

**From:** Marshall, Michael  
**To:** ["MAUER, Andrew"](#)  
**Cc:** [50.54f Seismic Resource](#); [DiFrancesco, Nicholas](#); [Shams, Mohamed](#)  
**Subject:** RESPONSE: Appendix H to NEI 12-06 August 20.docx  
**Date:** Wednesday, September 30, 2015 10:49:00 AM  
**Attachments:** [Attachment.pdf](#)

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Hello Andrew,

Attached are NRC's comments and questions on the draft Appendix H. By email dated August 20, 2015 to Mohamed Shams, NRC from Andrew Mauer, NEI (ADAMS Accession No. ML15233A050), NEI provided a draft version of Appendix H to NEI 12-06," Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (ADAMS Accession No. ML12242A378) to obtain feedback (i.e., comments and questions).

If you have any questions, please contact me at (301) 415-6197 or Nicholas DiFrancesco at 301-415-115 or at [Nicholas.DiFrancesco@nrc.gov](mailto:Nicholas.DiFrancesco@nrc.gov).

Sincerely,

Michael L. Marshall, Jr.

Senior Project Manager

Hazard Reevaluation Management Branch

Japan Lessons Learned Division

Office of Nuclear Reactor Regulation

301-415-2871

## **NRC Staff Comments on NEI 12-06, Appendix H**

By email dated August 20, 2015 to Mohamed Shams, NRC from Andrew Mauer, NEI (ADAMS Accession No. ML15233A050), NEI provided a draft version of Appendix H to NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (ADAMS Accession No. ML12242A378) to obtain feedback (i.e., comments and questions). Below are NRC's comments and questions on the draft Appendix H.

### **GENERAL COMMENT**

1. Throughout the Appendix H, the term MSSHI was used. Suggest using the GMRS and associated hazard curve instead.
2. Appendix H, as currently written, does not include guidance on preserving FLEX equipment that is not used for an AMS.

### **H.1 INTRODUCTION**

3. Page 1, 1<sup>st</sup> Paragraph: The last sentence should be omitted.
4. Page 1, 2<sup>nd</sup> Paragraph, last part of the 2<sup>nd</sup> Sentence: It might be better to match the language used in EA-12-049, "loss of normal access to the ultimate heat sink." Otherwise it gives the impression that you are rephrasing it in order to change the meaning. This would actually affect initial condition (3) of NEI 12-06, Section 3.2.1.3, which limits the availability of water inventory in UHS to robust piping.
5. Page 1, 2<sup>nd</sup> Paragraph, 3<sup>rd</sup> Sentence: This is not correct; we did not focus on seismically-induced events, but instead chose ELAP as a significant contributor for any externally initiated events. Also, "station blackout" has a specific § 50.2 definition that doesn't really fit properly here because it assumes the availability of alternate ac power sources for some plants.
6. Page 1, 3<sup>rd</sup> Paragraph, last Sentence: This statement needs to be clarified, because it reads as though it is different from an AMS.
7. Page 2, 1<sup>st</sup> Bullet: The phrase used in EA-12-049 and the proposed MBDBE rule would be "develop, implement and maintain," – not "Identify, assess, and implement." Recognizing that this wouldn't be to "maintain," what does this attempt to convey and how does it differ from "develop, assess and implement" as used in the next bullet?

### **H.2 CHARACTERIZATION OF THE SEISMIC HAZARD**

8. Page 2: The GMRS used by the licensee should be the one reviewed and endorsed by the NRC. If the SPRA uses a different PSHA (and hence a different GMRS), additional staff reviews may be needed.

### **H.3 APPROACH FOR COMPARISON OF MITIGATION STRATEGY SEISMIC DESIGN BASIS TO MSSHI**

9. Page 3, Figure 1: Consider revising the dark blue boxes to eliminate the discussion of the MBDDBE rule. Instead, discuss whether or not reasonable protection of the equipment is relied on for the strategies shown.
10. Page 3, 1<sup>st</sup> Paragraph, last Sentence: The use of “SSE” is a potentially confusing definition due to the use of the term SSE, which has a specific meaning that is different than this elsewhere in licensing for the licensees. If SSE must be used, it might be worth using a “FLEX” subscript to distinguish it. Alternatively, if parallelism with Appendix G is preferred and consider using a term like “FLEX DB SSE.”
11. Page 3, 2<sup>nd</sup> Paragraph, last Sentence: An AMS would be the strategy that makes use of the installed, reasonably-protected equipment (including some FLEX equipment in some cases), it should not merely be an evaluation. EA-12-049 and SECY-15-0065 don’t include or propose a requirement for performance of an evaluation, instead they require or would require development of guidance and strategies.

#### **H.4.1 PATH 1: GMRS < SSE**

12. Page 3, 1<sup>st</sup> Paragraph, last Sentence: There should be a discussion of the conclusion that a licensee may reach if the test is passed (i.e., that the FLEX strategies are reasonably protected to the GMRS based on the underlying process used to develop the FLEX strategies). Also, the SPID apparently allows for small narrowband exceedances as discussed in H.4.3. Would they be acceptable here?

#### **H.4.2 PATH 2: GMRS < SSE WITH HIGH FREQUENCY EXCEEDANCES**

13. Page 4, 1<sup>st</sup> Paragraph under “Background and Discussion:” An expanded discussion should be provided to provide a clearer basis for the limitation to Phase 1 equipment. If a licensee were to have installed diesel generators for Phase 2 that have relays and contactors that could lead to circuit seal-ins or lockouts would there be a problem? Would this be alleviated by an operational posture such as not having those circuits energized while in standby?
14. Page 4, 1<sup>st</sup> Paragraph under “Background and Discussion:” Consider referring to the evaluation of the permanently installed FLEX equipment that could potentially impact plant response.

#### **H.4.3 PATH 3: GMRS < HIS**

15. Page 5, 1<sup>st</sup> Paragraph, last Sentence: Is it the adequacy or the capacity that forms the basis for the AMS? The basis should be the capacity. The adequacy would seem to support the evaluation aspects of the MSA, whereas the AMS is a strategy that could be supported by the capacity demonstrated in the IPEEE to show reasonable protection. In any case, this sentence appears to be of disconnected from the main idea of the paragraph by the prior sentence that documents the acceptability of some alternatives for licensees to take. Consider revising the sentence order for the paragraph.
16. Page 5, 1<sup>st</sup> Paragraph under “Introduction:” This should speak to demonstrating reasonable protection for the AMS, not demonstrating the capability to achieve safe shutdown. They are related conceptually, but as worded this doesn’t support reliance on the AMS to meet the language of the proposed rule; instead it reads as an exemption argument.

17. Page 6, 1<sup>st</sup> Paragraph: If you don't include "pool" this can be read to include ISFSIs, which would not be in scope for this effort.
18. Page 6, 1<sup>st</sup> Paragraph: It would be better to phrase this in the conditional as "would remain cooled" rather than as an absolute statement that assumes the existence of such an earthquake.
19. Page 6, 1<sup>st</sup> Paragraph under "Background and Discussion," last Sentence: If the demonstration provided by the IPEEEs was disjunctive, reliance on it would not be an appropriate methodology to show reasonable protection of equipment for the underlying strategies as an AMS. The goal is to show reasonable protection of the capability to maintain or restore core cooling and containment capabilities, which would be consistent with the wording of the proposed rule.
20. Page 7, Bullet #3: Add a discussion about what is needed for those plants that relied on the SPRA for the IPEEE and the SPRA did not extend to 72 hours.
21. Page 7, Bullet #3, 7<sup>th</sup> Sentence: NEI 12-01 set the 24 hour restoration of near-normal site access as a condition for the staffing assessments of the § 50.54(f) letters of March 12, 2012. It did not "determine" that site access would be restored within 24 hours. The NRC can accept the 24 hour time for this approach consistent with NEI 12-01, but it isn't proper to characterize this as a determination.
22. Page 7, 1<sup>st</sup> Sentence under "Spent Fuel [Pool] Cooling Evaluation:" The GMRS used by the licensee should be the one reviewed and endorsed by the NRC to avoid additional staff reviews. Consider deleting "or the IHS."
23. Page 7, "Other Considerations:" This section could benefit from discussing the HF evaluations earlier rather than merely as an "other consideration." It really isn't just another consideration, but an integral part of what should be accomplished to show the reasonable protection of the equipment relied upon for the AMS.

#### **H.4.4 PATH 4: GMRS ≤ 2X SSE**

24. Page 8, third sentence under "Basis:" It is important to point out the limitations of the ESEP and why it was done to provide an overall context for the scope of this evaluation. The ESEP was developed as an interim evaluation so that more time taken to perform the SPRA. The scope of the ESEP was intentionally limited to meet expedited schedules. Therefore, these evaluations will have to address the omissions in the ESEP and supplement with new evaluations for SSCs and other aspects of mitigating strategies that have been not evaluated to the new seismic hazard.
25. Page 8, last Sentence under "Basis:" Include a discussion why the ESEP evaluations are applicable. Consider explaining why the criteria used in ESEP evaluations are appropriate for this assessment.
26. Page 8, Bullet #2: Consider rewriting this section. As written, this will allow to screen almost everything without any clearly defined basis. Also, it is inconsistent in a subtle way with notions discussed in Path 5. This section needs to be consistent with the concept of

inherently rugged in SPID 6.4.3. The intent described in this section should be to allow the same privilege as that allowed in a SPRA or margin evaluation.

Inherently Rugged SSC: Certain classes of equipment that were not included within the ESEP review are inherently seismically rugged and consequently have a very low probability of failing as a result of a seismic event. Insights from the earthquake experience data have been incorporated in several guidance documents used for SPRA, margin, and other evaluation (Refs. 6041, GIP, fragility handbook, etc.). These guidance documents and criteria listed in them should be used to identify the inherently rugged SSC. Note that supplemental evaluations may be needed to meet the criteria. The goal is to establish a framework for the acceptability of SSCs as inherently rugged based on established and/or published information and not engineering judgement. Need to describe the approach used to identify what SSCs are inherently rugged.

27. Page 8, Bullet #1: The last sentence should be revised to replace “reasonable assurance” with “reasonable protection.”
28. Page 8, Bullet #1: This sentence should include a condition that all potential applicable failure modes were included in the ESEP evaluation.
29. Page 8, Bullet #2: The way this is phrased implies that it is conditional on the high seismic capacities but never comes out and states that the SSCs listed have high seismic capacities, which is a bit problematic. A discussion needs to be included that provides a basis for declaring that an SSC is inherently rugged.
30. Page 8, Bullet #2, item a: HVAC is not necessarily rugged. Rugged should be tied to accepted SMA guidance (e.g., NP 6041). Also, consider removing HVAC from the list.
31. Page 9, Bullet #3: It should be noted that the comment in this same paragraph indicating that “these items [haul paths] do not require specific evaluations based on site configurations and quantitative arguments will suffice” may not be appropriate for any site where soil strength is relied upon to provide ruggedness. Soil properties must always be evaluated on a case-by-case basis. The way this sentence is written is problematic as it offers no context for why a detailed evaluation of soil failure may not be warranted. Consider providing a framework/acceptance criteria for performing limited soil evaluations for haul paths. For instance, consider guiding the licensee to provide discussion on-site capabilities for debris removal to reestablish haul paths.

#### **H.4.5 PATH 5: GMRS > 2X SSE**

32. General comment on Path 5: A screening value of SCDF of  $1E-5$  is less arbitrary than others and can be presented as a small enough fraction of the overall CDF risk ( $1E-4$ /yr) safety goal for the commission and is a viable surrogate for reasonable probability of plant equipment survivability and functionality under the GRMS.
33. General comment on Path 5 (see attached figure): The approach needs to end with an AMS for each branch of the flowchart. For sites where the risk is higher than the threshold and FLEX does not contribute effectively to reducing the risk, something must be done to address the higher than the threshold risk to satisfy the reasonable protection criteria of the proposed rule. So this branch should result in a change to FLEX to make it effective or address the plant vulnerability to reduce the SCDF number. Also, there should be an

explicit option to exit Path 5 and do an evaluation of FLEX by say  $C_{10}\%$  (regardless of the fact that FLEX won't reduce the risk) to fully address the proposed rule.

34. General comment on Path 5: The plant risk (which in this instant is  $> 1E-5$ ) would be assessed at the end of R2.1 and judged by RG 1.174 framework. Consider the use of SCDF only as a screening criteria to reduce the number of possibilities and in turn the complexity of follow-on actions if the threshold is exceeded. The combination of SCDF and SLERF may make sense in a plant-specific backfit context, but it appears to be less appropriate to address the proposed rule.
35. Page 11, last Paragraph, 4<sup>th</sup> Sentence: As phrased, there is an underlying conceptual error. An acceptably low risk from ELAP/LUHS could demonstrate that there is reasonable protection of the equipment relied on for a seismic AMS, but would not demonstrate an AMS. This confuses justification for an exemption (as it currently reads) with an argument that no exemption is necessary because the proposed requirement is met.
36. Page 12, 3<sup>rd</sup> Paragraph: The screening criteria should be: SCDF  $1E-5$  and SLERF  $1E-6$ . These screening levels have a stronger basis in the risk-informed decision making process and Phase 2 of R2.1. Changing the thresholds would make them more consistent with NRC regulatory analysis and backfit guidance, thus supporting our Phase 2 decision making process. Therefore, the screening should not exceed the above metrics.
37. Page 12, 3<sup>rd</sup> Paragraph: "NRC has previously deemed SCDFs less than  $1 \times 10^{-4}/\text{yr}$  do not pose a significant risk without consideration of SLERF." This SCDF value should be  $1 \times 10^{-5}/\text{yr}$ .
38. Page 14, Figure 4: While the result of this flow chart would show an MSA as being acceptable, it doesn't speak to the acceptability of an AMS.
39. Page 15, 1<sup>st</sup> full Paragraph, 1<sup>st</sup> Sentence: Consider expanding this paragraph to more clearly describe the two potential outcomes and how a plant screens out or not.
40. Page 17, 1<sup>st</sup> full Paragraph, 1<sup>st</sup> Sentence: This paragraph needs to be expanded to more clearly explain how this will be demonstrated. Is this simply a frequency of sequences that can be mitigated by the FLEX assuming that probability of success is 1, without any evaluations?

## **H.5 SEISMIC EVALUATION CRITERIA (HCLPF<sub>10</sub>)**

41. Page 18, 1<sup>st</sup> paragraph: The development of the basis for using the  $C_{10}\%$  capacity values is tied to ASCE 43-05 and ATC-63. It should be noted that the use of the  $C_{10}\%$  capacities combined with 150% of the DBE in ASCE 43-05 is linked to the desired performance goal of  $1 \times 10^{-5}$ . Also, it should be recognized that the DBE is developed by scaling the  $1 \times 10^{-4}$  ground motion to account for the slope of the hazard curve. Using these two factors and  $C_{10}\%$  capacities can be shown to exceed the demands at 100% of the DBE. ASCE 43-05 concludes that the performance goal is reasonably achieved if the seismic demands are computed at approximately the 80<sup>th</sup> percentile non-exceedance probability.

Substituting the GMRS into the process as the desired performance goal (when it is actually set at  $1 \times 10^{-4}$  ground motion levels and then scaled to account for the slope of the hazard curve) does not seem to provide the performance that is desired. A better connection would be to achieve the performance goal of  $1 \times 10^{-5}$  while accepting a higher damage state, for example, a Limit State A, B, or C. Then there is a clear connection between the demand and the seismic ruggedness. The justification for the acceptability of the  $C_{10\%}$  needs to be augmented perhaps considering a combination of the thoughts provided above and also perhaps looking at the estimated performance target based on  $C_{10\%}$  (i.e.,  $5 \times 10^{-5}$  as an upper bound) and explaining why it is acceptable for existing facilities and for beyond-design basis performance. Why is the 10% probability of unacceptable performance acceptable for MS? Is it okay because MS are an added defense in depth and not the first line of defense? Why is the associated level of nonlinear behavior acceptable? Does the mean value of the performance target hover around  $1 \times 10^{-5}$ ? What does this performance target (i.e.,  $5 \times 10^{-5}$ ) mean to plants' SCDF? Would the SDCF values continue to be acceptably low? Addressing these questions in Appendix H would be valuable to making the safety case for the use of  $C_{10\%}$ .

# NRC Perspective on NEI 12-06, Draft Appendix H, Path 5 (GMRS > 2X SSE)

