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Cc:	DiFrancesco, Nicholas; POLLOCK, Joseph; Davis, Jack; TSCHILTZ, Michael; Bowman, Eric
Subject:	[External_Sender] DRAFT Appendix H to NEI 12-06
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Mo,

Attached is a draft of Appendix H to NEI 12-06 that is based on the framework we have previously discussed. We look forward to further discussion at the 9/3 public meeting.

We appreciate your feedback.

Thanks,
Andrew

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NEI 12-06 APPENDIX H

H.1 INTRODUCTION

The purpose of this appendix is to provide guidance for a mitigation strategiesassessment (MSA) of the impact of the seismic hazard information developed in response to the Fukushima Near-Term Task Force (NTTF)Recommendation 2.1: "*Seismic on the implementation of theMitigationStrategies*"[1]. The performance of the MSAis not required to comply with EA-12-049[2].

The mitigation strategiesdeveloped in response to EA-12-049 [2]assumed an extended loss of alternating current (AC) power (ELAP) with a loss of normal access to the ultimate heat sink (LUHS) from an unspecified event.EA-12-049 [2]was issued to help address beyond design-basis external events prior to the time the information concerning the re-evaluated hazards was available.Specifically, since the information concerning the re-evaluated seismic hazards was not available to determine the impact on the facility, an unspecified event was used which presumed the event resulted in a loss of all AC power combined with a loss of the ability to pump water from the ultimate heat sink using normal design pathways, as described in EA-12-049[2].This presumption was based upon station blackout being a significant contributor to seismically-induced core damage frequency (SCDF) and seismically-induced large early release frequency (SLERF), for external initiating events.Now that the seismic hazards have been re-evaluated for all sites, more detailed evaluations of a plant's ability to withstand the re-evaluated seismic hazard can be performed and additional strategies for plant responses that preferably rely upon permanent installed plant equipment, which in some instances have been bolstered to withstand beyond design-basis seismic events, can be developed.The use of permanently installed plant equipment for these strategies results in less reliance on manual operator actions outside of the control room and the use of portable equipment following a beyond design-basis external event.

The MSA determines whether the mitigation strategies as developed to meet EA-12-049 [2]can be implemented for the mitigation strategy seismic hazard information (MSSHI).If it is determined that mitigation strategies developed to meet EA-12-049 [2]have not been evaluated or cannot be implemented for the MSSHI , the MSA considers other options such as performing additional evaluations, the existing mitigation strategies and/or diverse and flexible coping strategies (FLEX) equipment, or developmentofan alternate mitigation strategy (AMS) that address the MSSHI.If a mitigation strategy is developed that does not rely on FLEX, a basis for choosing the selected strategy should be provided. In those instances where an AMS is provided, FLEX equipment will provide for additional defense-in-depth through the provision of the FLEX equipment in FLEX storage and/or FLEX equipment transported to the site from the National Response Centers.The MSA will either demonstrate that the mitigation strategies can be implemented as currently developed or modified, or that an AMS can be developed that is effective for the MSSHI. Alternately, the MSA will demonstrate that a different mitigation strategy can be implemented to address the specific attributes of the MSSHI.

Licensees will use the guidance for performing an MSA in this Appendix to do the following:

- Confirm mitigating strategies, as currently implemented, are not renderedineffective by the reevaluated seismic hazards;

- Identify, assess, and implement modifications necessary to ensure mitigatingstrategies are able to address the reevaluated seismic hazards; or
- Develop, assess, and implement alternate mitigating strategies.

A brief description of the MSA approach (and associated sections in this appendix) is as follows:

- Section H.2 establishes the characterization of the MSSHI.
- Section H.3 provides the comparison of the seismic design basis (typically the plant safe shutdown earthquake (SSE) spectrum) used for mitigation strategy development to the MSSHI to determine if the MSSHI is bounded.
- Section H.4 provides the evaluation of mitigation strategies with respect to the MSSHI and methodologies for performing the MSA.
- Section H.5 provides performance criteria used to establish adequate seismic ruggednessrequirements for structures, systems, and components (SSCs) that support mitigation strategies.
- Section H.6 provides requirements for documentation of the results.

H.2 CHARACTERIZATION OF THE SEISMIC HAZARD

The MSSHI is determined based upon the licensee's reevaluated seismic hazard using probabilistic seismic hazard analysis (PSHA) and the resulting performance-based seismic hazard curves and ground motion response spectrum (GMRS) developed at the control point elevation stemming from the March 12, 2012, NRC letter issued under § 50.54(f)[2], or as subsequently modified to support the development of seismic probabilistic risk assessments (SPRAs) under § 50.54(f)[3].

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

This section provides the approach for comparing the MSSHI to theseismic design basis used for developing the FLEX mitigation strategies.Nuclear Energy Institute (NEI) 12-06, Section 5.3.1 [4]provides guidance for protection of FLEX equipment.In most cases, FLEX was designed to the SSE.In some cases, FLEX equipment storage structures were designed to American Society of Civil Engineers (ASCE) 7-10 [5]or storage was outside a structure and was evaluated for seismic interactions. The term SSE will be used herein to represent the seismic design basis used for the FLEX mitigation strategies.

The GMRS at frequencies 1 Hz and higheris compared to the SSE spectrum to determinewhether the SSE bounds the GMRS, or identify any areas of exceedance of the SSE.The results of the comparison are used as input to the evaluation of mitigationstrategies in Section H.4. The assessment process is illustrated in Figure 1 and described in detail below.

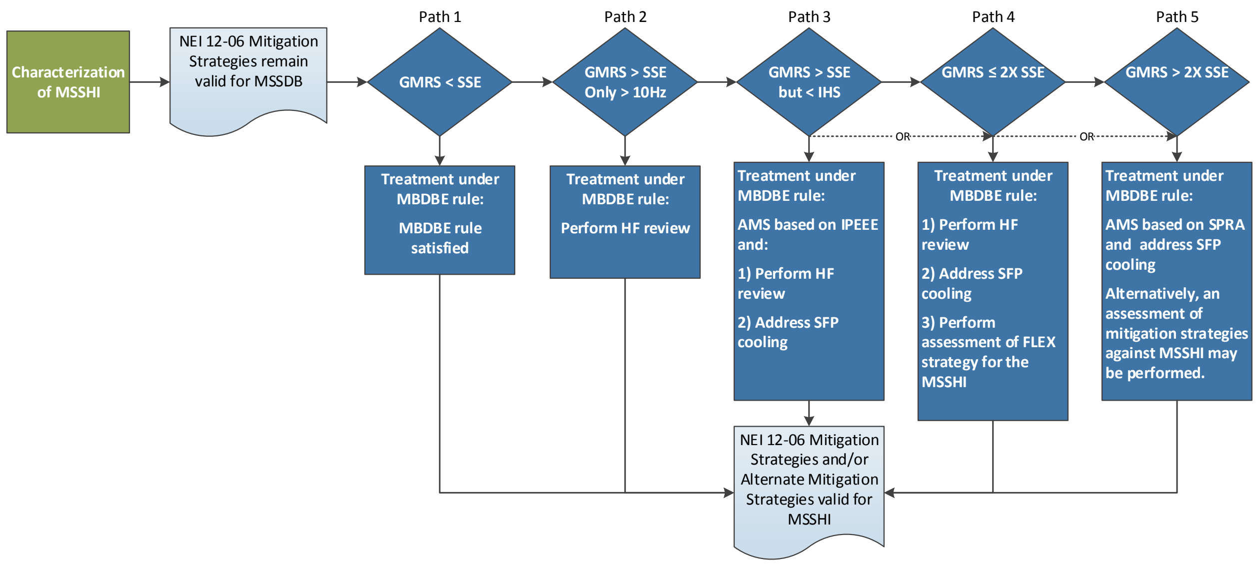

Figure 1:Mitigation Strategy Assessment Process for the MSSHI

H.4 EVALUATION OF MITIGATIONSTRATEGIES

The mitigation strategies are evaluated with respect to the MSSHI, using the process depicted in Figure 1.

If the SSE spectrum completely bounds the GMRS at frequencies 1 Hz and greater, no additional MSA is required as described in Section H 4.1 (Path 1 in Figure 1).In the event that the MSSHI is not fully bounded by the SSE, an assessment of the impacts on mitigation strategies is required.The purpose of the assessment is to determine the adequacy of strategies in consideration of the MSSHI.Sections H 4.2-4.5 of this appendix provide guidance for development of an MSA to support Paths 2 through 5, respectively, in Figure 1.

The MSA evaluates the SSCs, operator actions and procedures required to successfully implement the mitigation strategies so that a site may cope indefinitely due to the beyond design-basisseismic event.Sections H.4.2 and H.4.4 provide approaches to evaluateimplementation of the mitigationstrategies with respect to the MSSHI.Sections H.4.3 and H.4.5 provide approaches for evaluation of AMSthat are capable of demonstrating plant safety with respect to the MSSHI.An AMS consists of comprehensive plant safe shutdown seismic response evaluations that primarily rely upon permanent installed plant equipment and in some instances may include certain aspects of FLEX mitigation strategies that that have been evaluated to the MSSHI.

The MSA conducted under this section will be documented per Section H.6 of this appendix.

H.4.1 PATH 1: GMRS < SSE

If the GMRS described in Section H.2.0 is fully bounded by the SSE spectrum (consistent with the screening, prioritization and implementation details (SPID) as shown in Electric Power Research Institute (EPRI) 1025287[6])at frequencies 1 Hz and greater, then additional evaluation is unnecessary, consistent with Path 1 of Figure 1.

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

If the GMRS described in Section H.2.0 is fully bounded by the SSE between 1-10 Hz (consistent with the SIPD as shown in EPRI 1025287[6]) but is not bounded at frequencies >10 Hz, an MSA can be performed consistent with Path 2 of Figure 1.

Introduction:

Plants with SSE exceedances only above 10Hz can demonstrate adequacy of the mitigation strategy with respect to the MSSHI by performing an MSA that consists of an evaluation of high frequency (HF) sensitive in-plant SSCs required for mitigation strategy implementation.

Basis:

FLEX SSCs have been evaluated to demonstrate adequacy following the guidance in Section 5.3.1 of NEI 12-06[4].The HF SSE exceedances (i.e., >10Hz) must be evaluated by performing an MSA to provide assurance that mitigation strategies can be implemented as planned.EPRI 3002004396 [7]provides methodologies to address the effect of the HF exceedances on sensitive components.

Background and Discussion:

NEI 12-06[4]Section 5.3.1 requiresthat SSCs relied on for mitigation strategies be evaluated as seismically robust to the licensing basis seismic levels (e.g. SSE).This evaluation can be modified to consider HF GMRS exceedances above the SSE and can be performed using the process identified below.As described in the SPID as shown in EPRI 1025287[6], HF ground motions only impact functional failure modes during the GMRS seismic event (e.g. relay chatter), which only affects FLEX Phase 1 permanently installed plant equipment.Therefore, the FLEX 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[1]
- 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 Phase 1 FLEX capabilities for mitigation of seismic events, including credited direct current (DC) systems and alternating current (AC) systems supported through the inverters.

The contact devices above would be evaluated using the methods outlined in EPRI 3002004396, Sections H.4.3 and 4.4[7].

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[1] A SCRAM is a manually triggered or automatically triggered rapid insertion of all control rods into the reactor, causing emergency shutdown.

Restrictions:

The restrictions and caveats that apply in using this path are as follows.

1. GMRS spectral ordinates must be less than the SSE in the 1 to 10 Hz range consistent with the SPID as shown in EPRI 1025287[6].

Other Considerations:

There are no other considerations for this path.

H.4.3 PATH 3: GMRS < IHS

If the GMRS described in Section H.2.0 is bounded by the high-confidence-of-low-probability-of-failure (HCLPF) spectrum developed from evaluations for Individual Plant Examination of External Event (IPEEE) between 1-10 Hz (with the exception of small narrow band exceedances that meet the criteria of SPID as shown in EPRI 1025287 [6]and are acceptable), an AMS to address the MSSHI, which is based upon the IPEEE, may be utilized consistent with Path 3 of Figure 1., The plant may elect to perform an MSA of the impacts of MSSHI on mitigation strategies consistent with Path 4 of Figure 1 or perform a SPRA-based MSA consistent with Path 5 of Figure 1. The basis for development of an AMS is the demonstrated IPEEE adequacy.

Introduction:

An IPEEE-based AMS relies on the comprehensive seismic evaluation of plant equipment to demonstrate the capability to achieve safe shutdown with respect to a beyond design-basisseismic event. The IPEEE-based AMS addresses the ability to maintain or restore core cooling or containment capabilities, but typically does not address the spent fuel cooling function.

Plants that choose this path can rely on the previous seismic evaluations that were conducted under the IPEEE effort (and accepted by NRC per Enclosure 2 of their May 9, 2014 letter[8] or in a subsequent determination) provided the IPEEE HCLPF spectrum (IHS) completely envelops the GMRS of the re-evaluated seismic hazard in the 1 to 10 Hz range.The development of the IHS is described inEPRI 1025287[6].

IPEEEs relied on the results of a SPRA, an EPRI seismic margins methodology, or a NRC seismic margins methodology to demonstrate the capability to bring the plant to a safe shutdown condition following a review level earthquake (RLE)as described in NUREG-1407[9].These seismic evaluation approaches evaluated multiple redundant safe shutdown success paths.The safe shutdown success paths provide independent means of achieving a safe shutdown condition following a severe seismic event (e.g., core cooling by heat removal from the steam generators and core cooling by RCS ‘feed and bleed’).

Basis:

Seismic evaluations performed under IPEEE have included SSCs comprising multiple redundant safe-shutdown success paths.Therefore, based on the results of the IPEEE, safe-shutdown of the plant following a seismic event can be accomplished, and consequences can be mitigated, for a seismic event up to the plant capacity level (i.e., the IHS) for which

SSCs in the IPEEE have been evaluated.

In addition, MSSHI evaluations for spent fuel cooling are performed to demonstrate that spent fuel remains cooled following a beyond design-basis earthquake, and a review of HF sensitive components is performed, as needed.

Background and Discussion:

IPEEE Evaluations

The IPEEEs were completed by plants in the 1990s to meet NRC Generic Letter (GL) 88-20 Supplements 4[10]and 5[11] in accordance with the guidance of NUREG-1407[9]. Acceptable approaches to perform IPEEE included the NRC seismic margin assessment (SMA) method, the EPRI SMA method, or an SPRA.For each approach, a seismic equipment list (SEL) was developed which included multiple redundant safe shutdown success paths and/or accident sequences.The evaluation of redundant safe shutdown success paths provides demonstrates the capability to maintain or restore core cooling or containment capabilities for a beyond design-basisseismic event up to the level of the IHS, which envelopes the GMRS in the 1 to 10 Hz range (see Section H.2).

NUREG-1407 [9]categorized plants performing IPEEE in three bins – reduced scope, focused scope and full scope.

The IPEEEs were generally performed using input motions based on the following:

a. Median-centered response spectrum using the NUREG/CR-0098[12] shape, anchored to 0.3g peak ground acceleration (PGA).
b. For SPRAs, plants generally used the mean Uniform Hazard Response Spectra (UHRS) and hazard curves developed by Lawrence Livermore National Laboratory (LLNL) inNUREG-1488[13]and/or EPRI in EPRI NP-6395-D[14].
c. In some cases, past SPRAs were submitted for IPEEE closure that used input motions and hazard curves that preceded the LLNL and EPRI hazard curves of NUREG-1488 [13]and EPRI NP-6395-D[14]respectively.

Consistent with the input spectrum shape used in an IPEEE, anIHS can be developed, as described in EPRI 1025287[6].

The NRC reviewed the IPEEE submittals and provided comments via SafetyEvaluation Reports (SERs) to licensees to close the IPEEE.

Restrictions:

The restrictions and prerequisites that apply for using the IPEEE evaluations for this path are as follows.

1. Limited to previous seismic evaluations that were conducted under the IPEEE effort (and accepted by NRC per Enclosure 2 of their May 9, 2014 letter [8]or in a subsequent determination), provided the IHScompletely envelops the GMRS of the reevaluated seismic hazard in the 1 to 10 Hz range.

2. Plants using this approach should have conducted a full scope IPEEE or, if they were in the focused scope bin, plants can bring their focused scope IPEEE assessment in line with a full scope assessment as defined in GL 88-20 Supplements 4 [10]and 5[11] and NUREG-1407 [9]in accordance with the guidance in the SPID as described in EPRI 1025287 [6].Plants that conducted a reduced scope IPEEE assessment cannot use Path 3 for their AMS.
3. The EPRI SMA approach was based on the seismic margin methodology described in EPRI NP-6041-SL Rev. 1 [15].This approach defined the SEL for evaluation of safe shutdown success paths to be comprised of those SSCs required to bring the plant to a stable condition (either hot or cold shutdown) and maintain that condition for at least 72 hours.Therefore, for plants with an IPEEE based on the SMA described in EPRI 1025287[6] approach, the IPEEE results must be evaluated for limitations that are based on the 72 hour coping duration.Generally, the conclusions of the SMA are not sensitive to coping duration.However, certain consumable items, such as water and fuel oil inventories, may have been evaluated based on a limited onsite supply.The ability to continue coping would require re-supply of consumables.Site access is restored to a near-normal status and/or augmented transportation resources are available within 24 hoursas determined by NEI 12-01[16], to allow for additional supplies to be brought in and allow for continuation of coping strategies and maintain the plant in a stable condition.A plant-specific evaluation should be performed to conclude that SSCs that limit the EPRI SMA-based IPEEE coping duration to 72 hours are available for an indefiniteperiod following the beyond design-basisseismic event to support continued maintenance of the safe shutdown condition.

Spent Fuel Cooling Evaluation

Equipment (spent fuel pool (SFP) cooling system components, SFP makeup capability, SFP level instrumentation etc.) needed to accomplish the spent fuel cooling function should be evaluated for seismic adequacy to the GMRS or the IHS.For developing in-structure response spectrum(ISRS) corresponding to the GMRS or IHS, it is acceptable to scale the SSE-based ISRS by the highest ratio of GMRS/SSE or IHS/SSE in the 1 to 10 Hz range for these evaluations. A high frequency evaluation of the SFP cooling key safety function is not warranted since operators would have a significant amount of time to restore SFP cooling and there are not significant actions that need to be taken to reset any equipment that tripped.

Other Considerations:

This path is supplemental to the seismic requirements defined elsewhere in NEI 12-06 [4] for the existing FLEX. Plants following this path need to perform a high frequency evaluation of relays in the IPEEE scope consistent with the methodology of EPRI 3002004396 [7] as applicable.

H.4.4 PATH 4: GMRS ≤ 2X SSE

Licensees who have determined that the MSSHI described in Sections H.2.0 and H.3.0 is not fully bounded by the plant's design basis and whose peak GMRS/SSE ratio is ≤ 2, mayperform an MSA of the impacts of the MSSHI on mitigation strategies consistent with Path 4 of Figure 1or may elect to perform a SPRA and pursue the AMS in Section H.4.5 of this appendix consistent with Path 5 of Figure 1.

Introduction:

For plants with low to moderate GMRS (up to 2xSSE in the 1-10 Hz frequency range), the Review Level Ground Motion (RLGM) which formed the basis for the Expedited Seismic Evaluation Process (ESEP), as described in EPRI 3002000704[17],evaluated the new seismic hazard for the SSCs addressed within the ESEP.For those SSCs which are part of the MSA but were not included in the ESEP review, methods are recommended to demonstrate adequate seismic ruggedness.These methods include use of past experience to justify qualitative criteria for adequate seismic ruggedness and also a more quantitative approach based on the criteria described in Section H.5 of this appendix to demonstrate SSCs are seismically robust up to the GMRS earthquake level.

Basis:

FLEX SSCs have already been evaluated to show they are seismically robust following the guidance in NEI 12-06, Section H.5[4].Previous seismic evaluations will be credited to the extent that they apply.This includes the design basis evaluations for the plant, and the ESEP evaluations for the mitigation strategy in accordance with EPRI 3002000704 [17].To the extent necessary, these evaluations will be supplemented with new evaluations for SSCs that have not been evaluated to the new seismic hazard.The new evaluations would be used based on the methodology and criteria in Section H.5.0. Plants following this path may also have HF GMRS exceedances above the SSE at frequencies above 10 Hz, which should be addressed as described in Section H.4.2.

Background and Discussion:

NEI 12-06[4]previously required that SSCs relied on for mitigation strategies to be evaluated as seismically robust to the design-basis (DB) seismic levels.The evaluation of Path 4 SSCs within the MSA is conducted using Figure 2:

1. *ESEP Review* – The ESEP provided an evaluation that demonstrated seismic adequacy for all components in a single success path for core cooling, RCS makeup, and containment function strategies for a scaled SSE spectrum that bounded the GMRS from the re-evaluated seismic hazard (1-10 Hz) or the GMRS was directly used.For those SSCs which were within the scope of the ESEP, no further work is required to demonstrate the reasonable assurance to withstand the new seismic hazard.

2. *Qualitative Assessment Based on Seismic Experience*– Certain classes of equipment that were not included within the ESEP review and that have high seismic capacities would require no further actions to demonstrate reasonable assurance to withstand the new seismic hazard.These SSCs include:

a. Piping, cabling, conduit, heating, ventilating and air conditioning (HVAC), and their supports

b. Manual valves, check valves, and rupture disks

c. Power operated valves not required to change state as part of the FLEX mitigation strategies

d. Nuclear steam supply system (NSSS) components (e.g. reactor pressure vessel (RPV) and internals, control rod drive mechanisms (CRDMs), fuel rods, reactor coolant pumps (RCPs) and seals, etc.)

e. Portable FLEX equipment (only the tie downs need to be addressed using the approach 3 below)

f. Safety-related buildings

g. Other rugged components that can be justified by experienced seismic engineers based on past test or earthquake information

3. *Quantitative Assessment Based on the Criteria Defined in Section H.5.0* SSCs and seismic interactions that were not included within the ESEP review and cannot be justified to be inherently rugged with respect to seismic accelerations and displacements shall be evaluated to demonstrate adequate seismic ruggednesswhich results in an acceptably low probability of failure.Section H.5.0 describes the methodology for demonstrating this acceptably low probability of failure using the GMRS to define the seismic demand.Examples of these SSCs include:

   a. Haul Path – including liquefaction, slope stability and interactions (Note: for many sites these items do not require specific evaluations based on the site specific configurations and qualitative arguments will suffice to resolve)

   b. FLEX Equipment Storage Building and Non-Seismic Category 1 Structures

   c. Operator Pathways – interaction pathway review, useSection H.5 methods if calculation is required

   d. Tie down of FLEX portable equipment that are required to be restrained during the earthquake

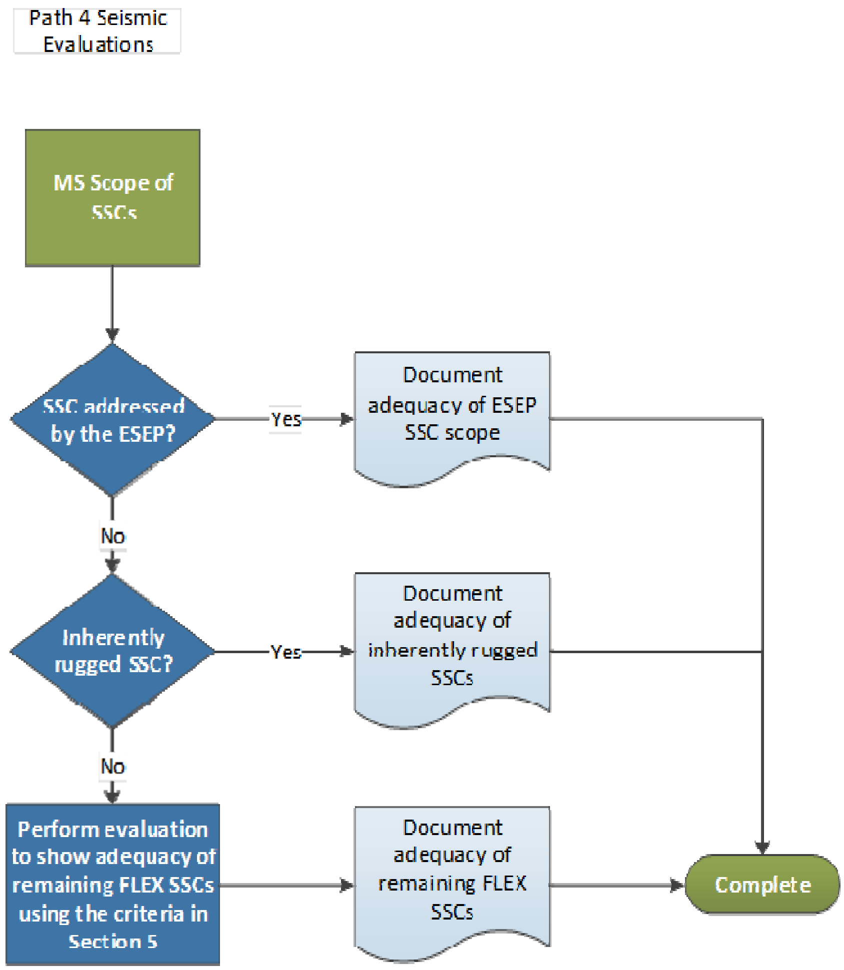

Figure 2: Evaluation of Path 4 SSCs with the MSA

Restrictions:

The restrictions and caveats that apply in using this path are as follows.

- GMRS spectral ordinates must be less than or equal to 2 times the SSE in the 1 to 10 Hz range for those plants that used a maximum factor of 2 times the SSE in their ESEP evaluations.

Other Considerations:

- Plants following this path need to perform HF evaluation of relays consistent with Path 2, if applicable.The description of the methodology for that HF evaluation of relays is described in Section H.4.2 of this appendix.
- Plants following this path need to ensure the SFPcooling capabilityis maintained. Equipment (SFP cooling system components, SFP makeup capability, SFP level instrumentation, etc.) needed to accomplish the spent fuel cooling function shall be evaluated for seismic adequacy to the GMRS.A high frequency evaluation of the SFP cooling key safety function is not warranted since operators would have a significant

amount of time to restore SFP cooling and there are not significant actions that need to be taken to reset any equipment that tripped.

H.4.5 PATH 5: GMRS > 2X SSE

Introduction:

The performance of a SPRA provides detailed plant-specific insights into the seismically-induced scenarios that can impact plant safety.These insights can, in turn, assist the plant in understanding the specific susceptibilities to ELAP/LUHS scenarios that the mitigationStrategies implemented under EA 12-049[2] are targeted for.Thus, in order to demonstrate an acceptable AMS, plants that perform an SPRA can utilize the results and insights from the SPRA to identify the degree to which protection is achieved or needs to be enhanced.A successive screening process is used to evaluate the plant-specific risk levels associated with SCDF and SLERF scenarios and target any enhancements to protection based on the insights from the SPRA.It is recognized that some SPRAs will include explicit credit for mitigation strategies in the base model.Other SPRAs may not.The screening process described below is established to support either case.If the SPRA risk levels (SCDF, SLERF) do not meet risk threshold targets, AMS options are available to address MSSHI for plants that are in this path, as discussed below.

Plants following this path also need to demonstrate the ability to maintain the SFP cooling capabilitywith respect to the MSSHI.

Basis:

An AMS utilizes any combination of FLEX equipment and/or installed plant equipment to maintain or restore core and SFP cooling and containment capabilities. The SPRA serves to demonstrate that the plant equipment is robust and can be credited for the coping strategy.Licensees that demonstrate acceptable risk levels from a SPRA under Path 5 will identify success paths for installed equipment such that it can be relied upon during the ELAP/LUHS.Plants that do not screen will be expected to evaluate the robustness of their mitigation capability through one of three options.

Screening Based On SPRA Results

Licensees that perform a SPRA are in a unique position to understand the manner in whichmitigation strategiesthat utilize FLEX equipment impact plant safety.Specifically, the results of the SPRA can be used to determine if the ELAP events addressed by mitigation strategies are important contributors to SCDF and/or SLERF and, where they are important, the nature of the scenarios can be defined.An SPRA is the best tool for evaluating plant-specific mitigation strategies because of the scenario-based nature of PRAs.If a plant has an acceptably low risk from ELAP/LUHS scenarios, then an AMS is demonstrated and additional protection is not needed.Consistent with other regulatory applications, the SCDF and SLERF for various accident sequences and for the plant from the SPRA are used to guide the evaluation of plant risk.

Seismic evaluations performed through the development of a technically adequate SPRA include SSCs that contribute to seismic risk.It is acknowledged that some plant-specific SPRAs may include credit for FLEX equipment utilized inmitigation strategies as part of their base PRA.In order to best identify the role of FLEX equipment inmitigation strategies in reducing risk, the SPRA results to be used in this evaluation should not include credit for the portable equipment used for mitigation strategies. Installed equipment credited as part of mitigation strategies can be included.

A screening process can be used to evaluate whether the consideration of mitigation strategies that rely on FLEX storage structures, haul paths, connection points and portable equipment is needed.Three successive screens are available in order to simplify the process:

1. *a sufficiently low level of total seismic risk from the SPRA, or*
2. *a sufficiently lowlevel of risk from seismically induced ELAP/LUHS sequences in the SPRA, or*
3. *a sufficiently lowlevel of risk from seismically induced ELAP/LUHSscenarios where the FLEX mitigationstrategies can be effective in reducing risk.*

Whether the level of risk is sufficiently low is assessed by comparing the risk results to a screening threshold.For the purposes of this evaluation, screening values of $3x10^{-5}$/yr ($SCDF_{Screen}$) and $3x10^{-6}$/yr ($SLERF_{Screen}$) are used for comparison to SCDF and SLERF results, respectively.These values are appropriate because they provide assurance that the NRC Safety Goals[18] are not impacted and provide margin to risk levels that would be considered significant.In GSI-191[19], the NRC has previously deemed SCDFs less than $1x10^{-4}$/yr do not pose a significant risk, without consideration of SLERF. Adopting a screening threshold that is only 30% of that criterion provides margin that helps address uncertainties in the seismic risk results.Further, the inclusion of SLERF addresses the defense-in-depth associated with containment.A SLERF screening value that is 10% of the SCDF value is consistent with other risk guidelines, such as Regulatory Guide 1.174[20].

The same threshold is used for each level of screening.The logic behind this is that the risk can be shown to be sufficiently low at any level since each level of screening is a subset of the previous case.

Figure3 shows an example of how a seismic risk result might breakdown in this manner.In Figure 3a, the total seismic risk is shown in two parts:ELAP/LUHS scenarios and Non-ELAP/LUHS scenarios.In this example, the ELAP/LUHS scenarios are the largest contributor to seismic risk.This is relevant because mitigation strategies are targeted to address ELAP/LUHS scenarios.Figure 3b further divides the ELAP/LUHS scenarios into PRA scenarios where mitigation strategies can be effectively used to prevent fuel damage.Not all ELAP/LUHS scenarios considered in the SPRA can be mitigated.For example, damage to safety-related structures due to earthquakes well beyond the plant DB could make operator actions infeasible due to inaccessibility.

In such a case, it is not useful to demonstrate that the FLEX storage structures, haul paths, connection points and portable equipmentare reasonably protected, since their availability would not materially impact plant response.

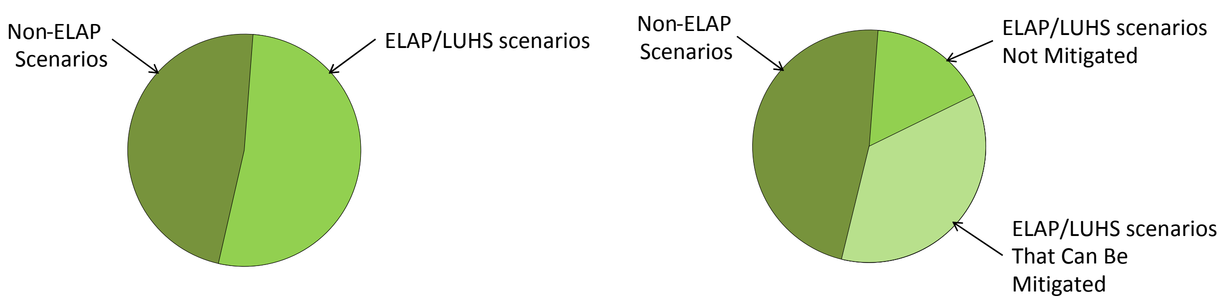

Figure 3a (left):Divided into Non-ELAP, ELAP

Figure 3b (right): Divided into Non-ELAP, ELAP Mitigated, and ELAP Non-Mitigated

Figure 3: Examples of the Total Seismic Risk Breakdown Divided Into Subsections

When considering the acceptability of these contributions, a plant could screen at any level.That is, only sites with significant contributions from ELAP/LUHS scenarios that can be mitigated would need to consider verification of the adequacy of seismic ruggednessof FLEX storage structures, haul paths, connection points and portable equipment.The screening process is shown as three successive screening questions, consistent with the above.

Plants with seismic risk parameters (SCDF, SLERF) that exceed the risk screening threshold should consider whether mitigation strategies that rely on FLEX equipment can address the ELAP/LUHS scenarios that may be important contributors to seismic risk.For plants where ELAP sequences are important contributors to the overall seismic risk, the use of FLEX equipment for mitigation should be assessed to determine if it is effective in substantially reducing the risk from ELAP events. If the use of FLEX equipment for mitigation could potentially result in *substantial reduction* in seismic risk for ELAP events, the FLEX mitigation capability or specific aspects thereof (i.e., specific equipment/capabilities that contribute significantly to reduce ELAP risk), should be evaluated for the MSSHI.The process for performing these evaluations is discussed in more detail below.

Licensees who do not screen based on Screens 1-3 in Figure 4 will perform an MSA consistent with the options discussed below for unscreened plants, which may include the use of NRC regulatory guidance developed to support the evaluation of external hazards in support of the mitigation of beyond design-basis events (MBDBE) rulemaking.

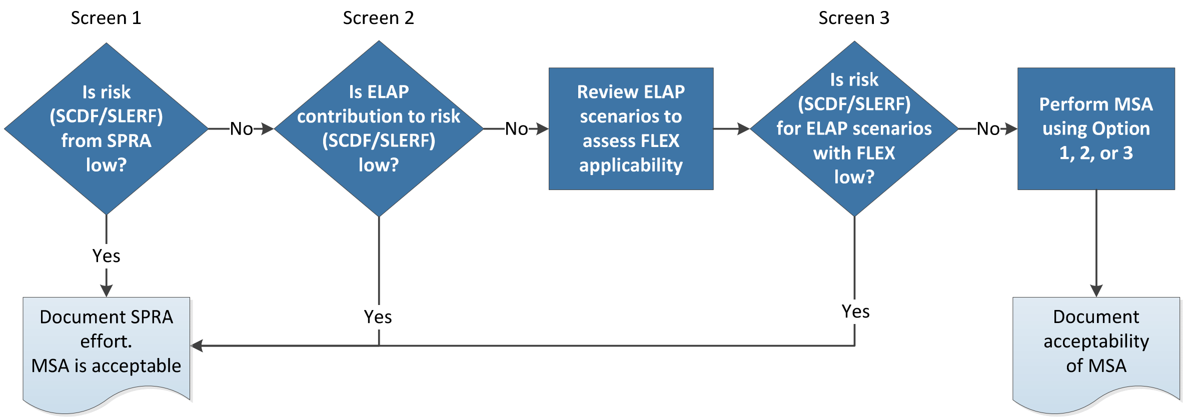

Figure 4: Process for Assessing Mitigation Strategies Using a SPRA

The manner in which these results would support screening is depicted in three cases shown below.The first situation, Case 1 (shown in Figure 5), is a plant with total SCDF and total SLERF values less than the screening threshold.Given the demonstrated low risk, there is no need to further evaluate the FLEX storage structures, haul paths, connection points and portable equipment for the MSSHI.

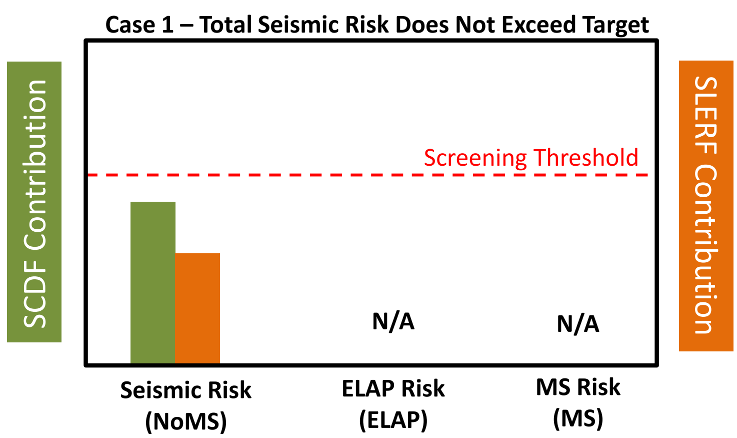

Figure 5: Case 1 – Total Seismic Risk Does Not Exceed Target

In Case 2 (shown in Figure 6), the total SCDF and SLERF exceeds the screening threshold, but the frequency of SCDF and SLERF scenarios involving ELAP does not.Given that mitigationstrategies are designed to mitigate ELAP/LUHS scenarios, the low risk posed by these scenarios provides a basis for the plant to be screened from further evaluation of the FLEX storage structures, haul paths, connection points and portable equipment for the MSSHI.

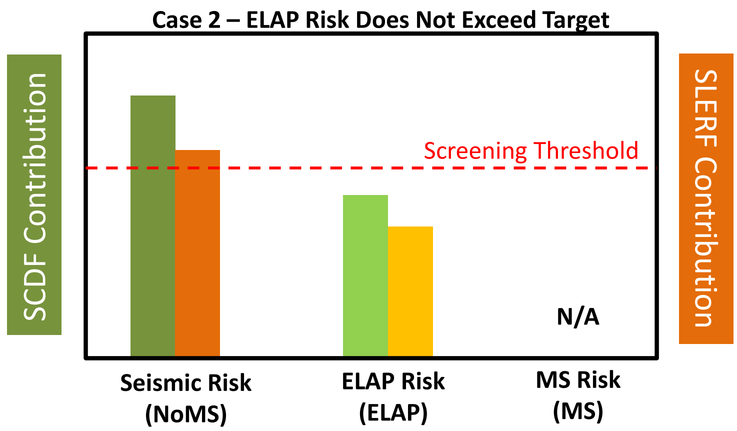

Figure 6: Case 2 – ELAP Risk Does Not Exceed Target

The last, Case 3 (shown in Figure 7), depicts a plant where the total SCDF/SLERF and ELAP SCDF/SLERF exceed the screening threshold, but upon investigation of the specific ELAP/LUHS scenarios from the SPRA it was determined that the frequency of scenarios that could be mitigated by FLEX mitigation strategies was below the screening threshold.Again, given the low risk posed by these scenarios provides a basis for the plant to be screened from further evaluation of the FLEX storage structures, haul paths, connection points and portable equipmentfor the MSSHI.

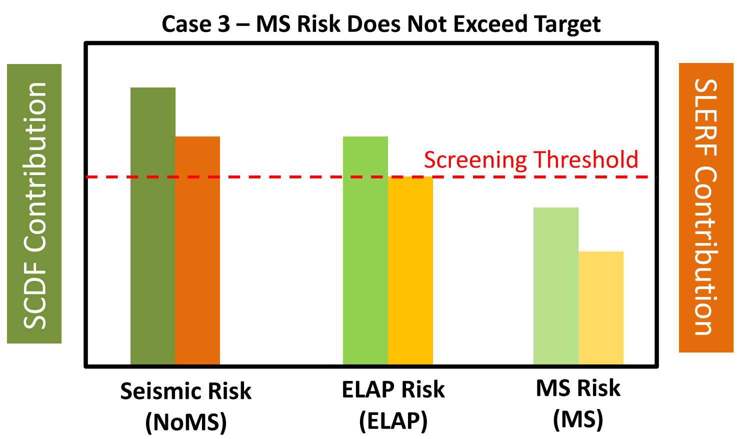

Figure 7: Case 3 – Mitigation Strategies Risk Does Not Exceed Target

Description of Screening Steps

The process outlined above is explained in more detail below.It should be noted that this screening process is designed to make the screening decision require as little analysis as possible.It is recognized that plants that have fully credited FLEX in their SPRAs may be able to skip the first two screening steps and simply quantify the risk without credit for the FLEX storage structures, haul paths, connection points and portable equipmentand the risk with FLEX mitigation capability as a means to screen without evaluating total SCDF/SLERF or ELAP contributions.Since the process is hierarchical leading to the same endpoint, this is an acceptable screening approach.The initial screening step of this process focuses on the total SCDF/total SLERF without credit for the FLEX storage structures,

haul paths, connection points and portable equipment, i.e., deployment of portable FLEX equipment.This may or may not be the base SPRA results for the plant, depending on how the SPRA was performed and quantified.For the purposes of this evaluation, these will be referred to as $SCDF_{NoMS}$ and $SLERF_{NoMS}$.

Screen 1 – Total SCDF/SLERF

For plants where the SPRA results demonstrate a sufficiently low level of overall seismic risk for MSSHI ($SCDF_{NoMS} < SCDF_{Screen}$) and ($SLERF_{NoMS} < SLERF_{Screen}$), additional evaluation of FLEX mitigation is not necessary.For plants screening out on Screen 1 (shown in Figure 4), the MSA is acceptable and this AMS should be simply documented using the overall SCDF/SLERF results from the SPRA.No further evaluation of the FLEX storage structures, haul paths, connection points and portable equipmentfor the MSSHI is required.

Screen 2 – ELAP Contribution to SCDF/SLERF

Plants that do not screen on total $SCDF_{NoMS}$ and $SLERF_{NoMS}$ should determine frequency of ELAP/LUHS scenarios within the SPRA that contribute to SCDF and SLERF.A PRA analyst familiar with the plant-specific SPRA should determine the frequency of scenarios involving ELAP conditions that contribute to SCDF and SLERF.For the purposes of this evaluation, these will be referred to as $SCDF_{ELAP}$ and $SLERF_{ELAP}$.Typically, this can be done through a sensitivity study or through the use of flag events and importance measures.If both $SCDF_{ELAP} < SCDF_{Screen}$ and $SLERF_{ELAP} < SLERF_{Screen}$ then the risk from ELAP/LUHS scenarios is sufficiently low and the MSA is acceptable through demonstration of an AMS.For Screen 2 (as shown in Figure 4), the documentation should include a description of the process and assumptions used to identify ELAP/LUHS scenarios in the SPRA and their total contribution to SCDF/SLERF.No further evaluation of the FLEX storage structures, haul paths, connection points and portable equipmentfor the MSSHI is required.

Screen 3 – Mitigation Scenarios

If the risk from the ELAP events within the SPRA is not sufficiently low considering ELAP/LUHS scenarios, then additional investigation is warranted to determine the frequency of SCDF/SLERF scenarios where FLEX deployment could feasibly reduce risks.In this case, the purpose is simply to assess the frequency of scenarios where FLEX could be beneficial, it is not to quantify the benefit.This will likely require a PRA analyst familiar with the SPRA to perform a sensitivity study that identifies where the Mitigation strategiesthat rely on FLEX storage structures, haul paths, connection points and portable equipment as defined under the plant-specific implementation of NEI 12-06[4] could be deployed.This will require identification of conditions where there is sufficient time, accessibility, and available installed equipment for the use of FLEX equipment as part of themitigation strategies to be effective.For example, SCDF/SLERF scenarios involving seismically induced failure of reactor core isolation cooling (RCIC)/auxiliary feedwater (AFW) may not provide sufficient time for deployment of FLEX.Likewise, very severe beyond design-basisseismic events that are commonly significant contributors to SCDF/SLERF may compromise the integrity of even safety-related structures where FLEX deployment is to occur.In these cases, FLEX will not be effective and there is no reason to consider the benefit of enhancing the protection of FLEX equipment for those scenarios.In

other cases, scenarios involving seismically-induced emergency diesel generator (EDG) or EDG support systems failures with RCIC/AFW available and structures intact should be directly mitigated by the mitigation strategies that utilize FLEX equipment.The risk analyst should initially compute the frequency of the ELAP/LUHS scenarios that could be mitigated by FLEX mitigation strategies. For the purposes of this evaluation, these will be referred to as $SCDF_{MS}$ and $SLERF_{MS}$.

If both $SCDF_{MS} < SCDF_{Screen}$ and $SLERF_{MS} < SLERF_{Screen}$ then the risk from ELAP/LUHS scenarios is sufficiently low and the MSA is acceptable through demonstration of an AMS.For Screen 3 (as shown in Figure 4), the documentation should include a description of the process, assumptions, and criteria used to identify ELAP/LUHS scenarios in the SPRA where FLEX mitigation strategies would not be effective and their contribution to SCDF/SLERF.In these cases, no further evaluation of the FLEX storage structures, haul paths, connection points and portable equipment for the MSSHI is required.

In cases where the plant fails to screen because the SPRA indicates that the SCDF/SLERF contribution from scenarios addressed by the use of portable FLEX equipment are not sufficiently low, the SPRA provides a valuable resource to guide the plant on how to best consider demonstrating a mitigation capability for the MSSHI.The SPRA analyst will be able to identify the specific scenarios driving plant risk, the seismically-induced failures contributing most significantly to those scenarios, the seismic fragilities of key equipment dominating the scenarios of interest, and potential assumptions, findings, and insights from the SPRA that may influence these results.

Options for Unscreened Plants

Plants that do not screen using the process described above can use one of the three options discussed below to provide adequate seismic ruggednessof FLEX mitigation strategies for the MSSHI:

Option 1: Demonstrate Capacity of FLEX mitigation strategies

When the risk parameters (SCDF, SLERF) from the SPRA or from ELAP sequences within the SPRA (with or without FLEX scenarios) are unacceptably high, plants performing the SPRA have the option to evaluate SSCs in the scope of FLEX using the MSSHI.

An SMA for SSCs in the FLEX scope stated above can be performed using the methodology of EPRI NP-6041 SL, Rev. 1[15].SMA calculations using the approach of Section H.5.0 provide adequate seismic ruggedness. If the capacity of the weakest SSC in the selected FLEX path is equal to or above the GMRS, the MSA is acceptable and this AMS should be documented using the results of the SMA.

Option 2: Update Plant Risk Evaluation

Plants have the option to refine the SPRA assumptions and/or methods to improve the risk insights and re-quantify the risk (SCDF/SLERF) and/or implement plant design modifications and/or augment the existing mitigation capabilities and re-quantify the SPRA risk (SCDF/SLERF) to show that it is acceptably low.If so, the

MSA is acceptable and an AMS should be documented using the results of the updated SPRA.

Option 3: Re-evaluate mitigation strategies to MSSHI

Plants may perform an evaluation of their mitigation strategy against the MSSHI using the criteria in Section H.5 of this Appendixfor the evaluation of the FLEX storage structures, haul paths, connection points and portable equipment, while utilizingNRC Regulatory Guide forMBDBErule, DG-1301[21].

Other Considerations:

Plants following this path need to ensure the key safety function of spent fuel cooling capability is maintained. Equipment (SFP cooling system components, SFP makeup capability, SFP level instrumentation, etc.) needed to accomplish spent fuel cooling function should be evaluated for seismic adequacy to the GMRS. A high frequency evaluation of the SFP cooling key safety function is not warranted since operators would have a significant amount of time to restore SFP cooling and there are not significant actions that need to be taken to reset any equipment that tripped.

H.5 SEISMIC EVALUATION CRITERIA (HCLPF$_{10}$)

NEI 12-06[4] requires that "Licensees or [Construction Permit] CP holders must provide reasonable protection for the associated equipment from external events.Such protection must demonstrate that there is adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities at all units on a site subject to this Order".For beyond design-basis seismic events, the recommended approach to define adequate seismic ruggedness consists of demonstrating that the GMRS level of seismic hazard at the site results in an acceptably low probability of failure.For purposes of defining what would be the appropriately low probability of failure, the guidance in ASCE/SEI 43-05[22] related to beyond design-basis seismic evaluation is used.ASCE/SEI 43-05 [22]defines a 10% probability of unacceptable performance ($C_{10\%}$) which is reviewed against the beyond design-basisseismic event (150% of the DBE ground motion for the ASCE/SEI 43-05 [22]case).This same 10% probability of unacceptable performance was used in a recent Applied Technology Council (ATC) project, ATC-63[23], which defined the acceptable low probability of collapse levels for structural evaluations to be the $C_{10\%}$ value.The ATC-63 [23]project stated "*acceptably low probability of collapse is interpreted to be less than a 10% probability of collapse under the [maximum credible earthquake] MCE ground motions*" as shown in Structural Engineers Association of California (SEAOC) 2007 Convention Proceedings[24].The MCE is the equivalent of the beyond design-basisseismic event for normal building code applications such as the ATC-63 [23]. The C10% performance level provides an adequate performance level of seismic ruggedness for mitigation strategies.

The process for calculating the $C_{10\%}$ values are defined in this section.Table 1 provides recommended values for β_C, β_R, β_U, and the ratio of the median capacity $C_{50\%}$ to the $C_{1\%}$ capacity taken from the SPID determined in EPRI1025287[6].The recommended β_C values are based on Kennedy's recommendations [25]and on average are biased slightly conservative (i.e., slightly low β_C on average).Because random variability β_R is primarily due to ground motion variability, a constant β_R value of 0.24 is recommended regardless of the SSC being considered.The

recommended uncertainty β_U values are back-computed from the recommended composite β_C and β_R values.The β values for Table 1 apply to fragilities tied to ground motion parameters (e.g., PGA or Peak Spectral Acceleration at 5 Hz).The ratios of the 10% failure probability capacity $C_{10\%}$ to the $C_{1\%}$ capacity have been calculated and are shown in the last column of Table 1.The methodology for demonstrating the adequate seismic ruggedness for mitigation systems would follow the approach for anSMA wherein a defined capacity is shown to exceed the defined demand.In the case of anSMA the demand for the assessment is referred to as the RLE.The following steps would be undertaken for SSCs within the mitigation systems that undertake the $C_{10\%}$ review:

- The GMRS will be the RLE for the beyond design-basis seismic review of the mitigation strategies
- The seismic capacity aligned with reasonable assurance will be the $C_{10\%}$ value.The $C_{10\%}$ can be calculated by:
    - Calculate the $C_{1\%}$ capacity using the methods documented in past SPRA and seismic margin documentation and as summarized in the SPID defined in EPRI 1025287 [6].
    - Multiply the $C_{1\%}$ capacity by the $C_{10\%}/C_{1\%}$ ratio from Table 1 based on the type of SSC being evaluated
- Verify that the $C_{10\%}$ capacity exceeds the RLE demand

Table 1: Recommended β_C, β_R, β_U, and $C_{50\%}/C_{1\%}$ Values to Use in Hybrid Method for Various Types of SSCs

Type SSC	Composite β_C	Random β_R	Uncertainty β_U	$C_{50\%}/C_{1\%}$	$C_{10\%}/C_{1\%}$
Structures & Major Passive Mechanical Components Mounted on Ground or at Low Elevation Within Structures	0.35	0.24	0.26	2.26	1.44
Active Components Mounted at High Elevation in Structures	0.45	0.24	0.38	2.85	1.60
Other SSCs	0.40	0.24	0.32	2.54	1.52

H.6 DOCUMENTATION

Document the characterization of the MSSHI for the site.

Document whether the MSSHI is bounded or not bounded by the SSE and describe the nature of any element not bounded.

Document the results of the process in Section H.4 and the basis for selecting the mitigation strategy.

6.1 FLEX: Document the evaluation that demonstrates existing FLEX are acceptable without modification for the MSSHI (Path 1).

- Description of the GMRS to SSE comparison

6.2 Modified FLEX: Document the evaluation that demonstrates that modifications enable FLEX for a single success path to be implemented based on the impacts of the MSSHI (Paths 2 and 4).The following items should be included:

- Discussion of the GMRS to SSE comparison
- Identification of the impacts to the FLEX
- A revised sequence of events demonstrating the necessity of revised FLEX actions
- Description and justification of the modifications (equipment, procedures, etc.) to address the revised FLEX actions
- Description of approach to address additional considerations for Path 4 (e.g. high frequency, spent fuel cooling)
- Validation documents in accordance with Appendix E

6.3 AMS: Document the evaluation that concludes that the selected strategy will mitigate the MSSHI.The following items should be included:

Path 3

- Description of GMRS to IHS and SSE comparison
- Description of plant-specific IPEEE and adequacy from 3/2014 submittal
- Description of the AMS and how it provides evaluation of redundant paths to plant safety
- Description of approach to address items outside scope of IPEEE (e.g. spent fuel cooling)
- Description of any limitations and how they are accommodated
- Description of evaluation of IPEEE to full scope
- Description of availability of FLEX equipment
- Validation documents in accordance with Appendix E

Path 5

- Description of GMRS to SSE comparison
- Description of the AMS
- Description of the screening process in Figure 4
- Description of approach to address items outside scope of the SPRA (e.g. spent fuel cooling)
- Description of any limitations and how they are accommodated
- Description of the success paths and sequence of events for the seismic hazard(s) (documented in MSA, not program document)
- Discussion of equipment necessary for the mitigation strategies (documented in MSA, not program document)
- Validation documents in accordance with Appendix E

The documentation identified above should be included in and be of the same level of detail as that included in the Program Document.

H.7 REFERENCES

1. U.S. NRC (Leeds, E &Johnson, M.), "*Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident*", Letter to All Power Reactor Licensees et al., Washington D.C.,March 12, 2012.
2. U.S. NRC, "*Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*", Order No. EA-12-049, ADAMS Number ML12054A735, Washington, D.C., March 12, 2012.
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Task Force Review of Insights from the Fukushima Dai-Ichi Accident", ADAMS Number ML12053A340, Washington, D.C., March 12, 2012.

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5. ASCE, "*ASCE/SEI 7-10: Minimum Design Loads for Buildings and Other Structures"*, Reston, VA, March 13, 2013.
6. EPRI, "*Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic*", Report Number 1025287, Palo Alto, CA, November, 2012.
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11. U.S. NRC, "*GL 88-20, Supplement 5:IPEEE for Severe Accident Vulnerabilities*",Washington, D.C., September 8, 1995.
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13. U.S. NRC, "*NUREG-1488: Revised Livermore Seismic Hazard Estimates for 69 Sites East of the Rocky Mountains*", Information Notice 94-32, Washington, D.C., April 29, 1994.
14. EPRI, "*EPRI NP-6395-D: Probabilistic Seismic Hazard Evaluations at Nuclear Plant Sites in the Central and Easter US: Resolution of the Charleston Earthquake Issue*", Palo Alto, CA, April, 1989.
15. EPRI, "*EPRI NP-6051-SL Revision 1: A Methodology for Assessment of Nuclear Plant Seismic Margin, Revision 1"*, Palo Alto, CA, August, 1991.
16. NEI, "*NEI 12-01 Revision 0: Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities*", Washington, D.C., May, 2012.
17. EPRI, "*Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic*", Draft Report Number 3002000704, Palo Alto, CA, April, 2013.

18. U.S. NRC, "*51 FR 30028: 10 CFR Part 50: Safety Goals for the Operations of Nuclear Power Plants; Policy Statement; Republication*", Washington, D.C., August 21, 1886.
19. U.S. NRC & Los Alamos National Laboratory (Shaffer, E. ; et al.), "*NUREG/CR-6874 & LA-UR-04-1227: GSI-191: Experimental Studies of Loss-of-Coolant-Accident-Generated Debris Accumulation and Head Loss with Emphasis on the Effects of Calcium Silicate Insulation*", Washington, D.C., May, 2005.
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H.8 ACRONYM / TERM LIST

AC	Alternating Current
ADS	Automatic Depressurization System
AFW	Auxiliary Feedwater
AMS	Alternate Mitigation Strategy
ASCE	American Society of Civil Engineers
ATC	Applied Technical Council
BWRs	Boiling Water Reactors
β	Logarithmic Standard Deviation in the Seismic Fragility
β_C	Composite Logarithmic Standard Deviation in the Seismic Fragility
β_R	Logarithmic Standard Deviation Representing the Aleatory (Randomness) Uncertainties in the Seismic Fragility

β_U	Logarithmic Standard Deviation Representing the Epistemic Uncertainties in the Seismic Fragility
$C_{X\%}$	The x^{th}-Percentile Conditional Probability of Unacceptable Performance
CP	Construction Permit
CDF	Core Damage Frequency
CRDMs	Control Rod Drive Mechanisms
DB	Design-Basis
DBE	Design-Basis Earthquake
DC	Direct Current
EDG	Emergency Diesel Generator
ELAP	Extended Loss of AC Power
EPRI	Electric Power Research Institute
ESEP	Expedited Seismic Evaluation Process
FLEX	Diverse and Flexible Coping Strategies
GL	Generic Letter
GMRS	Ground Motion Response Spectrum
HCLPF	High Confidence of Low Probability of Failure
HF	High Frequency
HVAC	Heating, Ventilating, and Air Conditioning
IHS	IPEEE HCLPF Spectra
IPEEE	Individual Plant Examination of External Events
ISRS	In-Structure Response Spectrum
LERF	Large Early Release Frequency
LLNL	Lawrence Livermore National Laboratory
LUHS	Loss of Normal Access to the Ultimate Heat Sink
MBDBE	Mitigation of Beyond Design-Basis Events
MCE	Maximum Credible Earthquake
MSA	Mitigation Strategies Assessment
MSSHI	Mitigation Strategies Seismic Hazard Information

NEA	Nuclear Energy Agency
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NTTF	Near-Term Task Force
OECD	Organization for the Economic Co-operation and Development
PGA	Peak Ground Acceleration
PORVs	Power-Operated Relief Valves (PORVs)
PSHA	Probabilistic Seismic Hazard Analysis
RCIC	Reactor Core Isolation Cooling
RCPs	Reactor Coolant Pumps
RCS	Reactor Coolant System
RLE	Review Level Earthquake
RLGM	Review Level Ground Motion
RPV	Reactor Pressure Vessel
SCDF	Seismically-Induced Core Damage Frequency
SEAOC	Structural Engineers Association of California
SERs	Staff Evaluation Reports
SFP	Spent Fuel Pool
SLERF	Seismically-Induced Large Early Release Frequency
SMA	Seismic Margin Assessment
SPRA	Seismic Probabilistic Risk Assessment
SPID	Screening, Prioritization and Implementation Details
SSCs	Structures, Systems and Components
SSE	Safe Shutdown Earthquake
SMA	Seismic Margin Analysis
SEL	Seismic Equipment List
UHRS	Uniform Hazard Response Spectra