NRC Public Meeting on NTTF 2.1 Seismic and Appendix H to NEI 12-06

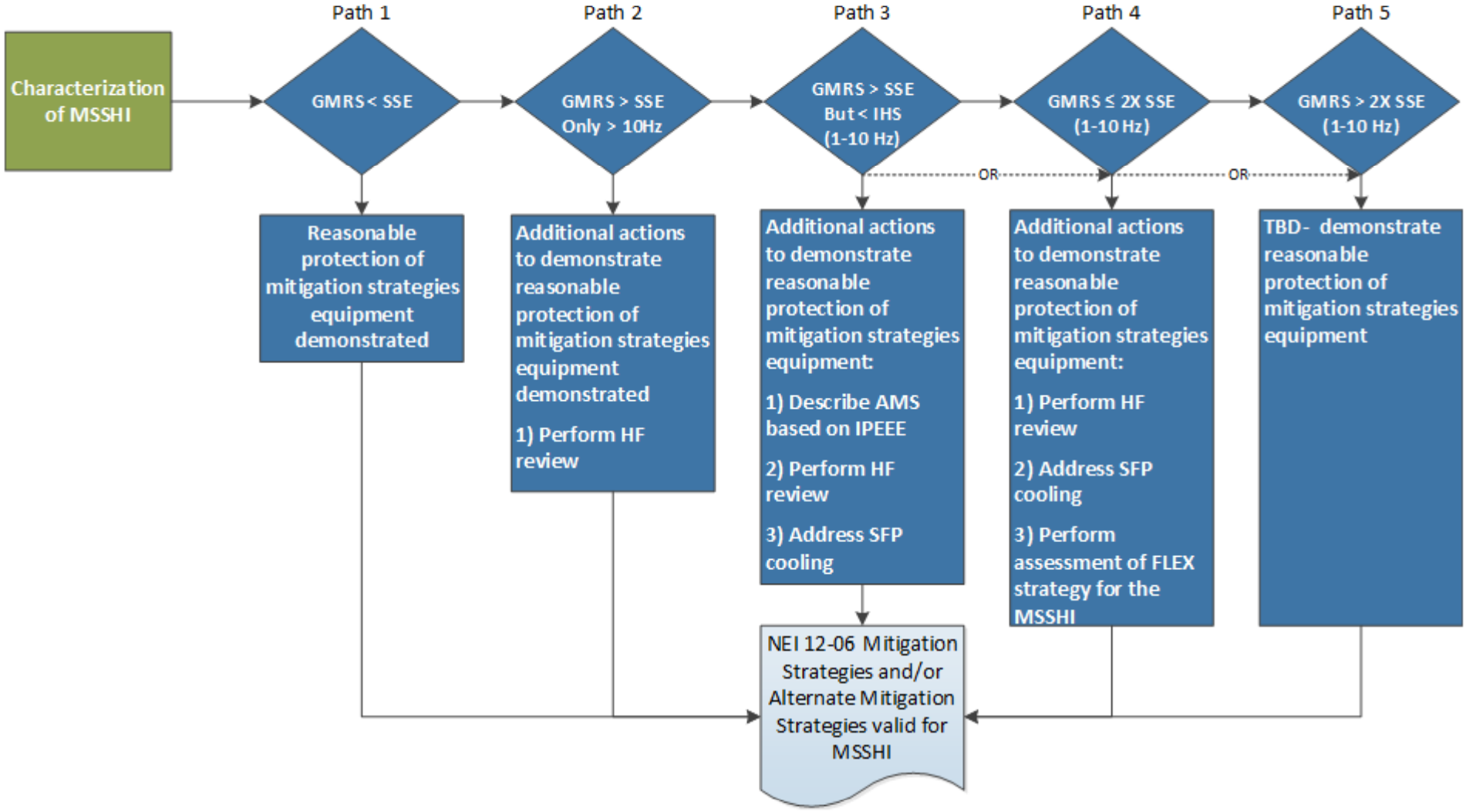
October 21, 2015

Update on Appendix H to NEI 12-06

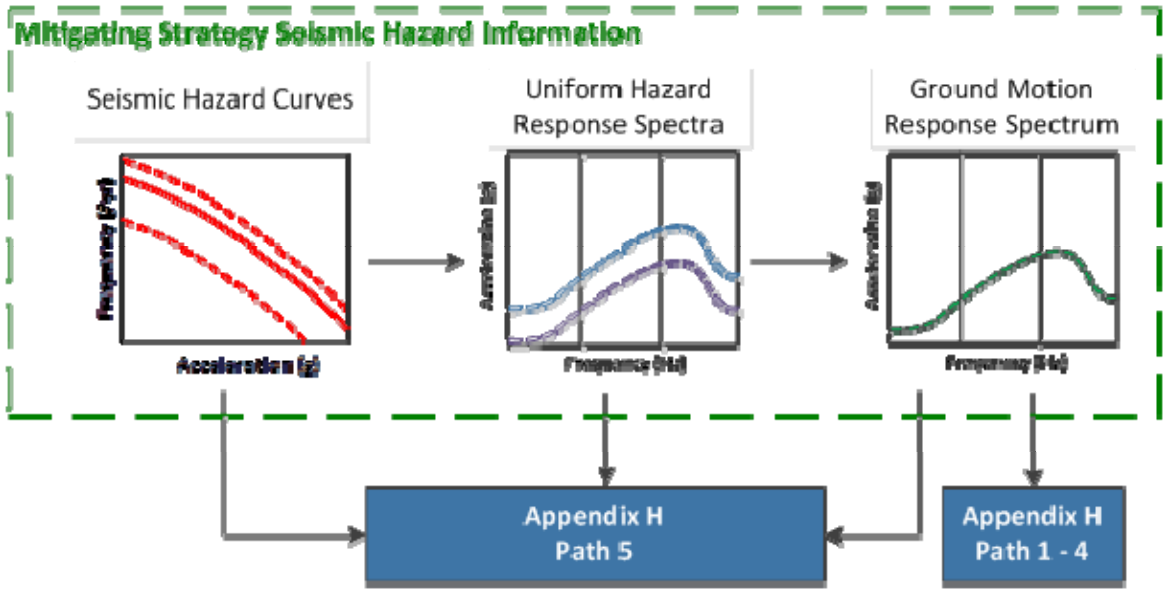
Current Status

- Desired outcome: achieve final comment resolution on Appendix H in December 2015/January 2016 timeframe, to enable progress on MSAs in 2016
- Initial draft provided to NRC on August 20, 2015
- NRC comments received on September 30, 2015
- Industry provided an updated excerpt on October 16, 2015 which addresses NRC comments 1-23
- Work continues to address remaining comments

Appendix H to NEI 12-06 Overview



Characterization of the Mitigation Strategy Seismic Hazard Information (MSSHI)



Path 1: GMRS < SSE

- If the GMRS is bounded by the SSE spectrum at frequencies 1 Hz and greater, then additional evaluation is unnecessary as the FLEX strategies are reasonably protected to the MSSHI based on the underlying process used to develop the FLEX strategies.

Path 2: GMRS > SSE at frequencies > 10 Hz

- For plants where the GMRS spectrum above 10 Hz exceeds the SSE spectrum, licensees can demonstrate adequacy of the mitigation strategy with respect to the MSSHI by performing an MSA that consists of an evaluation of HF sensitive in-plant SSCs required for mitigation strategy implementation.
- MSA HF evaluation scope is focused on seal-in and lock out circuits in the following systems and equipment.
  - Devices whose chatter could cause malfunction of a reactor SCRAM
  - Devices in seal-in or lockout circuits whose chatter could cause a reactor coolant system (RCS) leakage pathway that was not considered in the mitigation strategy. Examples include the automatic depressurization system (ADS) actuation relays in boiling-water reactors (BWRs) and relays that could actuate pressurizer power-operated relief valves (PORVs).
  - Relays and contactors that may lead to circuit seal-ins or lockouts that could impede the FLEX capabilities for mitigation of seismic events, including credited installed Phase 1 direct current (DC) systems and alternating current (AC) systems supported through the inverters and any permanently installed Phase 2 or 3 SSCs that have the capability to begin operation without operator manual actions.

Path 3: GMRS > SSE - IPEEE demonstrates seismic capacity above GMRS

Mitigation Strategy

- If the high-confidence-of-low-probability-of-failure plant capacity spectrum developed from the evaluations for the Individual Plant Examination of External Events (IPEEE) envelops the GMRS between 1 and 10 Hz, an AMS may be used based upon the IPEEE.
- IPEEE safe-shutdown paths would be used to demonstrate reasonable protection of SSCs relied upon for this AMS.
- The MSA for Path 3 will address spent fuel pool cooling and high frequency
- While the Path 3 AMS does not generally rely upon availability of FLEX equipment, the MSA will address availability of FLEX equipment as a means of additional defense in depth.
- Alternatively, licensees may elect to perform an MSA of the impacts of MSSHI on mitigation strategies consistent with Path 4.

Comment Resolution for Path 4

Path 4 NRC Comment Responses

- **H.4.4 PATH 4: GMRS ≤ 2X SSE**

Comment 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.

- Discussion added "The ESEP was an interim evaluation and included a review for all potential failure modes with one exception associated with seismic interactions. The ESEP included the reviews of seismic interactions associated with block walls in the vicinity of the ESEP equipment and for differential displacement type interactions for tanks. As such, any additional seismic interaction failure modes affecting the ESEP equipment would need to be considered as part of the MSA. Outside of these additional seismic interaction reviews, no further work is required to demonstrate the reasonable protection to withstand the new seismic hazard for those SSCs that were within the scope of the ESEP."

Path 4 NRC Comment Responses

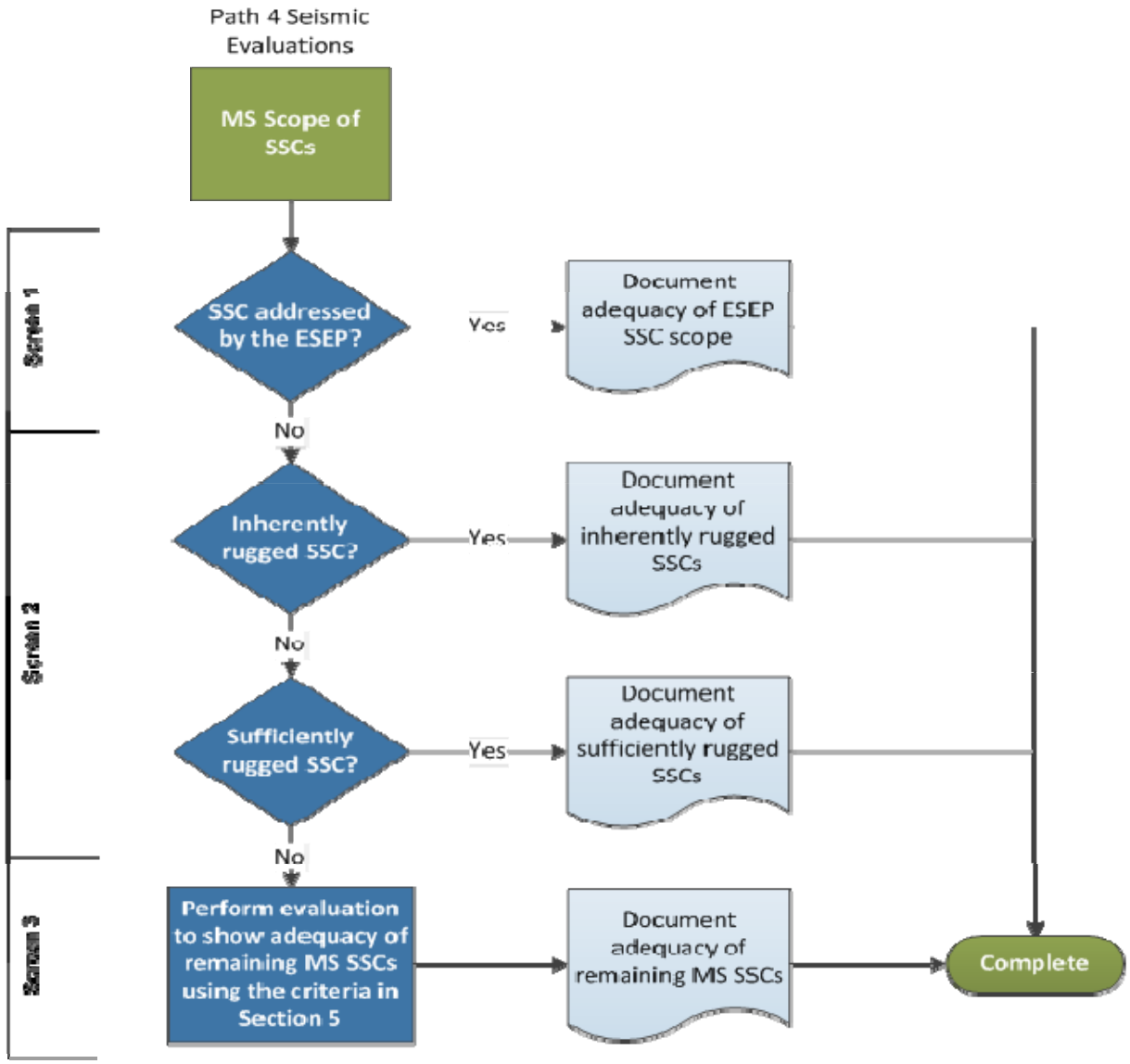
- **25**. Page 8, last Sentence under "Basis:" Include a discussion why the ESEP evaluations are applicable. Consider explaining why the criteria used in ESEP evaluations are appropriate for this assessment.

- Add discussion on ESEP being appropriate for this assessment
  - Scaled SSE assessment up to 10 Hz typically conservative and addresses the low frequency beyond design basis up to 2 SSE. Seismic is not a cliff edge and margin typically at a factor or two or greater to design
  - High frequency > 10 Hz addressed by the high frequency review

Path 4 NRC Comment Responses

- **26**. Page 8, Bullet #2: Consider rewriting this section. As written, this will allow to screen almost everything without any clearly defined basis.
- **29**. A discussion needs to be included that provides a basis for declaring that an SSC is inherently rugged.

- Will expand the section on inherently rugged to link specific SSCs to a reference document
- Will introduce a new set of SSCs with "sufficient ruggedness" with margin ≤ 2 X SSE, along with a basis tied to a reference document


Path 4 Seismic Evaluations
MS Scope of SSCs
Screen 1
SSC addressed by the ESEP?
Yes
Document adequacy of ESEP SSC scope
No
Screen 2
Inherently rugged SSC?
Yes
Document adequacy of inherently rugged SSCs
No
Sufficiently rugged SSC?
Yes
Document adequacy of sufficiently rugged SSCs
No
Screen 3
Perform evaluation to show adequacy of remaining MS SSCs using the criteria in Section 5
Document adequacy of remaining MS SSCs
Complete

Path 4 NRC Comment Responses

• 27. Page 8, Bullet #1: The last sentence should be revised to replace "reasonable assurance" with "reasonable protection."	• Edit completed
• 28. Page 8, Bullet #1: This sentence should include a condition that all potential applicable failure modes were included in the ESEP evaluation.	• Note added in response to comment #24 to address failure modes not already addressed in the ESEP

Path 4 NRC Comment Responses

- **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.

- HVAC ducting has shown to be rugged from past earthquakes. Add description from reference (e.g. NP 6041) and associated restrictions and caveats necessary.

Path 4 NRC Comment Responses

- 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. …….. 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.

- Wording will be updated to clarify when specific evaluations are not required for liquefaction & soil failure.
- Discussion will be added on debris removal

H.5 SEISMIC EVALUATION CRITERIA (HCLPF10)

- **41**. Page 18, 1st paragraph: The development of the basis for using the C10% 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 1x10-5.

- Use of the ASCE 43-05 was only intended to document where the concept was first introduced in the literature, but not to be the basis for demonstrating that $C_{10\%}$ was appropriate for Path 4. We will provide discussion of sensitivity studies to provide justification

H.5 SEISMIC EVALUATION CRITERIA (HCLPF10)

- 41 (Cont.) - The justification for the acceptability of the C10% needs to be augmented perhaps considering a combination of the thoughts provided above and also perhaps looking at the estimated performance target based on C10% (i.e., 5E-5 as an upper bound) and explaining why it is acceptable for existing facilities and for beyond-design basis performance.

- Documenting sensitivity studies showing impact of C10% performance goal
  - Annual Frequency of Unacceptable Performance (AFUP) of the MS equipment
  - GMRS submitted to NRC
  - C10% ≤ GMRS
  - Vary Beta and frequency
  - All sensitivity studies
  - AFUP < 5E-5 (defense-in-depth)
- Simplified plant logic model risk reduction – plant safety systems and mitigation systems alternate paths

Update on NTTF 2.1 Seismic

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- Limited Evaluations
  - High Frequency
    - Initial submittals expected by December 31, 2015
    - Submittal template being developed for remaining submittals – draft expected Q1 2015
  - Spent Fuel Pool
    - Evaluation for plants with GMRS peak SA ≤ 0.8g
      - Paper being finalized for peak Sa ≤ 0.8g – anticipate alignment on resolution of comments by December 31, 2015, NRC endorsement to follow
      - Submittal template being developed – draft expected Q1 2015
      - Submittals expected by December 31, 2016
      - Efforts continue on approach for sites with peak Sa > 0.8g
    - Evaluation for plants with GMRS peak SA > 0.8g
      - Finalize benchmarking/evaluation (2015-2016)
      - Identify two representative sites for detailed evaluation (2016)
      - Perform analysis when ISRS from two representative sites are provided from SPRA model(s) (2016-2017)
- Seismic Probabilistic Risk Assessment
  - Submittal template under development – draft expected Q1 2016