

<b>Reviewer: McMaster Nuclear Reactor – Operations/Nuclear Criticality Safety</b> <b>Country/Organization: Canada, McMaster University</b>			
Comment No.	Page/Para/Line No.	Proposed new text (if applicable)	Reason/Comment
0	General		<p>Although the document states that it complies with international standards there are apparently a number of differences in requirements. As is, it is not clear what parts of the document are paraphrased from existing standards and what modifications have been made. The existing document presents a Canada-only approach to requirements rather than along the basis of international standards. Clear referencing of other standards should be added and clear indication of deviations from international standards should be given along with clear justification for these modifications. Examples:</p> <ul style="list-style-type: none"> <li>• Quantification of credible/incredible frequency cut-off as 1E-6 / yr</li> <li>• Incorporation of quantification of 1E-7 / yr frequency cut-off for mitigation requirements</li> <li>• Assessment of risk in terms of frequency only rather than frequency/consequence</li> </ul> <p>Clearly indicating modifications to international standards and providing justification allows for a clear platform for further development of regulations and guidelines and informed compliance. This will allow for professional discussion in relation to these regulations/guidelines based on the founding principles, and avoid future confusion and mis-interpretation on both sides. There is likely valuable industry input available in the areas where modifications and deviations to existing international standards have been made. Suggest collecting industry input once these are explicitly stated.</p>

1	General to Program  Glossary, p.26	Fissile material: a material that is capable of sustaining a nuclear fission chain reaction	<p>Comment &amp; Recommendation: The definition of a fissile material should be modified so as <u>not to exclude</u> natural uranium or be restricted to thermal neutrons only. Both represent artificial bounds on nuclear criticality safety which are better and more clearly addressed in requirements and approaches.</p> <p>As demonstrated daily natural uranium fuelled reactors (CANDU) are able to sustain nuclear chain reactions given the proper configuration and moderating environment. Similarly nuclear fission chain reactions can be sustained on other than thermal neutron spectra. In the context of advanced system development both of these characteristics are relevant for consideration and would avoid separate regulation frameworks having to be developed.</p>
2	Glossary, p.25	Criticality accident: an unplanned/accidental production of a self-sustaining or divergent nuclear fission chain reaction	Comment: the energy release is a component of a nuclear criticality accident rather than the definition of one
3	Glossary, p.25		Comment: what is the rationale and existing standards for defining credible abnormal conditions as tied to 1E-6/yr?
4			Comment: why is Nuclear Criticality Safety Program limited in scope to out-of-core or out-of-reactor operations? Need to address boundary and overlap between NSCP and facility SAR.
5	Glossary, p.27		Comment: why define a light water reactor (LWR) and not also a heavy water reactor (HWR) or mention systems based on other coolant/moderators? Maybe better to distinguish between fast and thermal systems? (see comment 1)
6	Glossary, p.28		Comment: add supercritical to the definition of reactivity. Also add associated definition of delayed and prompt critical.
7	Glossary, p.28		Comment: distinguish/clarify difference between Subcritical Limit and Upper Subcritical Limit
8	Preface, Sec. 1.2	Suggest leaving out “Where no license condition exists, this regulatory document provides guidance and best	Reason: should the regulatory document ( <i>i.e.</i> , RD-327) provide guidance. Is this not the reason for the associated guidance

		practices” etc.	document (i.e., GD-327)?
9	Purpose, Sec. 1.1		Add: provides requirements for alarms and shielding
10	Section 1.2, p.1	Redefine “should” and “may” to be consistent with ANS-ANSI standards.	Reason: in existing international standards (e.g., ANS-ANSI 8.1) “should” denotes a recommendation, “may” denotes permission, neither a requirement nor a recommendation. Strongly-recommended and recommended does not practically mean anything in the context of regulations as it is subjective. This is related to the opening statement of Section 1.4 “National and International Standards” and as is, is not consistent.
11	Section 1.4		Remove Paragraph 2 and list as already contained in and more relevant to GD-327
12	Sec 2.1, p.3	Change section title to “Categorization of Fissionable Materials”. Move sub-section 2.1.1.4 to Section 2.1.2.	Comment: the title of this section does not appear to reflect the contents.
13	Sec 2.1.1.2, p.4, list item 2.c.i	Remove “more effective than water”	See Comment 1 for context
14	Sec. 2.1.1.4, p.5, paragraph 1	Remove: “, taking into account ... are not applicable. The program shall ensure that the entire process remains subcritical under normal and all possible abnormal conditions”.	Instead define the “reduced-scope” program requirements or reference applicable sections of the document.
15	Sec. 2.1.2.2, item 4a, p.6	Change wording from “an external event” to “an externally initiated event sequence”	Clarification needed on 4a: the 1E-7/yr frequency of occurrence should be for the event sequence initiated by an external event, not the frequency of the initiating external event.  Also, what is the justification for the 1E-7/yr frequency limit? Particularly if facilities are going to be required to spend safety related resources on providing mitigation against events/event sequences that are beyond credible (1E-6/yr). Is the concern that frequencies of occurrence are associated with large uncertainties and therefore an additional margin is necessary? Is there a better way to do this?  Suggestion: given that frequency analysis is somewhat less

			certain than consequence analysis, could the frequency limits used herein as part of the requirements be used as targets only, and in the cases of not meeting these limits then sound justification should be supplied to supplement?
16	Sec. 2.1.2.2, item 4b, p.6		Clarification need on 4b: Since the regulations are now dealing with beyond credible scenarios (associated with 1E-7/yr frequency of occurrence) what is considered a “convincing argument”? Same for “not possible” and “extremely unlikely”.
17	Sec. 2.1.2.2 item 4 p.7		Please define “most severe reasonably possible” with regards to event, what is “reasonably possible”? Is this supplied in GD-327?
18	Sec 2.1.2.2 item 4 (general)		It appears the approach being taken is frequency based only rather than a combination of frequency and consequence defining risk. This suggests the assumption that all criticality accidents are high consequence. Should seek industry input.
19	Sec. 2.1.2.6		Refer QA requirements to facility QA program. If referenced document is criticality specific then provide this in the associated GD-327.  Suggest remove first paragraph and adjust text in second paragraph to reflect that the facility already has a QA program in place.
20	Sec. 2.1.3 General		Many of the subsections contain recommendations (i.e., “should” statements. These may be better suited to the associated GD-327, e.g., 2.1.3.2 Double Contingency Principle 2.1.3.3 Geometry Control 2.1.3.5 Neutron Reflection
21	Sec. 2.1.3.5	Replace title with: <i>Neutron Reflection and Moderation</i>	Change text accordingly to accommodate principle of moderation
22	Sec. 2.1.4.4		The requirement of a written report of the validation. Is this part of the larger picture analysis. Perhaps change to general documentation. As is, this suggests a stand alone document on

			validation of method.
23	Sec. 3.1.1		Require guidance on “convincing argument” or, this needs to be defined quantitatively. Note: it is valuable to allow the facility/user to retain some flexibility in how requirements are met. Most useful would be founding principles of approach which could then be used as a platform for forming a convincing argument for compliance if required, e.g., more information required on risk to personnel viewpoint.
24	Sec. 3.1.2.1 Last Paragraph		<i>For this evaluation, individual areas may be considered...</i>  Remove to GD-327, as this is not a requirement
25	Sec. 3.1.2.2		Define what is an “excessive radiation dose”
26	Sec. 3.1.4 1 <sup>st</sup> paragraph		<i>Consideration shall be given to the avoidance of false alarms...</i>  Seems more suited to a recommendation rather than a requirement
27	Sec. 3.1.4 4 <sup>th</sup> paragraph		What is a “process area”? Please define or reword.
28	Sec. 3.2.2		What is the basis of the requirement for response time?
29	Sec. 3.2.3 3 <sup>rd</sup> paragraph		<i>Document LA-13638 ...</i>  More suited to the companion GD-327? Is this applicable to non-processing situations?
30	Sec. 3.2.4		Remove recommendations and permissions to GD-327
31	Sec. 3.3.4		See comment 25 above re “excessive radiation dose”
32	Sec. 3.3.6 2 <sup>nd</sup> paragraph		More suited to GD-327
33	Sec. 3.2.7	<i>These records are required to provide information...</i>	Add: are required to to second sentence
34	Sec. 4.0 Point 4 in list		Remove 1 <sup>st</sup> sentence to GD-327. Move requirements from GD-327 to this document.
35	Sec. 4.0 General		Could this section be modified into a more generic section on the use of neutron absorbers. As is this seems overly specific to one case. The case of Raschig Rings could be supplied in the

			GD-327 as an example.
36	Sections 5.0 through 11.0		<p>It is not clear as to the point of these sections. Could these either be incorporated into the accompanying GD-327 or into the previous sections of this document.</p> <p>Section 5 seems more suited to a more general section on personal safety                  Sections 6, 8, 9, 10, 11 all reference Section 2 so could be included there. Specifics and aspects of various situations could be provided in GD-327 as examples.</p> <p>Section 11: This appears to be more suited to Section 1.2 “Scope”</p>
37	Section 12.2 Last paragraph		<p>General guidance is referred to Section 2 of this document. Guidance should be provided in the associated GD-327 document not in this regulatory document.</p>
38	Sections 12, subsections 12.1-12.4		<p>The material in these sections appears to be an expansion of what is already presented in Section 2.1.2 “Management Practices”.</p> <p>Suggest either incorporating this into Section 2 or moving to guidance document as appropriate. Also note that organizational structures of different utilities/facilities will differ so the exact breakdown of responsibilities as given in Section 12.3 may not be directly appropriate.</p> <p>Suggest that the general approach with regards to establishing and maintaining a program should be to allow the facility to retain the flexibility to modify program administration when required.</p>
39	Sections 12.5		<p>Together with Section 2.1.4.4 (see Comment 22 above) this information could be combined into a standalone section on evaluation requirements. Possibly combine with validation etc</p>

40	Section 12.6		This information is already touched upon in this document and should not be restated. Incorporate into earlier sections if needed.
41	Section 12.7		Suggest making Emergency Response a separate section. Similar to QA requirements, an Emergency Response program may already exist for a facility. Could this simply be referenced with specific requirements to NCS added?
42	Section 12.8		This is general information and should be in an introductory section, perhaps Section 1 or 2.1.1.4 “Nuclear Criticality Safety Program”
43	Section 13		This should be incorporated into an earlier section. Similar to QA and EP requirements could also reference facility training program.
44	Section 14		More suited to Section 2.
45	Section 15		More suited to Section 2.
46	Section 16		More suited to GD-327