "*(or the equivalent)*"	Meaning of "or the equivalent" is not clear. Delete it if there is no explanation or replace "design basis accidents (or the equivalent)" by "accident conditions postulated". The concept of DEC should not be a priori excluded (see comment below on France stress tests on fuel cycle facilities)			Y	Term used is consistent with NS-R-5 and therefore cannot be changed.
5.	§ 2.3	Delete the § 2.3	The idea is already given in the previous § 2.2 (last sentence).			Y	2.3 is useful and also contains reference to Ref [10].
6.	§ 2.5/2, §3.18/3	Subcriticality implies a value of keff <u>strictly</u> less than unity… … or by calculation of the parameter value that meets the criterion that keff is <u>strictly</u> less than unity…	Strictly means that it is necessary to have a minimum safety margin, in accordance with the § 2.6.			Y	Adding the word "strictly" does not improve or change the recommendation to be less than unity.
7.	§ 2.7/5	Operational limits and conditions are often expressed in terms of process parameters, e.g. <u>fissile mass and moderator content, concentration, acidity, liquid flow rates and temperature.</u>	The initial hierarchy of examples is not correct because temperature is not a criticality parameter widely met in facilities instead of mass or other examples given. Add also concentration as a parameter.	Y			
8.	§2.10	Modifications to the facility and/or activities should be evaluated<u>, before being implemented,</u> to determine if the bases for the exemption are still met.	Assessment should be performed prior to implementation. To be consistent with 2.12	Y			

9.	§2.11	Consequently, the human factors, ~~and~~ the human-machine interface between human and engineered systems <u>and organizational factors</u> should be considered.	Organizational factors should also be considered	Y				
10.	§2.12/2nd bullet	~~For the correct~~ <u>To facilitate</u> implementation of operating procedures used to ensure subcriticality,	Involving operators does not *ensure* correct implementation…	Y				
11.	§2.12/ 7th bullet	Management should arrange for internal and independent inspection<u>*</u> of the criticality safety measures, <u>* These inspections are in addition to the ones performed by the regulatory body</u>	Clarification : inspection by the regulator does not relieve the licensee from these in-house generated inspections.		* Text added as a footnote.			
12.	§2.12 bullet list		The bullet "• Management should ensure that criticality safety assessments and analyses are conducted, documented and periodically reviewed;" should appear at the beginning of the list, maybe as the second bullet…				Y	Hierarchy is not implied by the list.
13.	§2.14	Inspection of existing facilities and activities <u>by the operating organization staff and management</u> as well as the proper control of modifications in facilities and activities are particularly important for ensuring subcriticality and should be carried out regularly and the results reviewed by management and corrective actions taken if necessary.	Clarification to avoid confusion with inspections by the regulator				Y	The text does not introduce any confusion with the regulator as the section is dealing with the responsibilities of the management.

14.	§2.16	The investigation should include an analysis of the operation of the facility and ~~human errors~~ <u>of workers and supervisors/manager actions</u>, and a review of the criticality safety assessment and analyses that were previously performed, including the safety measures that were originally established.	Alternative wording to be more positive…		Reference to human factors used instead.		
15.	§3.3	Delete §3.3	Superfluous. Furthermore, the Fukushima accident has induced, especially in Europe (stress tests), to consider accidents that are beyond basis accidents for NPP. In France, this approach was also implemented for the most significant fuel cycle facilities (especially La Hague reprocessing plant)…			Y	The para is referring to the application of the defence in depth concept that is a requirement from NS-R-5.
16.	Table 1/ Level 3	Safety measures, multiple and as far as ~~possible~~ <u>practicable</u> independent barriers ~~or~~<u>,</u> procedures for the control of events.	Clarification	Y			
17.	Table 1/level 4 and 5	In Table 1, merge “Means” cells of levels 4 and 5	The omitted line is not a “formatting error”. See § 3.3: “…the fourth level of defence in depth…may not be fully applicable in the context of criticality safety. However…”	Y			
18.	§ 3.5/5, § 4.9/4, § 5.56/1	Replace “containers” by “<u>equipment</u>”	Wording. Equipments is more generic than containers.	Y			
19.	§3.7/2nd bullet	The probability of occurrence of each event is ~~acceptably~~ <u>sufficiently</u> low.	Alternative, (“Acceptably” implies someone find it acceptable…)	Y			

20.	§ 3.8	The § 3.8 should be a bullet of § 3.7	The idea of "concurrent changes" is present in the double contingency principle as written in the Para II-5 NS-R-5.			Y	Existing bullets are compatible with the definition in NS-R-5. No need to add 3.8 as an additional bullet as it is addressing another concept other than the double contingency principle.
21.	§ 3.9/1	The system design should follow the fail-safe principle and, ~~as a minimum~~, the safety measures should fulfill the single failure criterion…	The expression "as a minimum" could mean that it's necessary to respect only he single failure criterion and that the double contingency principle is "optional". That is not the case as written in § 3.1.	Y			
22.	§3.11	~~The safety measures for ensuring subcriticality should be determined and the safety functions they perform should be defined~~ The safety functions needed for ensuring subcriticality should be determined and the safety measures implementing these functions should be defined.	Inverse the logic : identification of the functions to be implemented then the means of implementation	Y			
23.	§ 3.12/2nd bullet	(e.g. automatic process regulation system, automatically initiated shutdown system)	Add another example because there are other systems than automatic shutdown.		Following text added which has the same sense: (e.g. an automatically initiated shutdown or process control systems)		

24.	§ 3.17/3rd bullet	Limitation on the concentration of fissile nuclides within <u>an homogeneous hydrogenated mixture</u>	"homogeneous hydrogenated mixture" is more generic than "solution".	Y			
25.	§3.29	Such measures are highly preferred because they provide high reliability, cover a broad range of criticality accident scenarios, and require little operational support to maintain their effectiveness <u>as long as ageing aspects are adequately managed</u>.	Ageing should be considered	Y			
26.	§3.29	At the end, add "<u>Like active components, passive components are subject to (random) degradation and to human error during installation and maintenance activities. They require surveillance and, as necessary, maintenance</u>"	To be consistent with 3.32	Y			
27.	§3.30	~~In addition, certain components that function with very high reliability based on irreversible action or change may be designated as passive components.~~ <u>Usual</u> Examples of passive components are ~~geometrically favourable heat exchangers,~~ pipes, vessels and structures, solid neutron absorbing materials, and the form of fissile materials.	Questionable sentence.		Original text retained as some Member States refer to these devices as passive. However, the example list was not consistent with the text and has been moved into the previous para.		

28.	§3.31	~~Any engineered component that is not a passive component is designated an active component, though it may be part of either an active engineered safety measure or an administrative safety measure.~~	Brings confusion but highlight the difficulty of getting truly passive equipment… May be inconsistent with 3.30 (if kept as currently written).			Y	Agree with the sentiment regarding the difficulty of defining passive equipment, but important to acknowledge the role that passive components may play in an active system.
29.	§3.31	Should be located after 3.33	More logical location			Y	Para is referring to passive devices and should therefore remain.
30.	§3.32	Active components act by <u>“</u>sensing<u>”</u> a process variable important to criticality safety <u>(or by being actuated through the I&C system)</u> and providing automatic action to place the system in a safe condition, without the need for human intervention	Clartification	Y			
31.	§3.32	The use of redundant systems and components should be considered, <u>although it does not prevent common cause failure</u>.	Clarification	Y			
32.	§3.33	Examples of active components are neutron or gamma monitors, computer controlled systems for the movement of fissile material, weighing scales, trips based on process parameters (e.g. conductivity, flow rate, pressure and temperature), pumps, <u>valves</u>, fans, relays and transistors.	Clarification	Y			

33.	§3.33	~~Active components that require human action in response to an engineered stimulus (e.g. response to an alarm or to a value on a weighing scale) are administrative safety measures, though they contain active engineered components.~~	Superfluous. No need to enter into this kind of debate….			Y	Retained as it provides clarity
34.	§3.34	Specialists in human performance and human factors should be consulted <u>when developing the procedural controls and</u> to inform management as to the robustness, or otherwise, of the procedural controls and to seek improvements where appropriate.	HF specialists should be associated to the development of administrative measures, and not only later to inform the management…	Y			
35.	§3.35/last bullet	~~• The safety functions and safety classification of the structures, systems and components important to safety (e.g. this is applicable to the design, procurement, administrative oversight of operations, and to maintenance, inspection, testing and examination).~~	It is already covered by the various procedures mentioned in the bullet list			Y	Retained to ensure the list is exhaustive.
36.	§3.36	Should be located before 3.29	More logical place.			Y	Retained as the para refers generally to engineered safety measures and not just passive.
37.	§3.40	Management may delegate authority for the implementation of specific criticality safety measures to supervisors. The authority that is permitted to be delegated to a supervisor should be specified and documented <u>in the management system</u>.	Clarification	Y			
38.	§ 3.41	Delete the § 3.41	There is no criticality specific. Is it not already stated by Ref. [3] ?			Y	Accepted, but still provides useful recommendations.

39.	§3.42	In addition to these organizational requirements, management <u>and supervisors</u> should promote, in accordance with the requirements of Ref. [3], a safety culture	As supervisors are mentioned in 3.40	Y			
40.	§3.42	Split 3.42 in two paragraphs, the second one limited to the bullet list (which is somehow focused on resources and not indirectly at safety culture)				Y	Retain connection, as the provision of the organizational means is management's way of demonstrating support for the role of the criticality safety staff and is therefore related to safety culture.
41.	§3.43	Delete 3.43	Not specific to criticality… Covered by 3.35			Y	Retention of training records of criticality staff is related to the management of criticality safety.
42.	§3.44/1st bullet	• Provision of documented criticality safety assessments for systems of <u>or area with</u> fissile material;	To also include areas	Y			
43.	§3.45 bullet list	Add a bullet: "<u>• to promote a questioning attitude from staff and to demonstrate a safety oriented mind</u>"	In relation to safety culture In line with 3.32		Added, but reference to personnel to maintain consistency with document.		

44.	§3.46 bullet list	Add: "In relation to criticality safety, the responsibilities of operating personnel and other personnel should be to cooperate and comply with management instructions and procedures as well as to develop questioning attitude and a safety oriented mind"	In relation to safety culture In line with 3.32		Text added to end of sentence.		
45.	§3.49	Where administrative controls are required as part of a safety measure, these should be tested regularly ~~included in the functional testing~~.	To avoid mixing with functional tests.	Y			
46.	§3.50/2nd bullet	• The potential for common mode failure or common cause failure of safety measures;	To consider common cause failure.	Y			
47.	§4.1	In such an approach the adequacy ~~reliability~~ of safety measures in successfully minimizing, detecting and intercepting deviations in control parameters to prevent a criticality accident is judged mainly against a set of favourable characteristics such as the independence, redundancy and diversity of the safety measures, or whether the safety measures are engineered or administrative, or passive or active.	Reliability is restrictive and may infer PSA results… To mention redundancy and viersity	Y			
48.	§ 4.1/8	~~If these rules and requirements are met then it is inferred that the criticality risk (see para 4.2) is acceptably low.~~	Superfluous. Furthermore, there is not link between this sentence and § 4.2.			Y	It is the basis of the deterministic approach.
49.	§4.2	Using this value and a measure of the consequences ~~(sometimes assumed to be a single fatality per criticality accident for unshielded operations)~~, an estimate of the criticality risk can be made and compared with risk targets or criteria, if any, for the facility or activity.	This may not be such a good example….	Y			

50.	§4.3	The probabilistic approach is used to evaluate the extent to which overall operations at the facility are well balanced and~~, in some cases, may~~ to provide additional insights into possible weaknesses in the design or operation,	Simpler wording (the "may" is covered by "*possible* weaknesses"	Y			
51.	§4.3	Difficulties in applying the probabilistic approach are sometimes encountered in criticality safety assessment if ~~one or more of the safety measures includes the action of operating personnel as a significant component. The reliability of safety measures of this type can be very difficult to quantify. Also, in some cases~~ there ~~may be~~ is a lack of data on reliability, for example on human performance or for new types of equipment, hardware and software.	Simplification as manual diagnosis/actions is also a question of reliability data in modeling the facility operation.			Y	Current text highlights the problems in quantifying human performance.
52.	§4.3	Consideration should be given to the uncertainties in the values of risk derived by these methods when using the insights provided, especially if such values are to be used as a basis for significant modifications to a facility or activity.	Significant modification is one example only….	Y			
53.	§4.12	To provide clarity and understanding, the description of the operations should ~~include~~ be substantiated by relevant drawings, illustrations and/or graphics as well as operating procedures.	Not all items may be available…	Y			
54.	Title before § 4.19	Verification and validation of the calculation methods and nuclear data.	Complete the end of the title to be conformed with § 4.10	Y			
55.	§ 4.25	Move this para in the part "Methodology for criticality safety assessment" after the para § 4.16 or 4.18	This § concern also the part "methodology"	Y			

56.	§ 4.26, § 4.27, § 4.28	Move these para in the part "Verification and validation…"	These § concern the part "codes and calculation"	Y			
57.	§ 5.2/2	… <u>conversion</u> …	As § 5.7 said, conversion facilities can achieve criticality risk. However, in § 5.2 conversion is quoted as facilities where criticality risk is not credible. To be consistent with § 5.7, include conversion among examples given for facilities in which criticality risk is credible.			Y	5.2 is referring to conversion of natural uranium and 5.7 is referring to conversion of enriched or reprocessed uranium. The criticality hazard is therefore different.
58.	§5.3	The scope and level of detail to be considered for the criticality safety assessment can be influenced by the type of facility and its operation<u>*</u>. <u>*</u>Experimental facilities tend to have lower amounts of fissile material and flexible working procedures, and so human errors may be more prevalent. Fuel production facilities and fuel utilization facilities often have large amounts of fissile material and high production demands and use well-defined processes, which may depend on both human performance and the proper functioning of process equipment.	Transfer the end of the § in a footnote as it is a judgment not substantiated (for example, 80% of events reported at NPP have human errors in their causes…=	Y			
59.	§5.5 and 5.6		§5.5 and §5.6 could be merged as both address conversion of natural uranium.			Y	Noted, but preference is to keep the current structure.

60.	Between § § 5.13 & § 5.14	Put the part relating to "material cross-over" as written in § 5.20 of DS407 version 4	The reason given to delete this part is not convincing. The feedback shows that this type of event has already been met.	Y			
61.	§ 5.14/6, § 5.14/10, § 4.25/3	Replace "ventilation" with "<u>ancillary</u>"	Ancillary is more generic than ventilation (as presented in § 3.35).		4.25/3 not replaced as it was only an example.		
62.	§5.17	The storage area for fresh fuel should meet the requirements specified in the ~~design~~ safety assessment	No reason to restrict to a part of the safety assessment.	Y			
63.	§ 5.26/5	~~Further guidance on safety of spent nuclear fuel storage is provided in Ref. [22].~~	Duplicates § 5.34.			Y	Noted.
64.	Between § 5.31 & § 5.32	Add § 5.41 of version 4 of DS407	What is the reason of this suppression? (no comments found)	Y			
65.	§ 5.32/4	"peak keff approach"	Give a definition in footnotes.		An explanation of peak keff added in para 5.32.		
66.	§ 5.35/1st bullet	• Increased flexibility of operations ~~and simplification of administrative requirements~~	Subjective and not always true.	Y			
67.	§ 5.35/3rd bullet	• ~~Improved efficiency (e.g.~~ increased loading densities in spent fuel storage areas~~)~~.	Efficiency may not be the most appropriate word…	Y			
68.	§5.49	A process flow sheet[11] ~~should be used to~~ help<u>s</u> in determining the plant response and sensitivity of the facility to changes in the process, control or safety parameters.	Should is too strong…	Y			
69.	§ 5.67	Delete § 5.67	National positions may be very different on this point.	Y			

70.	§5.71 to 5.75	Delete 5.71 to 5.75	5.70 is enough Offsite transport conditions, and more generally operations covered by the transport regulations, are out of the scope of this guide.			Y	Transport is within the scope of DS407, see the DPP.
71.	§6.2	Despite all the precautions that are taken in the handling and use of fissile material, there remains a possibility~~, while very small,~~ that a failure (i.e. of instrumentation and controls, or an electrical, mechanical or operational error) or an event may give rise to a criticality accident	Superfluous	Y			
72.	§6.3	In demonstrating the adequacy of the emergency arrangements, the expected worker dose, and if relevant to a person from the public, due to external exposure should be calculated.	Clarification	Y			
73.	§6.13	• Provision of individual personal dosimeters, capable of measuring radiations emitted during a criticality accident;	To be explicit on capabilities of dosimeter (neutron measuring)	Y			
74.	§6.20	The operating organization should have the capability of conducting~~, or should engage external experts to conduct,~~ or having conducted an assessment of radiation doses appropriate for a criticality accident.	Alternative wording	Y			

75.	§6.22	In the design and operation stages and as part of periodic safety review, consideration should be given to identifying measures to further prevent a criticality accident and to mitigate the consequences of a criticality accident, e.g. for intervention in order to stop the criticality.	Prevention should not be omitted.	Y			
76.	§ 6.23/2nd bullet	• Decision on the ~~size~~ power of the criticality accident (i.e. the number of fissions that have occurred);	Power is a better term to characterize a criticality accident.	Y			
77.	§6.38	The emergency procedures should specify the criteria and radiological conditions on the site ~~and off the site~~ that would lead to evacuation of potentially affected ~~neighbouring~~ areas and a list of persons with the authority to declare such an evacuation. If these areas could exceed the site limits, relevant information should be provided to off-site emergency services and appropriate information should be included in the emergency procedures.	Off-site actions are usually not in the power of the licensee.	Y			

78.	§ 6.48/2	The need for a criticality detection and alarm system should be evaluated for all activities involving ~~more than a minimum safe mass~~ activities where the risk of exceeding a safe mass is credible"	The sentence may be confusing on whether the abnormal conditions are addressed or not.		Sentence also modified by USA comment no 55. The need for a criticality detection and alarm system should be evaluated for all activities involving, or potentially involving, involving more than a minimum the risk of exceeding a safe mass.		
79.	6.50	A criticality detection and alarm system should be provided ~~to mitigate the risk incurred and~~ to minimize the total dose received by personnel from a criticality accident and to initiate mitigative actions.	The detection system does not reduce the risk…	Y			
80.	6.51	Exceptions to the recommendation to provide a criticality detection and alarm system may be justified in ~~are~~ the following:	Don't be too affirmative…	Y			

81.	6.51/last bullet	Licensed or certified transport packages for fissile material in a state covered by the transport regulations ~~awaiting shipment or during shipment or awaiting unpacking. In such cases certain conditions should be met, e.g. the potential for neutron interaction with other fissile materials in adjoining areas should be negligible~~.		Y			
82.	6.66	Where tests reveal inadequate performance of the criticality detection and alarm system, management should be notified immediately and corrective actions should be agreed with management and taken without delay. <u>Mobile detection systems may need to be installed to compensate for the defective fixed systems.</u>	Clarification To be consistent with 6.67	Y			
83.	References	Ref. [23] should be "<u>ISO 27468, Nuclear criticality safety – Evaluation of systems containing PWR UOX fuels – Bounding burnup credit approach</u>"	The reference to an International standard is better than a national one.	Y			
84.	Annex handbooks and guides	J. Anno, N. Leclaire, V. Rouyer, Minimum critical values of uranyl and plutonium nitrate solutions using the new isopiestic nitrate density law, IRSN SEC/T/2003-41, <u>Decembre 2003</u>	Precision about the origin of document: IRSN French TSO	Y			
85.	Annex handbooks and guides	X. Knemp, J. Rannou, Updated rules for mass limitation in nuclear plants, <u>IRSN</u> SEC/T/2004-14, January 2004	Precision about the origin of document: IRSN French TSO	Y			
86.	Annex handbooks and guides	S. Evo, Critical values for homogeneous mixed plutonium-uranium oxide fuels (MOX) – Cristal V1 results, <u>IRSN</u> SEC/T/2005-299, July 2005	Precision about the origin of document: IRSN French TSO	Y			

87.	Annex handbooks and guides	C. Galet, I. Le Bars, Analysis guide – Nuclear criticality risks and their prevention in plants and laboratories, IRSN SEC/T/2010-334, Septembre 2011	Precision about the origin of document: IRSN French TSO	Y			
88.	/						
/							

CRITICALITY SAFETY FOR FACILITIES AND ACTIVITIES HANDLING FISSIONABLE MATERIAL (DS407)

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	1	1.1	2nd sentence: "Some of these nuclides are also fissile, meaning that they can sustain a critical <u>chain</u> reaction in a <u>thermalized (</u>'slow'<u>)</u> neutron energy ~~neutron~~ flux."	More precise terminology which is commonly used in the scientific community.	Y			
2	2	1.4	last but one sentence: "This Safety Guide presents guidance and recommendations on how to meet the requirements relating to criticality safety established in … ~~Geological~~ Disposal of Radioactive Waste [7] …"	Correct title of the Safety Requirements SSR-5.	Y			
3	3	1.6	5th sentence: "Section 5 provides recommendations on criticality safety practices in the various areas of … waste management <u>(i.e. processing, storage and disposal)</u> and decommissioning …"	Clarification.	Y			
2	4	2.2	footnote No. 4 to the term 'effective neutron multiplication factor': "The <u>effective</u> neutron multiplication factor <u>k_{eff}</u> is the ratio of ~~neutron production to neutron loss of a fission chain reaction.~~ <u>the total number of neutrons produced by a fission chain reaction, to the total number of</u>	Since the 'effective neutron multiplication factor (k_{eff})' is used in the draft, a meaningful definition is required, incorporating the terms 'subcritical' and 'supercritical'. Mention of leakage is recommended to	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			neutrons lost by absorption and leakage. The system is (a) critical if k_{eff} = 1; (b) subcritical if k_{eff} < 1; and (c) supercritical if k_{eff} > 1."	avoid confusion with the 'in-finite neutron multiplication factor (k_{inf})', which may be used as a conservative estimate of k_{eff}. The definition of k_{inf} is provided in the Safety Guide SSG-15 "Storage of Spent Fuel", footnote to para 6.35.				
1	5	2.12	add new bullet point: "In the context of criticality safety, the following items should be addressed: … • Management should ensure that regulatory requirements are complied with;"	Management as the interface to the regulatory body is responsible for the implementation of regulatory requirements concerning the criticality safety of the facility / activity, thus ensuring the due involvement of the regulator.	Y			
2	6	2.13	1st sentence: "The nature of the criticality hazard is such that deviations towards insufficient subcritical margins ~~a less safe condition~~ may not be immediately obvious, i.e. there may be no obvious indication that the effective neutron multiplication factor is increasing."	Clarification and maintaining consistency with the use of the terms 'safety margins' (paras 2.5 and 2.6) and 'k_{eff}' (paras 2.2, 2.4, 2.5 and 2.6) in the draft. 'Less safe conditions' are not well defined in criticality safe-ty. Consequently, the use of this phrase should be avoided.	Y			
2	7	2.16	2nd and 3rd sentence:	In case of a deviation it is not	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			"The investigation should be carried out to analyse the causes of the deviation, to identify lessons to be learned, ~~and~~ to determine and to implement corrective actions to prevent re-occurrences. The investigation should include an analysis of the operation of the facility and of human errors, and …"	sufficient only to identify corrective measures but in particular to implement those.				
3	8	3.12	last bullet point: "and s~~S~~afety measures provided by operating personnell …"	Editorial.	Y			
2	9	3.13	"In addition to following the ~~preventative control~~ hierarchy of preventative safety measures and consistent with the concept of defence in depth, mitigatory safety measures … should be employed to the extent practical."	Clarification. The term 'control hierarchy' is not defined in the draft. Compare with paras 3.12 and 3.15.	Y			
1	10	3.15	2nd sentence: "If subcriticality cannot be ensured through this means, further safety measures shall ~~should~~ be employed."	If passive safety features cannot ensure subcriticality then it is not sufficient that further safety measures should be considered – they shall be considered in order to prevent a criticality accident.			Y	This is a safety guide providing recommendations and not requirements, therefore can only use the word should.
3	11	3.20	last sentence:	Editorial and wording.	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			"… that long-chain CH_2-type oils (i.e. aliphatic hydrocarbons) could be exchanged for …"					
3	12	3.22	last sentence: "… to monitoring the credible long term degeneration and/or degradation of neutron absorbers."	Completion.	Y			
2	13	3.26	last sentence: "… engineered means, e.g. fixed storage racks ~~in fissile material stores~~ for storage of arrays of drums containing fissile material ~~contaminated with plutonium~~."	There is no obvious reason for the limitation of this recommendation to material contaminated with plutonium. The guidance should apply to all fissile materials.	Y			
1	14	3.36	Note: This para is missing an advice to account for regulatory involvement concerning the aspects described.	The regulatory body is always involved before initiating a new activity with fissile material.		Agreed, the following text was added tp para 3.36. The introduction of a new activity may be subject to authorization from the regulatory body before it can be initiated.		
3	15	3.47	2nd sentence: "Where applicable, reliance may be placed on safety measures already present in the facility or activity or applied to the system of interest."	Completion.	Y			

CRITICALITY SAFETY FOR FACILITIES AND ACTIVITIES HANDLING FISSIONABLE MATERIAL (DS407)

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
3	16	4.15 a.	3rd bullet point: "Hazard and operability analysis <u>(HAZOP)</u>;" 5th bullet point: "Failure modes and effects analysis <u>(FMEA)</u>."	Include commonly used abbreviations for completeness.	Y			
2	17	4.22	2nd sentence: "Validation relates to the process of determining whether the overall calculation method adequately reflects the real system being modelled and enables the quantification of any calculation/code bias and uncertainty<u>, by comparing the predictions of the model with observations of the real system or with experimental data [2]</u>."	Clarification as explicitly stated in the Safety Requirements GSR Part 4 "Safety Assessment for Facilities and Activities", para 4.60.		This comment related to para 4.23 not 4.22		
3	18	4.25	1st sentence: "The overall safety assessment for the facility <u>or activity</u> should also be reviewed and used …"	Completion.	Y			
2	19	5.2	1st sentence: "… and facilities for which the criticality hazards may be credible, e.g. … waste <u>processing</u> ~~treatment~~ facilities and disposal facilities."	Wording and correct use of terminology for consistency with GSR Part 5 "Predisposal Management of Radioactive Waste" (Requirement 10) as well as with the IAEA Safety	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				Glossary (2007 Edition). The term 'processing' includes 'pretreatment', 'treatment' and 'conditioning' of the radioactive waste. Compare also with para 5.1.				
1	20	5.2	last sentence: "Facilities in this second group shall ~~should~~ be designed and operated in a manner that ensures subcriticality in operational states and in design basis accidents (or the equivalent)."	According to the IAEA Safety Standard NS-R-5, this is a requirement, not a recommendation. Compare with the Appendices I–III of NS-R-5, paras I.1 + I.5 (uranium fuel fabrication facilities), paras II.1 + II.5 (MOX fuel fabrication facilities), and paras III.1 + III.5 (enrichment facilities).			Y	This is a safety guide providing recommendations and not requirements, therefore can only use the word should.
3	21	5.7	"Conversion facilities can also be used for the conversion of enriched or ~~regenerated~~ reprocessed uranium, which has a higher enrichment than natural uranium and ~~in some~~ under certain conditions can achieve criticality."	Wording.	Y			
2	22	5.9	"Fuel fabrication facilities process powders, solutions, gases and metals of uranium and/or plutonium …"	UF_6 is usually processed from solid to gaseous state.	Y			
1	23	5.10	"… by the isotopic composition of	Include the plutonium quality	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			the Pu in the mixture (principally ^{239}Pu, ^{240}Pu and ^{241}Pu), by the fissile fraction of plutonium, i.e. the ratio (^{239}Pu + ^{241}Pu)/(total Pu) as a measure of Pu quality, and by the ^{235}U content in the uranium.”	to evaluate the potential for criticality properly. The even isotopes of Pu (^{238}Pu, ^{240}Pu and ^{242}Pu) due not contribute significantly to fission reactions.				
1	24	5.28	add new sentence: “… to prevent boron dilution. Additionally, appropriate measures to ensure Boron mixing by e.g. thermal convection caused by decay heat in the storage pond should be taken into account.”	Mixing of boron should be explicitly mentioned since it is a key parameter in maintaining subcriticality for the whole spent fuel assembly.	Y			
2	25	5.32	“Usually, in criticality safety assessments for operations involving spent fuel, the spent fuel is conservatively assumed to have the same composition as fresh fuel. … This more realistic approach is commonly known as ‘burnup credit’ … The application of burnup credit is covered in more detail in paras 5.35 to ~~5.39~~ 5.38.”	Clarification and consistency with the wording in the Safety Guide SSG-15 “Storage of Spent Fuel”, paras II.7 – II.9. Wrong para is cited in the last sentence.	Y			
3	26	5.35	2nd bullet point: “… could result in an inherently subcritical material~~.~~;”	Editorial.	Y			
3	27	5.41	last bullet point: “… furnace operations causing	Editorial.	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Relevance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			condensation in powders.”					
3	28	5.44	last sentence: “… external connections could be added in an ~~adhoc~~ ad hoc manner …”	Editorial.	Y			
3	29	5.53	3rd bullet point: “Post-dissolution monitoring for gamma radiation …”	Editorial.	Y			
2	30	5.58	“The collection and storage of unconditioned radioactive waste before its ~~treatment~~ processing should be made subject to the same considerations in the criticality safety assessment as the processes from which the waste was generated. Additionally special considerations may be necessary if such waste streams are mixed with other radioactive ~~and/or non-radioactive~~ waste streams of different origin, which is frequently the case in research centres. Although the inventory of fissile material may generally be small, significant accumulations of such material may occur in the subsequent waste collection and waste ~~treatment~~ processing procedures.”	1st and 3rd sentence: Correct use of terminology for consistency with GSR Part 5 “Predisposal Management of Radioactive Waste” (Requirement 10) as well as with the IAEA Safety Glossary (2007 Edition). The term ‘processing’ includes ‘pretreatment’, ‘treatment’ and ‘conditioning’ of the radioactive waste. Compare also with para 5.1. 2nd sentence: Mixing of radioactive waste streams with non-radioactive waste streams should be avoided. Non-radioactive waste containing toxic or hazardous substances should be managed in	Y			

CRITICALITY SAFETY FOR FACILITIES AND ACTIVITIES HANDLING FISSIONABLE MATERIAL (DS407)

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				compliance with non-nuclear national regulations.				
2	31	5.59	2nd sentence: add a footnote to the term 'legacy waste' with the following text: "<u>Legacy waste is radioactive waste that may contain fissile materials that have remained from historic fissile material facilities and past activities that (a) were never subject to regulatory control or (b) were subject to regulatory control but not in accordance with the requirements of the International Basic Safety Standards.</u>"	Clarification. The term is not defined in the IAEA Safety Glossary (2007 Edition). As a result of the Member States comments to DS407 Version 4, a proper definition of the term was included. Our proposal for an improved definition is consistent with the Safety Requirements GSR Part 3 (International Basic Safety Standards), para 5.1 (a).	Y			
3	32	5.63	last sentence: "In the case of a disposal facility, disruption of protective barriers and effects on transport mechanisms are likely to be more significant than the immediate effects of direct radiation from a criticality <u>event because the radiation would be shielded by the surrounding host rock formation and/or backfill materials</u>."	Clarification and completion.	Y			
2	33	5.64	2nd sentence: "Consideration should be given to the following particular characteristics of	A cross-reference to the Safety Guide GSG-1 "Classification of Radioactive Waste" is rec-	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			waste management operations with respect to criticality safety: • <u>The radiological, physical and chemical properties of the waste as parameters for waste classification;</u> • Variation and uncertainty in the form and composition of the waste; • The need to address the degradation of engineered ~~features~~ <u>barriers</u> and the evolution of waste packages <u>after emplacement</u> over long time scales."	ommended here. Depending on the maximum amounts of fissile nuclides involved, criticality safety assessment may be required for high level waste (HLW) that is generated from chemical reprocessing of spent fuel. For low level waste (LLW), however, no specific criticality safety measures may be necessary in most cases. Use of the term 'engineered barriers' is advisable for maintaining consistency with para 5.63 ("Following closure of a disposal facility, engineered barriers provided by the package design and the form of the waste will tend to degrade, allowing the possibility of separation, relocation and accumulation of fissile nuclides …") as well as with the Safety Requirements SSR-5 "Disposal of Radioactive Waste".				
3	34	5.65	"~~This~~ <u>Variation and uncertainty in</u>	Due to possibly insufficient	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			waste forms is a particular challenge for some types of legacy waste for which the accuracy and completeness of historical records may be limited. Therefore, criticality safety assessments for legacy waste to be disposed of should be performed in a comprehensive and detailed manner. If …”	documentation and knowledge, a criticality safety assessment for legacy waste requires special care.				
2	35	5.66, 5.67	change title of related subsection: “Degradation of engineered ~~features~~ barriers over long time scales”	See our comment to para 5.64.	Y			
2	36	5.66	2nd sentence: “Over the very long time scales considered in post-closure criticality safety assessments, some reduction and change in the fissile inventory of the nuclear waste will occur due to radioactive decay.” 3rd sentence: “… credible degradation of the engineered ~~features~~ barriers of waste packages, with consequential relocation and accumulation of fissile and non-fissile components.”	Clarification and completion. See our comment to para 5.64.	Y			
3	37	5.74	1st sentence: “The assessment for the package de-	Editorial (missing space).	Y			

CRITICALITY SAFETY FOR FACILITIES AND ACTIVITIES HANDLING FISSIONABLE MATERIAL (DS407)

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			sign referred to in para._5.73 …”					
3	38	Section 6	General note: The draft refers to ‘assembly areas’ (see paras 6.10, 6.13, 6.31, 6.34 and 6.39), while the Safety Requirements GS-R-2 (para 4.51) and the Safety Guide GS-G-2.1 (Tables 14 and 15) mention ‘assembly points’.	Maintaining consistency with the terminology used in other IAEA Safety Standards covering emergency preparedness and response.	Y			
2	39	6.4	“Of the 22 criticality accidents <u>in fuel processing facilities</u> reported in Ref. [16], all but one involved fissile material in solutions or slurries. In these events, the key physical parameters affecting the fission yield (<u>i.e.</u> the <u>total</u> number of fissions <u>in a nuclear criticality excursion</u>) were the following: …” last but one bullet point: “<u>Change of t</u>~~T~~emperature;” footnote No. 14 to the term ‘Doppler feedback’: “… Depending upon the enrichment or composition of the materials, this phenomenon can increase or decrease the <u>effective</u> neutron multiplication <u>factor (k_{eff})</u> of a system.”	Clarification. Clarification. More precise terminology. See also our comments to paras 2.2 and 2.13.	Y			

CRITICALITY SAFETY FOR FACILITIES AND ACTIVITIES HANDLING FISSIONABLE MATERIAL (DS407)

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	40	6.6	add a footnote to the term ‘fission excursion spikes’ with the following text: “A fission spike is the initial power pulse of a nuclear criticality excursion, limited by quenching mechanisms and mechanical damage.”	Clarification. The term is not defined in the IAEA Safety Glossary (2007 Edition). The proposed definition is taken from Ref. [16], Appendix A.	Y			
3	41	6.10	1st sentence: “However, the radiation dose from a criticality accident may still be significant, even for people located at some distance from the accident. Thus, ~~and so~~ a mechanism for identifying appropriate evacuation and assembly areas should be developed.”	Wording.	Y			
2	42	6.10	last sentence: “Appropriate safe evacuation routes and assembly areas should be defined (see paras ~~6.33~~ 6.32 to ~~6.37~~ 6.36).”	Wrong paras are cited.	Y			
2	43	6.12	“The provision of additional means for shielding should also be considered in minimizing the radiological consequences of a criticality accident. In employing shielding as a protective measure, the implications that penetrations	Clarification and completion.	Y			

CRITICALITY SAFETY FOR FACILITIES AND ACTIVITIES HANDLING FISSIONABLE MATERIAL (DS407)

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			through the shielding may have for radiation dose should be evaluated. <u>When planning additional shielding measures (e.g. walls) for emergency cases, priority should be given to safe escape routes for operating personnel.</u>"					
3	44	6.13	"In general<u>,</u> the emergency response plan <u>specific to a criticality accident</u> should include the following: …"	Clarification recommended to avoid confusion with the (more comprehensive) emergency plan of the operating organization covering all kinds of accidents. Requirements for such a plan are specified in the overarching IAEA Safety Standards GS-R-2 (paras 5.13 to 5.24) and NS-R-5 (paras 9.62 to 9.67).	Y			
1	45	6.14	add new sentence: "Emergency procedures should be established and made subject to approval in accordance with the management system. <u>Management should review and update the emergency response plan on a regular basis (e.g. due to modifications in the facility operations, due to changes in</u>	Self-explanatory.	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			<u>the organization, etc.).</u>"					
2	46	6.17	"Management should conduct emergency exercises <u>on a regular basis</u> to ensure that personnel are aware of the emergency procedures …"	Consistency with the Safety Requirements GS-R-2 "Preparedness and Response for a Nuclear or Radiological Emergency", paras 5.33 to 5.35.	Y			
3	47	6.22	2nd sentence: "… e.g. for ensuring the availability of neutron absorbers and the means of ~~injecting~~ <u>introducing</u> them into the ~~materials~~ <u>system</u> where the criticality has occurred …"	Wording. 'Injection' is limited to solutions. The guidance should also apply to solid neutron absorbers.	Y			
3	48	6.23	1st sentence: "The process of calculating the <u>radiation</u> dose from a criticality accident is subject to various uncertainties." 3rd bullet point: "Calculation of the effect of any shielding (including the source of the criticality itself) between the <u>location of the critical system</u> ~~criticality accident~~ and those likely to be affected, i.e. operating personnel;"	Wording. Wording.	Y			
2	49	6.25	2nd bullet point: "The <u>radiological,</u> physical and	Completion.	Y			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with comments of GRS, BfS and VdTÜV** Page 1 of 12 Country/Organization: **Germany** Date: 2012-05-25				RESOLUTION			
Rele-vance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			chemical properties of the fissile material, including quantities;” 4th bullet point: add a footnote to the term ‘quenching mechanisms’ with the following text: “A quenching mechanism is a physical process other than mechanical damage that limits a fission spike during a nuclear criticality excursion, e.g. thermal expansion or microbubble formation in solutions.”	Clarification. The term is not defined in the IAEA Safety Glossary (2007 Edition). The proposed definition is taken from Ref. [16], Appendix A.				
3	50	6.28	1st sentence: “In some accidents there have been instances where ~~ill-planned~~ improper actions of operating personnel have inadvertently initiated …”	Wording.	Y			
2	51	6.51	2nd bullet point: “… Examples of such facilities might include hot cells and closed underground repositories ~~stores (closed repositories)~~.”	Correct use of terminology. In this bullet point, ‘storage facility’ is wrongly used as a synonym for ‘disposal facility’.	Y			
3	52	Ref. [7]	INTERNATIONAL ATOMIC ENERGY AGENCY, Disposal of Radioactive Waste, IAEA Safety Standards Series No. SSR-5, IAEA, Vienna ~~(2006)~~ (2011).	The new Safety Requirements SSR-5 were published in 2011.	Y			

Relevance: 1 – Essentials 2 – Clarification 3 – Wording/Editorial

CRITICALITY SAFETY FOR FACILITIES AND ACTIVITIES HANDLING FISSIONABLE MATERIAL (DS407)

COMMENTS BY REVIEWER Reviewer: **P. MALESYS** Page 1 of. 1 Country/Organization: **International Organization for Standardization (ISO)** Date: 28 May 2012				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	5.75	The package design assessment referred to above in 5.74 provides a safety basis but the final safety **is assured by confirming that the** ~~assessment can only be made at the time of transport, accounting for real fissile materials, real packaging, real loading, labelling, etc. and~~ real transport conditions **comply with the requirements set forth in the package design approval.** .	No additional or dedicated safety assessment is made at the time of the transport. Safety is provided by comparing the real transport conditions and the conditions imposed in the approval issued by the competent authority.	Y			

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.2 /2-3	to ensure criticality safety ~~subcriticality, as far as is reasonably practicable~~, in normal operation, anticipated operational occurrences and design basis accidents (or the equivalent)	For completeness. "As far as reasonably practicable" is inappropriate expression for "criticality safety."	Y			
2	1.4 / 9-10	Substitute the requirement related to disposal from WS-R-4(Geological Disposal of Radioactive Waste) to SSR-5(Disposal of Radioactive Waste). Regulations for the Safe Transport of Radioactive Material [6], Disposal of Radioactive Waste ~~Geological Disposal of Radioactive Waste~~ [7] and	New SSR-5 is already published.	Y			
3	REFERENCES	[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Disposal of Radioactive Waste, IAEA Safety Standards Series No. SSR-5, IAEA, Vienna (2011~~2006~~).	For completeness.	Y			

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
4	2.7	Add following sentence after first sentence. This should also be demonstrated in the criticality safety assessment.	Agree to Canada/AEC comment no.24 in “MEMBER STATES COMMENTS on DS407 Version 4” with full text. This sentence explains the important role of a criticality safety assessment.	Y			
5	2.9	The one ~~primary~~ approach in seeking exemption should be to demonstrate that the inherent features of the fissile material itself are sufficient to ensure subcriticality, ~~while~~ the other ~~secondary~~ approach should be to demonstrate that the maximum amounts of fissile nuclides involved are so far below critical values that no specific safety measures are necessary to ensure subcriticality in normal operation, anticipated operational occurrences and design basis accidents (or the equivalent).	For clarification. There is no priority in two types of exemption materials.			Y	Consistent with hierarchy of controls.
6	3.2/3	with the objective of preventing failures, or if prevention fails, ensuring detection and mitigating ~~limiting~~ the consequences.	For clarification. In table 1, “mitigation” is used.	Y			

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
7	Table 1	Refer the objective words of TABLE1 in NS-R-5(Safety of Nuclear Fuel Cycle Facilities) to this TABLE1 in this guide. e.g. DS407: Mitigation of the consequences of accidents *NS-R-5: Control of accidents*	For completeness. At least, the objective wording of “defence in depth” should be consistent with upper level documents.			Y	The title of each objective may differ from NS-R-5, but the objectives to be met are the same. The wording used in Table 1 provides a clearer description of the objective.
8	3.5/ 1	The passive safety of the facility or activity should be such that the system will remain subcritical without the need for active engineered safety measures or administrative safety measures.	Original sentence simply explained "passive safety". Without "passive", the meaning of the sentence changes to recommends that the facility should necessarily have passive safety measures. Such a sentence is not realistic.	Y			

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
9	3.24 / 9	Demonstration of t~~T~~ for the continued presence and effectiveness of neutron absorbers throughout their operational lifetime should be considered.	The meaning of the original sentence was changed. The continued presence and effectiveness of neutron absorbers is always needed. No need for consideration of it. What is needed is "Demonstration for the continued presence and effectiveness of neutron absorbers "	Y			
10	3.36 / 2-3	administrative safety measures should be determined, prepared and independently reviewed by ~~operating~~ personnel knowledgeable in criticality safety.	For completeness. Generally operating person does not review independently.	Y			
11	3.48/2nd bullet	• The need for instrumentation for ensuring that the operational limits and conditions are adequately monitored and controlled (e.g. the measurement of ~~moisture in~~ fissile dioxide powder mass);	For clarification. Section 3 is general description, so example should be main operational limit.		Agree, however this example was deleted by UK comment no 3.		
12	4.18 / 3-4	along with any ~~codes used for calculation of~~ cross-sections processing codes that were used.	For completeness. Original expression is rather correct. In this case, "cross-section processing" means	Y			

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			processing raw cross section data to use in a individual condition.				
13	4.20/1	add the following sentence. "in order to ensure that changes of operating environment of the codes including software, hardware, for example OS version-up, doesn't have adverse effects on the code's execution."	For clarification. It should be clear why verification should be performed periodically. If the left addition is correct, the validation is rather appropriate as defined in the IAEA safety glossary 2007.		Agreed, the following text was added: …"and for computer codes should ensure that changes of the operating environment, i.e. operating system, software and hardware, do not adversely affect the codes execution".		
14	5.11/6th bullet	The introduction and removal of moderating material, e.g. equipment or cleaning material, within moderation controlled environments such as gloveboxes, packaging areas or criticality controlled areas, should be monitored (e.g. weighing moderating material) and controlled to avoid unsafe accumulations of moderated fissile materials.	For clarification. Fuel fabrication is mainly batch process. Weighing moderating material should be added as example of "monitor".	Y			

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
15	5.12 / 4-5	or neutron absorbers,・・・the integrity of the neutron shielding.	For clarification.	Y			
16	5.18	For wet and dry storage systems that use fixed solid neutron absorbers, a surveillance programme should be put in place to ensure that the absorbers are installed ~~and to verify that they have not lost their effectiveness or become displaced~~. If degradation of the absorbers is predicted (e.g. use of organic material), the effectiveness of the absorbers should be monitored.	For clarification. The case in which verification of effectiveness of the absorbers is required should be described explicitly.		Agreed, the following text was added: "if degradation of the absorbers is predicted, to monitor their effectiveness and to ensure verify that they have not lost their effectiveness or become displaced."		
17	5.35/2nd bullet	· Verified properties of the sufficiently irradiated fuel could result in an inherently subcritical material.	For completeness. Insufficiently irradiated fuel with burnable poison is not inherently subcritical.	Y			
18	5.41 / 4th bullet	accumulations of ~~fines~~ fissile materials in ~~conditioning and vacuum vessels~~ process equipment or ventilation systems or	For clarification. In other parts, "ventilation" is used for fissile material accumulation for example, at 5.14.		Agreed, the following text was added: "…accumulations of fissile material fines in process equipment (e.g. conditioning and vacuum vessels) or ventilation		

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
					systems or chronic leaks (including leaks of liquors onto hot surfaces).”		
19	5.46/6-9	Move last two sentences to para. 5.56	For completeness. Last two sentence say about accumulation and should be moved and merged to 5.56. see comment for 5.56			Y	Although the text is referring to accumulation it is related to some of the issues of using sumps ad is therefore retained.
20	5.56 / 1-2	Recommendations to trap leaks in containers with favourable geometry and to provide monitored sumps to detect such leaks are provided in para 5.46. It should not be assumed that leaks will be detected in sumps as they may evaporate and form solid accumulations over time. Consideration should be given to carrying out inspections to prevent any long term build-up of fissile material, especially in areas where personnel are not present (see Ref. [24]). Similar ~~However, the~~ possibility of non-detection exists for・・・・	Last two sentences of 5.46 were move after the first sentence.			Y	See response to comment no 19. It is noted that this para makes a cross reference to para 5.46

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
21	5.63/6-9	Consideration of the consequences of criticality after closure of a disposal facility will differ from that for, for example, fuel stores or reprocessing plants, where a criticality accident may have immediate recognizable effects ~~fatal consequences~~. In the case of a disposal facility, effects on disruption of protective barriers and ~~effects on~~ transport mechanisms of radionuclides are likely to be more significant than the immediate effects of direct radiation from a criticality.	Editorial and clarification.				
22	5.72/3-4	delete last sentence " Additional safety assessment is required for the actual transport operation (see para. 5.74). " And move para. 5.74 after para. 5.72.	Redundant sentence It is not only transport field that many safety assessments are required in actual designs or operation phases. From the view point of connection of context.			Y	The last sentence was added by Sweden comment no 51 on Version 6 in order to emphasize the importance for transport.

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
23	5.73/last sentence	delete last sentence " The criticality safety assessment for transport should therefore only be carried out by persons with suitable knowledge and experience of the transport requirements. "	Any safety assessment needs the specialists or experts with suitable knowledge and experience. Only transport field doesn't need them.			Y	Specialism in transport safety requirements is necessary to make these judgments and so the recommendation is retained.
24	6.10/ 4	delete last sentence " Appropriate safe evacuation routes and assembly areas should be defined (see paras 6.33 to 6.37)."	Redundant sentence. The same content is already written in 9th bullet of para.6.13 and para.6.32.	Y			
25	6.13 / 3	· Definition of the responsibilities of the management team~~, emergency coordinator~~ and the technical ~~operating~~ personnel,	Original expression is rather appropriate. It is need to explain the role of "emergency coordinator". Original sentence used "technical personnel" instead of "operation personnel". We think that "technical personnel" is appropriate because "technical personnel" could include the person with some speciality and role, for example, criticality safety staff.	Y			

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
26	6.21 / 5	Such an evaluation of credible criticality accidents should include an estimate of the fission yield and the likelihood of recurrence ~~occurrence~~ of the criticality.	Original expression is rather appropriate. We interpret "recurrence" in the original sentence as reoccurrence of criticality after first criticality stopped due to change of some parameters, such as temperature of the system,, void density of the solution, etc. This "recurrence" phenomena is very important from the view point of the evacuation and re-entry action.			Y	It is a reference to the likelihood of the initial criticality.
27	6.54/5th bullet	· It should continue to alarm until evacuation is complete (including the alarm which continues for a specific time necessary to assure the completion of evacuation);	For clarification.			Y	Clarification not necessary, recommendation is covered by original text.
28	2.2/5	microscopic properties such as neutron fission, capture or scattering cross sections.	Editorial.	Y			
29	3.3/5	However, for mitigation of the radiological consequences of a criticality accident, the	Editorial.	Y			

COMMENTS BY REVIEWER Reviewer: Page 54 of 9 Country/Organization: Japan / NISA/JNES Date: **5/18/12**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
30	3.13/1	In addition to ~~following~~ the preventative control hierarchy and	Editorial.	Y			
31	5.22/8	(<u>e.g.</u> in spent fuel ponds~~, for example~~);	Editorial.	Y			
32	5.39/1-2	Spent fuel reprocessing involves operations to recover the uranium and plutonium ~~isotopes~~ from waste products the waste products (i.e. fission products, minor actinides <u>in</u> ~~and~~ fuel assemblies),	Editorial.	Y			

Note: **<u>Underlined</u> means insertion of word(s) and ~~delete~~ means deletion.**

COMMENTS BY REVIEWER Reviewer: A Hart / D Simister / D Scowcroft Page.... of.... Country/Organization: UK / ONR Date: 14 May 2012				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	pg 19, para 3.24	Suggested " … tested and/or validated prior to first use …".	It is difficult to know what is envisaged by the term 'tested' in the context of fixed neutron poisons. It may not always be physically tested for neutron absorption or chemical form. It is also important to verify/validate its physical inclusion.	Y			
2.	pg20 , Para 3.29	Replace first 2 sentences with: "Passive engineered safety measures use passive components rather than moving parts to ensure sub-criticality."	use of the words `highest ranked' may not be strictly correct since intrinsic physical properties eg neutron cross section are ` better' than passive engineered features. Suggest making introductory line align with 3.32 and not mention "highest ranked".	Y			

3.	pg25 , para 3.48, bullet 2	Delete “dioxide powder”.	Reference to “dioxide powder” is superfluous and reads poorly – delete without losing any technical sense.	Y			
4.	pg 28, para 4.4	Change: “… decommissioning and post-operational clean-out …” to “…post-operational clean-out and decommissioning …”	POCO is chronologically before decommissioning, hence ought to be listed in this order in the text.	Y			
5.	pg 28, para 4.6	Change “… their consequences” to “the radiological consequences”	The last sentence is unclear regarding what consequence is being determined. Is it whether or not the faults lead to criticality or what the radiological consequence is, which is by definition bounding?	Y			
6.	Pg 33, para 5.7	5.7 placed after 5.8 and amended “Conversion facilities are also used for enriched or reprocessed uranium and may require similar criticality safety controls to those in the later fuel fabrication section to prevent criticality.”	Does regenerated mean “reprocessed”? This section omits that conversion includes enriched uranium hexafluoride to powder as most commercial fuel. Suggest that 5.7 is placed after 5.8 and is amended	Y			

			as suggested.				
7.	pg 42, para 5.52	Replace, "so the risk of criticality is low" with "so the risk of criticality will often be lower than in a wet environment".	The statement that the risk of criticality is low presumes a low enriched system where fuel is removed from a pond. This may not be true for high enriched fuel.	Y			
8.	pg47 , para 5.76	Add bullet: "Interaction with other fissile materials that may come close in transit"	Add an additional bullet to cover the case of proximity of other fissile materials or processes.	Y			
9.	pg 49, para 6.4		Guidance / reference should be made to methodology for calculating doses from a criticality.			Y	Recommendations on calculating radiation dose from a criticality accident is included in para 6.23.
10.	pg 49, para 6.5	After "that have been reported" insert "to have occurred during process operations,"	22 accidents only refers to process accidents as worded in reference 12 – needs clarity	Y, but used "processing facilities" as suggested by			

				German comment no 31.			

USA Comments on IAEA Draft Safety Guide "Criticality Safety for Facilities and Activities Handling Fissile Material," (DS407)

COMMENTS BY REVIEWER Reviewer: United States of America Country/Organization: U.S. Nuclear Regulatory Commission Date: 5/8/12				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.1 3rd sentence	Delete third sentence	It implies a fast ICE isn't possible. It is, they have happened. According to this paragraph an ICE with fissionable material alone is not possible. I believe they are and several previous ICEs are believed to have been due to the fast neutron flux. Also the paragraph suggests that there can't be an ICE with 'equipment designed to be critical'. This isn't accurate.			Y	Sweden comment no 1 on Version 6 (during the review by Member States) requested that this sentence be included and is thus of the opinion that such an event is not credible.
2	1.4 and 1.5	This Safety Guide presents guidance and recommendations on how to fulfill the criticality safety requirements established in the following IAEA Safety Requirements publications: … Regulations for the Safe Transport of Radioactive Material [6]… This Safety Guide encompasses all	The draft Safety Guide is internally inconsistent with regard to applicability to transport. Section 1.4 explicitly identifies that the guide presents guidance and recommendations on how to meet the transport requirements with reference	Y			

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Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		types of facilities and activities that have or use fissile materials, except systems that are: designed to be intentionally critical, e.g. a reactor core at a nuclear reactor, or a critical assembly**. In cases where criticality safety is specifically addressed** ~~, or are covered~~ by other regulations, e.g. transport which is performed according to transport regulations Ref. [6]**, this Safety Guide supplements but does not replace the specific transport guidance provided in the transport Advisory Material [20].**	to TS-R-1, while Section 1.5 appears to exclude applicability to transport with reference to TS-R-1. The recommended change to Section 1.5 recognizes the value of the criticality guidance provided in DS407 as it relates to transport of radioactive material, but consistent with the Transport section of DS 407, Sections 5.71 – 5.76, notes the dominance of the transport requirements in reference 6 and the transport guidance in reference 20.				
3	1.5	The criticality safety objectives are to prevent a self-sustained nuclear chain reaction and to minimize the consequences if this were it to occur. This Safety Guide makes recommendations on how to ensure sub-criticality in systems involving fissionable materials during normal	Restore lifecycle discussion to ensure readers are aware of need for criticality control throughout lifetime of the facility, especially because additional guidance exists in the case of decommissioning	Y			

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Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		operation, anticipated operational occurrences, and, in the case of accident conditions, within design basis accidents from initial design, through commissioning, through operation, and through decommissioning and disposal. It encompasses all types of facilities and activities that have or use fissile materials, except those that are designed to be intentionally critical, …	activities. Decommissioning is not mentioned in earlier paragraphs				
4	1.5 5th line	Clarify the phrase " e.g. transport which is performed according to transport regulations Ref. [6]. "	Seems to be in conflict with paragraph 1.4. What NCS guidance is there in Ref 6?			Y	Correct, there is no guidance in [6] which provides regulations. Para 1.4 states that guidance and recommendations are provided for requirements not regulations, therefore there is consistency between para 1.4 and 1.5.
5	1.12 and Definitions	Retain list of definitions as a separate section or appendix to DS 407. Delete footnote 4 (p58) that suggests use of footnotes to identify new or revised	Need to retain separate list of new and revised definitions as a separate section or appendix, and propose revisions to the IAEA Safety Glossary to			Y	In consultation with the Technical Editor, it was decided to adopt the position as proposed in the footnote.

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Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			include the definitions. Do not include new or revised definitions in footnotes.				
6	2.2	A description of the neutron multiplication of a system based on these parameters ~~alone is incomplete, and a full description would require the use~~ **determines the corresponding values** of microscopic properties such as fission, capture or scatter cross sections. ~~For these reasons~~ **Because of the large number of variables upon which neutron multiplication depends,** there are many examples of apparently 'anomalous' behavior in fissile systems where the neutron multiplication factor (k_{eff}) changes in ways that seem counter-intuitive.	This sentence confuses the relation between microscopic and macroscopic variables. The values of the (microscopic) nuclear cross sections determine the safe values of the macroscopic parameters. The last sentence is also unclear. The existence of the microscopic properties is not the reason that 'anomalous' and 'counter-intuitive' behavior is observed.		We believe that the first part of the para is clear in presenting the macro and micro variables, consequently, only included the changes to improve the clarity of the last sentence.		
7	2.4	Safety criteria based on the critical value of controlled parameter(s) such as mass, volume, concentration, geometry, moderation, **reflection, interaction**, isotopic composition and density, and taking into account	The list seems to confuse the relation between macroscopic and microscopic variables. Reflection and interaction are normally considered	Y			

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		neutron production, leakage, scattering, ~~reflection, interaction~~, and neutron absorption.	controlled parameters. The others are all nuclear cross sections and other quantities used in the definition of k_{eff}. These two sets should not be mixed.				
8	2.4, 2nd bullet	The critical value is that value of a controlled parameter that would result in the system no longer being reliably known to be sub-critical	The definition of "critical value" is presented in the text of Section 2.4. The definition should be included in the set of definitions presented on page 58.		Moved to a footnote.		
9	2.6	Remove: "In practice, uncertainties in measurement, instruments and sensor delay should also be considered." Or else consider a separate section concerning the establishment of operating limits.	Add definition of "safety limits." The discussion about the uncertainty in measurement, instrumentation, etc., is usually considered when establishing operating limits below defined safety limits (which are based on criticality calculations, etc.) If there are different types of limits, margin, etc., this should be explained.		Sentence moved to para 2.7 which considers the setting of operational limits.		
10	2.6 5th line	Change "should" to "shall."				Y	This document is a Safety Guide, not a

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							Safety Requirements document and therefore the use of shall is not appropriate.
11	2.7	Operational limits and conditions are often expressed in terms of process parameters, e.g., temperatures, liquid flows, **and** acidity, ~~fissile mass and moderator content.~~	The last two added are not normal process parameters, but among the macroscopic controlled parameters.			Y	Some Member States consider these as process parameters.
12	2.8	In some facilities or activities the amount of fissile material may be so low or the isotopic composition may be such that a full criticality safety assessment would not be justified. <u>Exemption criteria should be developed, reviewed by management and agreed with the regulatory body as appropriate.</u> A useful starting point is the exception criteria applied to fissile classification of transport packages, (Ref. [6].	The paragraph needs clarification to identify what is to be exempted. The first sentence of Section 2.8 discusses conducting a "full" criticality safety assessment , while the second highlighted sentence discusses exemption criteria. The implication is that a "full" safety assessment may be exempted. Is that the intent of this paragraph?			Y	The intent of the para is as you have understood, i.e. to exempt a full criticality safety assessment.
13	2,8 4th	Are there exception criteria in other references?	Clarifications.			Y	Not all references have been reviewed for exemption criteria. It is not necessary. The transport exemption

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							given as an example. It is for the licensee to develop its exemption criteria and agreed with the regulatory body.
14	2.12 7th bullet	States personnel conducting inspections do not have to be independent of the operating organization. Should say "do have to be independent."	Without independence from the operating organization, inspectors may be reluctant to identify issues.			Y	There isn't a requirement for these inspections to be independent of the operating organization.
15	2.12, last two bullets	Clarify what is meant by the term "adequate resources" (Adequate resources to protect personnel/recover from the consequences of a criticality accident?)	This criterion is somewhat vague. Meaning is unclear.			Y	Clarification not required. It is not intended to be prescriptive, but recommend that the management give consideration to the availability of resources, whichever they chose them to be.
16	Table 1	Clarify "objective" of the five levels, and revise sample application ("means") to be more in line with the objectives.	The meaning of the different levels as applied to criticality is not clear. Criticality alarms are mentioned in Level 4, but they seem more applicable to Level 3 or 5. The difference between		Table 1 is based on and consistent with NS-R-5 Table 1. For clarity, reference to		

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			"controlling" consequences (3) and mitigating them (5) is also not clear.		controlling consequences (3) deleted as controlling events is an improved phrase. The provision of criticality detection & alarms in level 4 is consistent with the DID levels as it is only in level 4 that a criticality accident has occurred.		
17	2.13 2nd sentence	Insert the following as the second sentence and retain the current 2nd sentence as the third. If unexpected operational deviations occur, operating personnel should immediately place the system into a known safe condition.	Waiting to tell the supervisor before taking action could be too late. Operating personnel should be trained and empowered to immediately place the system into a safe condition.	Y			
18	3,11	Define a threshold for 'credible'.	Set a standard, otherwise			Y	The criteria for

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	3.22 3.23 3.34		the threshold could be different for each evaluation. See comment on definition of credible.				"credible" in the paras listed will be different. It is not appropriate to be prescriptive in this safety guide as it cannot cover all instances.
19	3.12	Remove first bullet under "administrative safety measures." Also, add: "**To minimize the susceptibility to common-mode failure, preference should be given to diverse means of control (e.g., reliance on two different parameters rather than two controls on one parameter**."	Refers to operating personnel manually initiating an "active" or "automatic" system. If the system requires such human intervention, it is not an active engineered control. Given this, there does not seem to be any substantive difference between the first and second bullets. Diversity in parameters and controls should also be included in the hierarchical preference.			Y	First and second bullets are different. In the first, the operator initiates an active engineered safety measure, i.e. one that contains active elements. In the second the operator performs the safety measure.
20	3.25	Materials with low density (such as ~~steam~~ **mist** or foam) can cause a significant change in the neutron multiplication factor.	Steam is such low water density that it would seem to have no significant impact on reactivity. Water mist, such as from a fire		Reference to water mist added, reference to steam retained.		

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			sprinkler system, with entrained droplets, could have a more significant impact.				
21	3.29	Remove: "In addition, certain components that function with very high reliability based on irreversible action or change may be assigned to this category."	The intent of this sentence is unclear. However, a device that performs an action, reversibly or irreversibly, should not be considered a passive control.			Y	Original text retained as some Member States refer to these devices as passive.
22	3.29 3.30 3.31	Add a requirement to monitor passive safety measures.	Even passive systems and components can and will degrade over time.		Text added, covering this proposal see France comment no 26.		
23	3.30	Remove "and fissile material form." (Or else specify that this is only sometimes a passive control.)	The material form may not be a passive control. While all the former items are obviously passive, material form may be controlled by various means (e.g., active control of chemical reagents, temperature, etc.).			Y	As is acknowledged, material form may or may not be employed as a passive control and is therefore retained.
24	3.31	Add clarification of when an item is passive and when it is active.	Valves would only be passive when, for example,			Y	It is not possible to cover all applications of

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			their dimensions are limited for geometry control. When they are credited with being open or closed at certain times, they are active devices. Rupture disks would be passive in the same sense as overflow lines are passive.				these devices. It is sufficient to acknowledge, as para 3.31 does, that such devices require special consideration before being designated active or passive..
25	3.33	Most of the bulleted items are not 'administrative safety measures' but rather they are requirements of the " comprehensive criticality safety programme" from the first bullet of paragraph 2.12. Change the wording to reflect that this is what should be in the " comprehensive criticality safety programme".	Otherwise an organization that does not think it has 'administrative safety measures' may not develop a sufficient "comprehensive criticality safety programme".		Cross reference to 2.12 added.		
26	3.33 9th bullet.	Change to apply to all passive safety measures, with neutron absorber as an example,	All passive safety measures should be periodically verified.			Y	Covered by addition of text in para 3.30
27	3.35	The use of administrative safety measures **may** ~~should~~ include…"	Since administrative control is the least preferred, this should be stated as permission, not a recommendation.			Y	The hierarchy of control has been clearly identified in the safety guide. This para is providing recommendations when

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							(and if) administrative measures are employed (see para 3.35), therefore the word should is appropriate.
28	3.36	Before starting a new facility or a new activity with fissile material the engineered and administrative safety measures should be determined, prepared and independently reviewed by ~~operating~~ personnel knowledgeable in criticality safety.	Engineered and administrative controls should be reviewed by plant operations, but they are prepared by criticality safety engineers, not operations.	Y			
29	3.39	Change the first line to read, “Management has given the responsibility for overseeing the implementation of the”	Based on the definition of Management there is no one to give Management the responsibility, they already have it.	Y			
30	3.41	Should say that inspectors “do have to be independent of the operating organization.”	Without independence from the operating organization, inspectors may be reluctant to identify issues.				There isn’t a requirement for these inspections to be independent of the operating organization.
31	3.46	Add the following bullet: if unsafe conditions are possible in the event of a deviation from normal operations, to stop work and report,	While this could be construed as being under the existing bullet, it may not be if the “management” hasn’t directed this to be the first action of workers. And	Y			

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			it should be the first action of workers and there should be no doubt.				
32	3.48	Clarify what is meant by "criticality safety considerations."	Term is vague.		Text changed to "Consideration of criticality safety……. See also comment by Technical editor in Version 7.		
33	3.50	At the end of the second sentence had the following phrase: " but not limited to"	The list is not all inclusive.	Y			
34	4.4	A criticality safety assessment should be performed prior to the commencement of any new or modified activity involving fissile material. The criticality safety assessment should be carried out during the design, prior to construction, commissioning and operational phases of a facility or activity, and also prior to decommissioning and post-operational clean-out, transport **[insert a new footnote to refer the user to specific criticality safety transport**	SSR-6 (TS-R-1) has specific criticality safety requirements that must be met to support transport of fissile material. Many of the elements of a critical safety assessment are addressed in the design and review of transport packages as required in SSR-6 (TS-R-!).	Y			

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		requirements in SSR-6 (TS-R-1), reference 6] and the storage of fissile materials.					
35	4.23	Add "**neutron energy spectrum**" to the list.	This is a primary neutronic characteristic that should be considered in selecting the benchmarks for validation.	Y			
36	4.24	Calculation methods should also be re-verified following changes to the computer code system and periodically.	There is currently no discussion of periodic re-verification.		Added as an additional bullet.		
37	4.27	Add additional sentence after 2nd: **An additional margin may be necessary to account for validation uncertainties in this case.**	This is a common approach to addressing extrapolation beyond existing benchmark data.	Y			
38	5.2, Last sentence	Control over fuel geometry may also be affected by corrosion of structural materials by embrittlement and **creep** of the fuel as a result of irradiation.	Some materials like Zircalloy may creep, when irradiated.	Y	Note comment appears to be on para 5.24 in version 6 and version 7.		
39	5.7	Define the term "regenerated uranium."	This time is not widely used throughout the industry. If this is the same as reprocessed or recycled uranium, use that more familiar term.		Reprocessing used.		
40	5.9 – 5.16	The criticality safety aspects of a fuel facility cover a much wider range of conditions than discussed here. The	Consider including more detailed discussions of the various criticality safety			Y	No proposed text.

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		focus in this section is on moderator control, which is but one small aspect. (Does not discuss, for example, considerations applicable to geometry, mass, or concentration control.)	aspects of a fuel fabrication facility.				
41	5.31	Some spent fuel storage facilities may accept material from a range of reactor sites. To accommodate the different types of fuel the facility is usually divided into areas with distinct design features and requiring different criticality safety controls. <u>In these situations, the possibility of misloading of spent fuel into a wrong storage location should be considered in the criticality safety assessment.</u> Safety measures associated with this type of event may preferably include engineered features to preclude misloading (e.g. based on the physical differences in fuel assembly design) or otherwise administrative controls and verification of the fuel assembly markings.	The underlined sentence should have broader applicability than the limitation in Section 5.31 to spent fuel storage facilities that receive spent fuel from a range of reactor sites. The "possibility of misloading of spent fuel in the wrong storage location" should be considered in all criticality safety assessments for spent fuel storage facilities. A single reactor site will typically have spent fuel with differing initial enrichments, differing burnup levels, varying fuel/assembly conditions, and in some cases differing vendor designed/fabricated assemblies that will need to			Y	Please refer to the scope of the document, para 1.5 which covers the possibility that these recommendations may be applied to NPP, e.g. the storage and handling of fresh fuel and spent fuel.

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			be addressed in their site specific criticality assessment. See also Sections 5.33 and 5.37 that identify the need for considering misloading.				
42	5.41 – 5.58	In the list of possible means of control for a reprocessing facility, include some passive engineered features. Examples: include the use of overflow lines/siphon breaks in the discussion of mobility and misdirection of solutions, include passive filtration in the bullets in 5.64, etc.	Many of the control features listed appear to be active engineered systems. Keeping with the preference for passive controls, some of these should be included in the list.		Reference to the use of overflow lines and siphon breaks added to para 5.45. Could not located the bullets in para 5.64?		
43	5.56	At the end of the second sentence had the following phrase: " but not limited to"	The list is not all inclusive.		Phrase added to sentence 3		
44	5.62	Criticality safety control of waste operations should be based on the application of appropriate limits on the waste package contents. Other criticality safety controls may include the design of the packages and the arrangements for handling, storing and disposing of many packages within a single facility. Where practicable,	Whether the waste is being stored temporarily or for an extended period, the next step in the journey for the waste will be transport to another storage facility, a waste processing facility or a disposal facility. The criticality safety	Y			

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		package limits should be applicable to all operations along the waste management route, including operations at a disposal facility, so that subsequent re-packing, with its associated hazards may be avoided. **The future transport of the waste packages should also be considered to avoid potential repackaging of the waste to meet the criticality safety and other transport requirements [6].**	requirements and other transport requirements of SSR-6 (TS-R-1) need to be considered early in the process to avoid future repackaging of the material and to facilitate future transport of the waste.				
45	5.65	Criticality safety assessment for waste management operations should consider the specific details of the individual facilities and processes involved. The special characteristics of waste management operations with respect to criticality safety should include consideration of: - variability and uncertainty in the form and composition of the waste; - the need to address the degradation of engineered features and evolution of waste packages over long time scales. -**criticality safety and other transport requirements to facilitate future**	The consideration of planning for transport of the waste should also be identified as an element for consideration in the critical safety assessment as discussed in the previous comment.	Y			

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		transport of the waste.					
46	5.67 – 5.68	Remove reference to "post-closure."	This is a general section on waste. The idea of pre- and post-closure only applies to a permanent repository. It may belong in a section on long-term disposal, but not here.			Y	The safety guide does not have a specific section dealing with a repository, and so these recommendations are retained in this section. Also the scope given in para 5.61 covers disposal.
47	5.69	…A method for estimating and tracking accumulations of fissile materials that are not readily visible should be developed to ensure that the work stations remain sub-critical during decommissioning operations. These methods should take into account operating experiences, successive interventions, ~~and~~ recording of information**, physical inventory differences, process losses, and measured holdup.**…	Material balance and material accountancy records also provide a source of input to assist in determining if residual materials in quantities of concern may reside in the plant and plant equipment.	Y			
48	5.70	The approach to ensure sub-criticality may be similar to that used for research laboratory facilities described below, where setting a low limit on allowable fissile material mass provides the basis for allowing other parameters (e.g.,	Revise to make consistent with expectation for initial and final decommissioning plans and with graded approach to decommissioning	Y			

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		geometry, concentration, moderation, absorbers) to take any value. In line with general requirements on decommissioning of facilities established in Ref. [5], an initial decommissioning plan for a facility should be developed during facility design and construction and it should be maintained during facility operations. When a facility approaches shutdown, a final decommissioning plan needs to be prepared. In facilities handling significant amounts of fissile material, consistent with the graded approach, all the decommissioning plans should be supported by criticality safety assessments looking ahead to ensure that practices during the operating lifetime of the facility do not create avoidable problems during decommissioning.					
49	5.71	~~Transport~~ **Movement or transfer of radioactive material** within a licensed site should be considered as other onsite operations. Safe transport of radioactive material offsite (i.e. public domain), including consideration of the criticality hazard, is detailed in Refs. [6,	To avoid confusion on the applicability of the IAEA transport requirements, onsite movement of radioactive materials within a site that do not traverse public transit paths (road,	Y			

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		18-20], which constitute IAEA safety requirements and recommendations on the subject.	rail, water), should be referred to as movements or transfers.				
50	5.76	Hazards to be considered for onsite ~~transport~~ **transfer** should include, but not be limited to:….	See previous comment	Y			
51	OLD 5.94	To ensure sub-criticality safety during decommissioning, a graded approach should be applied that considers the type of facility and the fissile material present. Generally, this Safety Guide should be applied for sub-criticality concerns as long as fissile material in relevant amounts is present. Additional guidance and recommendations on the decommissioning of nuclear fuel cycle facilities are given in Ref. [34]	Restore decommissioning with graded approach. Restore the reference to the Safety Guide on Decommissioning of Fuel Cycle Facilities, which is under revision. That revised Safety Guide is expected to include special considerations for sub-criticality safety during decommissioning.	Y			
52	6.5	Add “in process facilities” back in.	While there have been 22 known criticality accidents in processing facilities, other accidents have occurred in other types of facilities.		Reference to fuel processing facilities added by German comment no 39.		
53	Section 6.14	Section 6.14. Add bullet: assess and manage the physical protection interface with criticality safety in a		Y			

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		manner to ensure that they do not adversely affect each other and that, to the degree possible, they are mutually supportive. This aligns the document with INFCIRC 225 rev 5, as section 4.11 discusses protection of theft of SNM.					
54	6.24	**If desired, c**~~C~~alculate the effect of any shielding… between the incident and those likely to be affected. Add after the bullets: "**The determination of the doses should be conservative (but not so conservative that it endangers personnel through measures such as unnecessary evacuation)**."	There is considerable uncertainty about the factors that go into the dose calculation, so some mention that they should be estimated conservatively should be made. Conservatism may include neglecting any present shielding. This should be allowed if licensees do not wish to control and maintain such shielding (although the user should also be cautioned against excessive conservatism.)	Y			
55	6.49	The need for criticality alarm systems should be evaluated for all activities involving, **or potentially involving,** more than a minimum critical mass.	Coverage should be provided over areas where critical mass quantities of material *could* be present,		Sentence also modified by France comment no		

COMMENTS BY REVIEWER Reviewer: United States of America Country/Organization: U.S. Nuclear Regulatory Commission Date: 5/8/12				RESOLUTION			
Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			even if only under abnormal conditions.		78. The need for a criticality detection and alarm system should be evaluated for all activities involving, or potentially involving, involving more than a minimum the risk of exceeding a safe mass.		
56	6.52	Add after the bullets: "**Where the potential for criticality exists, but no criticality alarm system is employed, a means to detect the occurrence of a criticality event should still be provided**."	Particularly in a shielded facility, criticality is undesirable and there should be a means of detecting it (whether or not it meets all the criteria for a fully qualified alarm system or generates an evacuation signal.	Y			
57	6.52	Remove: "The guidance provided here	There are many situations		Sentence		

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		is principally concerned with gamma-radiation rate-sensing systems."	in which a neutron-detecting system is allowed or even may be preferable (e.g., where the background gamma radiation is high). There is nothing in the proposed safety guide that is specific to gamma-detecting systems, nor should they be given preference.		deleted by Technical Editor, see Version 7.		
	Definitions	Credible: Replace with **Cedibility shall be evaluated against an accepted standard, preferably using a probability of occurrence analysis.**	Engineering judgment is not an acceptable criteria as it is too vague.			Y	Some Member States include engineering judgment.
58	Definitions	Favourable geometry: A system, whose dimensions and shape are such that a nuclear criticality event cannot occur ~~so long as the selected control parameters (e.g., fissile material concentration, enrichment) are maintained within specified limits~~ **even with all other parameters at their worst credible conditions.**	Favorable geometry implies that all other parameters are at their most reactive credible or optimal values. While geometry may be used in conjunction with other means of control, favorable geometry has a more rigid connotation.	Y			
59	Definitions	Fissile nuclides and fissile material…Fissile material refers to a material containing any of the fissile nuclides **in sufficient proportion to**	This is why I favored the more general term "fissionable." A mixture of fissile and non-fissile	Y			

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		enable a self-sustained nuclear chain reaction with slow (thermal) neutrons.	nuclides should only be considered fissile if the proportion of fissile nuclides is such that it has a similar nature to a pure fissile nuclide. Also, the term “thermal” is more technical than the term “slow.”				
60	Definitions	Sub-critical: **having a calculated** k_{eff} less than 1~~.0000,~~ **including sufficient margin to ensure a high level of confidence of safety.**	The definition applies to the actual, real-world k_{eff}, but we base criticality analyses on calculated values, which must generally meet some lower value for added confidence (e.g., 0.95).			Y	Definition deleted by Technical Editor and is covered in para 2.5
61	Definitions:	Neutron multiplication factor: Revise “The ratio of neutron production to neutron losses of a fission chain reaction – see also, *k*eff.” To read as “The ratio of neutron production to neutron losses of a fission chain reaction.”	Keff is not defined in the standard’s definitions,		Definition covered by footnote 4.		
62	Biblio-graphy	References to applicable NRC documents should be included (e.g., NUREG/CR-6410, -6698, -6361 and Standard Review Plans such as NUREG-1520, ISG-8 on burnup credit, etc).	This standard is intended to apply to a wide range of fuel facilities worldwide, including ones similar to those regulated by the US NRC.		NUREG/CR’s added.		

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Comment No. / Reviewer	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		Editorial Comments					
1	2.6	“Criteria” should be “criterion” in two places. The original term “case” was more apt here.	Editorial comment			Y	No reference to criteria in 2.6?
2	Table 1	Present Table 1 on a single page	Editorial comment— Table 1 is split between pages 14 -15. In the final version of DS407, present Table 1 on a single page.		Noted, will be addressed in the final editing by the Publications Committee.		