



JAPAN LESSONS-LEARNED DIVISION

REVISION TO JLD-ISG-2012-01

**Compliance with Order EA-12-049,
Order Modifying Licenses with Regard to
Requirements for Mitigation Strategies for
Beyond-Design-Basis External Events**

Interim Staff Guidance

Revision 2

February 2017

Revision to JLD-ISG-2012-01, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, DATED February 8, 2017

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OFFICIAL AGENCY RECORD

**COMPLIANCE WITH ORDER EA-12-049,
ORDER MODIFYING LICENSES WITH REGARD TO REQUIREMENTS FOR
MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS
REVISION TO JLD-ISG-2012-01**

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) staff is providing this Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) to assist nuclear power reactor applicants and licensees with the identification of measures needed to comply with requirements to mitigate challenges to key safety functions. These requirements are contained in Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012 [Reference 1]; Virgil C. Summer Nuclear Station (V.C. Summer), Unit 2, License No. NPF-93, Condition 2.D.(13) [Reference 2]; V.C. Summer, Unit 3, License No. NPF-94, Condition 2.D.(13) [Reference 3]; Enrico Fermi Nuclear Plant, Unit 3, License No. NPF-95, Condition 2.D.(12)(g) [Reference 4]; South Texas Project, Unit 3, License No. NPF-97, Condition 2.D.(14)(g) [Reference 5]; South Texas Project, Unit 4, License No. NPF-98, Condition 2.D.(14)(g) [Reference 6]; Levy Nuclear Plant, Unit 1, License No. NPF-99, Condition 2.D.(12)(f) [Reference 7]; Levy Nuclear Plant, Unit 2, License No. NPF-100, Condition 2.D.(12)(f) [Reference 8]; William States Lee III Nuclear Station, Unit 1, License No. NPF-101, Condition 2.D.(12)(j) [Reference 9]; and William States Lee III Nuclear Station, Unit 2, License No. NPF-102, Condition 2.D.(12)(j) [Reference 10].

This ISG is applicable to holders of, and applicants for, operating licenses for nuclear power reactors issued under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and the holders of, and applicants for, combined licenses for nuclear power reactors issued under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." This ISG revision endorses, with exceptions, additions, and clarifications, the methodologies described in the industry guidance document, Nuclear Energy Institute (NEI) 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 4, issued December 2016 [Reference 11]. Previous revisions of this ISG have endorsed, with exceptions, additions, and clarifications, Revision 0 and Revision 2 of NEI 12-06, as described below. This revised ISG provides one acceptable approach for satisfying those requirements. Holders of operating licenses or combined licenses for nuclear power reactors issued under 10 CFR Part 50 or 10 CFR Part 52 may use other methods for satisfying these requirements. The NRC staff will review such methods and determine their acceptability on a case-by-case basis.

BACKGROUND

Following the March 11, 2011, accident at the Fukushima Dai-ichi nuclear power plant, the NRC established a senior-level agency task force referred to as the Near-Term Task Force (NTTF). The NTTF conducted a systematic and methodical review of the NRC regulations and processes to determine whether the agency should make additional improvements in NRC regulations or processes in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a comprehensive set of recommendations, documented in the enclosure to SECY-11-0093, "Recommendations for Enhancing Reactor Safety in the 21st Century, The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated July 12, 2011 [Reference 12]. These recommendations were enhanced by the NRC staff

following interactions with stakeholders. Documentation of the staff's efforts is contained in SECY-11-0124, "Recommended Actions To Be Taken without Delay from the Near-Term Task Force Report," dated September 9, 2011 [Reference 13], and SECY-11-0137, "Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011 [Reference 14].

As directed by the Commission's staff requirements memorandum (SRM) for SECY-11-0093, dated August 19, 2011 [Reference 15], the NRC staff reviewed the NTTF recommendations within the context of the NRC's existing regulatory framework and considered the various regulatory vehicles available to the NRC to implement the recommendations. In SECY-11-0124 and SECY-11-0137, the staff established prioritization of the recommendations.

After receiving the Commission's direction in SRM-SECY-11-0124, dated October 18, 2011 [Reference 16], and SRM-SECY-11-0137, dated December 15, 2011 [Reference 17], the NRC staff conducted public meetings to discuss enhanced mitigation strategies intended to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities following beyond-design-basis external events. At these meetings, the industry described its proposal for a Diverse and Flexible Mitigation Capability (FLEX), as documented in a letter from NEI dated December 16, 2011 [Reference 18]. FLEX is proposed as a strategy to fulfill the key safety functions of core cooling, containment integrity, and spent fuel cooling. Stakeholder input led the NRC to pursue a performance-based approach to improve the safety of operating power reactors different than that envisioned in NTTF Recommendation 4.2, SECY-11-0124, and SECY-11-0137.

On February 17, 2012, the NRC staff provided SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami" [Reference 19], to the Commission, including a proposed order to implement enhanced mitigation strategies for beyond-design-basis external events. As directed by SRM-SECY-12-0025, dated March 9, 2012 [Reference 20], the NRC staff issued Order EA-12-049 and, in parallel, issued a request for information under 10 CFR 50.54(f) (hereafter referred to as the 50.54(f) letter [Reference 21]) for a reevaluation of licensees' flooding and seismic hazards. On March 30, 2012, the Commission issued Memorandum and Order CLI-12-09 [Reference 22], which includes the requirements for mitigation strategies as a license condition for V.C. Summer, Units 2 and 3.

Guidance and strategies required by the order would be available if a loss of power, motive force, and normal access to the ultimate heat sink to prevent fuel damage in the reactor and SFP affected all units at a site simultaneously. The order requires a three-phase approach for mitigating beyond-design-basis external events. The initial phase requires using installed equipment and resources to maintain or restore key safety functions, including core cooling, containment, and SFP cooling. The transition phase requires providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely.

On May 4, 2012, NEI submitted NEI 12-06, Revision B [Reference 23], to provide specifications for an industry-proposed methodology for the development, implementation, and maintenance of guidance and strategies in response to Order EA-12-049. On May 13, 2012, NEI submitted NEI 12-06, Revision B1 [Reference 24]. The strategies and guidance described in NEI 12-06 expand on those that industry developed and implemented to address the limited set of

beyond-design-basis external events that involve the loss of a large area of the plant due to explosions and fire required pursuant to 10 CFR 50.54(hh)(2).

On May 31, 2012, the NRC staff issued a draft version of this ISG [Reference 25] and published a notice of its availability for public comment in the *Federal Register* (77 FR 33779; June 7, 2012), with the comment period running through July 7, 2012 (30 days after its publication). The staff received seven comments during this time and addressed the comments as documented in “NRC Responses to Public Comments, Japan Lessons-Learned Project Directorate Interim Staff Guidance JLD-ISG-2012-01: Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” dated August 29, 2012 [Reference 26].

On July 3, 2012, NEI submitted Revision C to NEI 12-06 [Reference 27], incorporating many of the exceptions and clarifications included in the draft version of this ISG. On August 3, 2012, NEI submitted Draft Revision 0 to NEI 12-06 [Reference 28], incorporating many of the remaining exceptions and clarifications. On August 21, 2012, NEI submitted Revision 0 to NEI 12-06 [Reference 29], making various editorial corrections. The NRC reviewed Revision 0 to NEI 12-06 and endorsed it as an approach the NRC considers acceptable for meeting the regulatory requirements, with noted clarifications in Revision 0 of this ISG, dated August 29, 2012 [Reference 30].

By February 2013, licensees of operating power reactors submitted their overall integrated plans (OIPs) under Order EA-12-049 describing the guidance and strategies to be developed and implemented. Because development and implementation of these mitigating strategies were to be accomplished in parallel with the reevaluation of the seismic and flooding hazards under the 50.54(f) letter issued subsequent to SECY-12-0025, the OIP submittals included in their key assumptions a statement that typically read, “[f]lood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012, are not completed and therefore not assumed in this submittal. As the reevaluations are completed, appropriate issues will be entered into the corrective action system and addressed on a schedule commensurate with other licensing bases changes” (see, for example, Vermont Yankee Nuclear Power Station’s OIP [Reference 31]).

To clarify the relationship between Order EA-12-049 and the hazard reevaluations, the NRC staff provided COMSECY-14-0037, “Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation [sic] of Flooding Hazards” [Reference 32], to the Commission on November 21, 2014, requesting that the Commission affirm that “[l]icensees for operating nuclear power plants need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events (Order EA-12-049 and related [mitigation of beyond-design-basis events] MBDBE rulemaking).” In COMSECY-14-0037, the NRC staff further requested affirmation that “[l]icensees for operating nuclear power plants may need to address some specific flooding scenarios that could significantly damage the power plant site by developing targeted or scenario-specific mitigating strategies, possibly including unconventional measures, to prevent fuel damage in reactor cores or spent fuel pools.” In SRM-COMSECY-14-0037, dated March 30, 2015 [Reference 33], the Commission affirmed these two items and noted that “it is within the staff’s authority, and is the staff’s responsibility, to determine, on a plant-specific basis, whether targeted or scenario-specific mitigating strategies, possibly including unconventional measures, are acceptable.”

On August 25, 2015, NEI submitted Revision 1 to NEI 12-06 [Reference 34]. The purpose of this revision was to incorporate lessons learned in the implementation of Order EA-12-049, document alternative approaches taken by licensees for compliance with that order, and add guidance for mitigating strategies assessments (MSAs) regarding reevaluated hazard information. The MSAs are assessments of the mitigating strategies developed in response to Order EA-12-049 considering the reevaluated flooding and seismic hazard information provided in response to the 50.54(f) letter. The mitigating strategies that licensees developed in response to Order EA-12-049 were initially designed to be effective with respect to the plants' design-basis external hazards. The purpose of the MSAs is to determine whether a plant's mitigating strategies will still be effective when considering external hazards up to the reevaluated levels, or if changes are needed to account for these reevaluated hazards. The guidance includes several paths for seismic and flooding MSAs, depending on the severity of the change in the external hazard. After a public webinar on September 21, 2015, to discuss potential exceptions and clarifications, on October 6, 2015, NEI submitted Revision 1A to NEI 12-06 [Reference 35] to the NRC for endorsement.

On October 30, 2015, the NRC staff issued Draft Revision 1 to this ISG [Reference 36] and published a notice of its availability for public comment in the *Federal Register* (80 FR 69702; November 10, 2015), with the comment period running through December 10, 2015 (30 days from its publication). The staff received four comments during this time, which it addressed as documented in "NRC Responses to Public Comments, Revision to Japan Lessons-Learned Division Interim Staff Guidance JLD-ISG-2012-01: Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated January 22, 2016 [Reference 37].

On December 10, 2015, NEI submitted Revision 2 to NEI 12-06 [Reference 38], incorporating many of the clarifications and additions included in the draft version of Revision 1 to this ISG. While NEI 12-06, Revision 2, includes guidance for licensees to use when conducting MSAs for reevaluated flooding information and reevaluated seismic hazard information up to twice the plant's safe-shutdown earthquake, Section H.4.5 of NEI 12-06, Revision 2, notes that detailed guidance for MSAs for licensees having reevaluated seismic hazards more than twice their safe-shutdown earthquake is under development and is expected to be available to support MSAs for those licensees. The NRC staff reviewed Revision 2 to NEI 12-06 and endorsed it as a process the NRC considers acceptable for meeting the regulatory requirements, with noted clarifications and additions, in Revision 1 of this ISG, dated January 22, 2016 [Reference 39].

On September 22, 2016, NEI submitted Revision 3 to NEI 12-06 [Reference 40] to provide additional guidance in Section H.4.5 for the performance of MSAs for plants with reevaluated seismic hazard information that includes a ground motion response spectrum that has spectral ordinates greater than twice the plant's safe-shutdown earthquake anywhere in the frequency range of 1 to 10 hertz. Revision 3 to NEI 12-06 also addresses certain lessons learned in the implementation of Order EA-12-049. These lessons learned relate to the timing of out-of-service periods for equipment supporting the required strategies, the location of guidance for the performance of drills, and documentation and configuration control. In addition, Revision 3 incorporates the guidance from JLD-ISG-2012-01, Revision 1, on the SFP spray strategy.

On November 10, 2016, the NRC staff issued Draft Revision 2 to this ISG [Reference 41] and published a notice of its availability for public comment in the *Federal Register* (81 FR 79056; November 10, 2016), with the comment period running through December 12, 2016 (30 days from its publication). The staff received six timely comments during this time and one late-filed

comment, which it addressed as documented in “NRC Responses to Public Comments, Revision 2 to JLD-ISG-2012-01, ‘Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,’” dated January 8, 2017 [Reference 42].

On December 12, 2016, NEI submitted Revision 4 to NEI 12-06 [Reference 11] to clarify the provisions on the availability and functionality of equipment relied upon for the mitigating strategies, while retaining the changes that had been proposed in Revision 3 to NEI 12-06.

RATIONALE

1. Order EA-12-049 requires that licensees shall develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities following a beyond-design-basis external event. The three-phase approach described in the order is a conceptual framework built upon the need for a licensee to address challenges to the safety functions when they occur, using installed structures, systems, and components for a coping period until portable mitigating equipment can be used to address those challenges. The finite level of resources on site makes the arrangement of offsite resources necessary to address potential widespread catastrophes, such as the occurrence at Fukushima, where the restoration of offsite power is precluded by damage. Licensees’ emergency operating procedures will provide the command and control structure in response to beyond-design-basis external events. Additional guidance documents will be developed for deployment of the FLEX strategies in support of the emergency operating procedures.
2. The NRC has previously provided regulatory guidance for the development, implementation, and maintenance of guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities under the circumstances associated with the loss of large areas of the plant due to explosions or fire. This was done through the endorsement of NEI 06-12, “B.5.b Phase 2 & 3 Submittal Guideline,” Revision 2, issued December 2006 [Reference 43], for holders of and applicants for operating licenses issued under 10 CFR Part 50, and Revision 3 of NEI 06-12, issued July 2009 [Reference 44], for holders of and applicants for combined licenses under 10 CFR Part 52. This regulatory guidance continues to provide an acceptable means of meeting the requirement to develop, implement, and maintain the necessary guidance and strategies for the subset of beyond-design-basis external events addressed by 10 CFR 50.54(hh)(2).
3. The approach described in NEI 12-06, Revision 4, for development, implementation, and maintenance of mitigating strategies for beyond-design-basis external events provides a framework and methodology for such strategies to address those events that are not covered within the requirements of 10 CFR 50.54(hh)(2), subject to the exceptions, additions, and clarifications in the enclosure to this ISG.
4. The approach described in NEI 12-06, Revision 4, and its Section H.4.5 for the performance of assessments of the mitigating strategies under the reevaluated seismic and flooding hazards developed in response to the March 12, 2012, 50.54(f) letter provides an appropriate methodology for licensees to address the reevaluated seismic and flooding hazards in a manner that aligns with the proposed mitigation of beyond-design-basis events rulemaking.

APPLICABILITY

This ISG shall remain in effect until it has been superseded, withdrawn, or incorporated into a regulatory guide or the Standard Review Plan (SRP).

GUIDANCE

As discussed above, this ISG is applicable to holders of power reactor operating licenses, construction permits, or combined licenses.

The NRC staff considers that the development, implementation, and maintenance of strategies and guidance in conformance with the guidelines provided in NEI 12-06, Revision 4, are an acceptable means of meeting the requirements of Order EA-12-049, subject to the exceptions, additions, and clarifications in the enclosure to this ISG. However, NRC endorsement of NEI 12-06, Revision 4, does not imply NRC endorsement of references listed in NEI 12-06, Revision 4.

IMPLEMENTATION

Except in those cases in which a licensee or construction permit (CP) holder proposes an acceptable alternative method for complying with Order EA-12-049, the NRC staff will use the methods described in this ISG to evaluate licensee and CP holder compliance as presented in submittals required in Order EA-12-049. The methods described in Revision 0 and Revision 1 of JLD-ISG-2012-01, combined with plant-specific alternatives that have been previously approved by the NRC staff, remain acceptable for establishing compliance with Order EA-12-049.

BACKFITTING DISCUSSION

Licensees and CP holders may use the guidance in this document to demonstrate compliance with Order EA-12-049. Accordingly, the NRC staff's issuance of this ISG is not considered backfitting, as defined in 10 CFR 50.109(a)(1), nor is it deemed to be in conflict with any of the issue finality provisions in 10 CFR Part 52.

FINAL RESOLUTION

The contents of this ISG may subsequently be incorporated into the SRP or other guidance documents, as appropriate.

ENCLOSURE

1. Guidance for Developing, Implementing, and Maintaining Mitigation Strategies

REFERENCES

1. U.S. Nuclear Regulatory Commission (NRC), Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A736 (package)).
2. NRC, "Combined License, Virgil C. Summer Nuclear Station, Unit 2," License No. NPF-93, April 10, 2014 (ADAMS Accession No. ML14100A092).
3. NRC, "Combined License, Virgil C. Summer Nuclear Station Unit 3," License No. NPF-94, April 10, 2014 (ADAMS Accession No. ML14100A101).
4. NRC, "Combined License, Enrico Fermi Nuclear Plant Unit 3," License No. NPF-95, May 1, 2015 (ADAMS Accession No. ML15084A170).
5. NRC, "Combined License, South Texas Project Unit 3," License No. NPF-97, February 12, 2016 (ADAMS Accession No. ML16033A020).
6. NRC, "Combined License, South Texas Project Unit 4," License No. NPF-98, February 12, 2016 (ADAMS Accession No. ML16033A047).
7. NRC, "Combined License, Levy Nuclear Plant Unit 1," License No. NPF-99, October 26, 2016 (ADAMS Accession No. ML12265A034).
8. NRC, "Combined License, Levy Nuclear Plant Unit 2," License No. NPF-100, October 26, 2016 (ADAMS Accession No. ML12265A045).
9. NRC, "Combined License, William States Lee III Nuclear Station Unit 1," License No. NPF-101, December 19, 2016 (ADAMS Accession No. ML16302A104).
10. NRC, "Combined License, William States Lee III Nuclear Station Unit 2," License No. NPF-102, December 20, 2016 (ADAMS Accession No. ML16302A105).
11. Nuclear Energy Institute (NEI), NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 4, December 2016 (ADAMS Accession No. ML16354B421).
12. NRC, SECY-11-0093 Enclosure, "Recommendations for Enhancing Reactor Safety in the 21st Century, the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," July 12, 2011 (ADAMS Accession No. ML11186A950 (package)).
13. NRC, SECY-11-0124, "Recommended Actions To Be Taken without Delay from the Near-Term Task Force Report," September 9, 2011 (ADAMS Accession No. ML11245A158 (package)).
14. NRC, SECY-11-0137, "Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned," October 3, 2011 (ADAMS Accession No. ML11272A111 (package)).

15. NRC, SRM-SECY-11-0093, "Staff Requirements—SECY-11-0093—Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," August 19, 2011 (ADAMS Accession No. ML112310021).
16. NRC, SRM-SECY-11-0124, "Staff Requirements—SECY-11-0124—Recommended Actions To Be Taken without Delay from the Near-Term Task Force Report," October 18, 2011 (ADAMS Accession No. ML112911571).
17. NRC, SRM-SECY-11-0137, "Staff Requirements—SECY-11-0137—Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned," December 15, 2011 (ADAMS Accession No. ML113490055).
18. NEI (Adrian Heymer), Letter to NRC (David L. Skeen), "An Integrated, Safety-Focused Approach to Expediting Implementation of Fukushima Dai-ichi Lessons Learned," December 16, 2011 (ADAMS Accession No. ML11353A008).
19. NRC, SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," February 17, 2012 (ADAMS Accession No. ML12039A103 (package)).
20. NRC, SRM-SECY-12-0025, "Staff Requirements—SECY-12-0025—Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," March 9, 2012 (ADAMS Accession No. ML120690347).
21. NRC, "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," March 12, 2012, (ADAMS Accession No. ML12053A340).
22. NRC, Commission Memorandum and Order, CLI-12-09, dated March 30, 2012 (ADAMS Accession No. ML12090A531)
23. NEI, NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision B, May 4, 2012 (ADAMS Accession No. ML12144A419).
24. NEI, NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision B1, May 13, 2012 (ADAMS Accession No. ML12143A232).
25. NRC, Draft Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," May 31, 2012 (ADAMS Accession No. ML12146A014).
26. NRC, "NRC Responses to Public Comments, Japan Lessons-Learned Project Directorate Interim Staff Guidance JLD-ISG-2012-01: Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Docket ID NRC-2012-0068, August 29, 2012 (ADAMS Accession No. ML12229A253).

27. NEI, NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision C, July 3, 2012 (ADAMS Accession No. ML121910390).
28. NEI, NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Draft Revision 0, August 3, 2012 (ADAMS Accession No. ML12221A205).
29. NEI, NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, August 21, 2012 (ADAMS Accession No. ML12242A378).
30. NRC, JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Revision 0, August 29, 2012 (ADAMS Accession No. ML12229A174).
31. Entergy Nuclear Operations (Christopher J. Wamser), Letter to NRC, "Vermont Yankee Overall Integrated Plan in Response to March 12, 2012 Commission Order To Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," February 28, 2013 (ADAMS Accession No. ML13064A300).
32. NRC, COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation [sic] of Flooding Hazards," November 21, 2014 (ADAMS Accession No. ML14238A616).
33. NRC, SRM-COMSECY-14-0037, "Staff Requirements—COMSECY-14-0037— Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards," March 30, 2015, (ADAMS Accession No. ML15089A236).
34. NEI, NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 1, October 2015 (ADAMS Accession No. ML15244B006).
35. NEI, NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 1A, October 2015 (ADAMS Accession No. ML15279A426).
36. NRC, Revision to JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Draft Revision 1, October 30, 2015 (ADAMS Accession No. ML15294A078).
37. NRC, "NRC Responses to Public Comments, Revision to Japan Lessons-Learned Division Interim Staff Guidance JLD-ISG-2012-01: Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Docket ID NRC-2012-0068, January 22, 2016 (ADAMS Accession No. ML15357A147).
38. NEI, NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 2, December 2015 (ADAMS Accession No. ML16005A625).
39. NRC, Revision to JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for

- Beyond-Design-Basis External Events,” Revision 1, January 22, 2016 (ADAMS Accession No. ML15357A163)
40. NEI, NEI 12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” Revision 3, September 2016 (ADAMS Accession No. ML16267A274).
 41. NRC, Revision to JLD-ISG-2012-01, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” Draft Revision 2, November 4, 2016 (ADAMS Accession No. ML16277A617).
 42. NRC, “NRC Responses to Public Comments, Revision 2 to JLD-ISG-2012-01, ‘Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,’” Docket ID NRC-2012-0068, January 8, 2017 (ADAMS Accession No. ML17005A187).
 43. NEI, NEI 06-12, “B.5.b Phase 2 & 3 Submittal Guideline,” Revision 2, December 2006 (ADAMS Accession No. ML070090060).
 44. NEI, NEI 06-12, “B.5.b Phase 2 & 3 Submittal Guideline,” Revision 3, July 2009 (ADAMS Accession No. ML092120160) (Nonpublic, for Official Use Only—Security Related Information).

GUIDANCE FOR DEVELOPING, IMPLEMENTING, AND MAINTAINING MITIGATION STRATEGIES

1. Development and Implementation Process

U.S. Nuclear Regulatory Commission (NRC) Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012 [Reference 1], requires that applicants or licensees develop and implement guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities following a beyond-design-basis external event (BDBEE). The guidance and strategies developed and implemented under Order EA-12-049 must be implementable sitewide and must include obtaining sufficient offsite resources to sustain the functions of core cooling, containment, and SFP cooling indefinitely.

1.1. Establishment of Baseline Coping Capability

Section 1.3 of Nuclear Energy Institute (NEI) 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 4, issued December 2016 [Reference 2], provides the objectives and guiding principles of the FLEX program that are responsive to Order EA-12-049 and provide that plant-specific analyses will determine the duration of each phase of the three-phase approach required by Order EA-12-049, as described below in Section 1.1.1.

Section 2 of NEI 12-06, Revision 4, provides a high-level discussion of the site-specific nature of the actions required by each licensee to properly implement the performance-based requirements in Order EA-12-049. Sections 2.1 through 2.5 of NEI 12-06, Revision 4, discuss the coping capacities, types of external hazards, strategies, and controls each licensee should implement to meet the requirements of the order.

Section 3 of NEI 12-06, Revision 4, provides performance attributes, general criteria, and baseline assumptions for use in the development and implementation of the strategies and guidelines under Order EA-12-049. NEI 12-06, Revision 4, further provides that licensees should use these criteria and assumptions for analyses used to establish a baseline coping capability. The assumptions include the initial conditions listed in Section 3.2.1.3 of NEI 12-06, Revision 4, that include a loss of offsite power (LOOP) affecting all units at a plant site and the specification that "[a]ll design-basis installed sources of emergency on-site ac [alternating current] power and SBO [station blackout] alternate ac power sources [as defined in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.2, "Definitions"] are assumed to be not available and not imminently recoverable."

Section 3.2.1.7 of NEI 12-06, Revision 4, specifies that "[s]trategies that have a time constraint to be successful should be identified and a basis provided that the time can reasonably be met." Section 11.4.3 of NEI 12-06, Revision 4, specifies that FLEX support guidelines (FSGs) will be developed to provide guidance that can be employed

for a variety of conditions, and that the FSGs will be reviewed and validated to ensure they are feasible. Appendix E to NEI 12-06, Revision 4, provides a method for validating the FSGs.

Section 3.2.1.13 of NEI 12-06, Revision 4, specifies that best estimate analyses are appropriate for the purpose of establishing the baseline coping capabilities.

Staff Position: Sections 1, 2, and 3 and Appendix E to NEI 12-06, Revision 4, provide an acceptable method for licensees to follow to develop a baseline coping capability for mitigating an extended loss of ac power (ELAP) concurrent with either a loss of normal access to the ultimate heat sink (LUHS) or, for a nuclear power plant with a passive reactor design, a loss of normal access to the normal heat sink, with the following clarifications and addition:

1. An element of a set of strategies to maintain or restore core and SFP cooling and containment functions includes knowledge of the time a licensee or applicant can withstand challenges to these key safety functions using installed equipment during a BDBEE. This knowledge provides an input to the choice of storage locations and conditions of readiness of the equipment required for the follow-on phase. This duration is related to, but distinct from, the specified duration for the requirements of 10 CFR 50.63(a) related to the loss of all ac power because it represents the current capabilities of the licensee or applicant rather than a required capability. Licensees and applicants should (1) account for the SFP cooling function, which is not addressed by 10 CFR 50.63(a), and (2) assume the nonavailability of alternate ac sources, which may be included in meeting the specified durations of 10 CFR 50.63(a). This is implicit in the principles described in Section 3.2.1.7, paragraph (6), and Section 3.2.2, paragraph (1), of NEI 12-06, Revision 4.
2. The use of best estimate analyses for establishing the baseline coping capabilities is appropriate in the context of the BDBEEs for Order EA-12-049. This includes the use of normal fluid levels for tanks that are maintained by procedure or administrative controls rather than the minimum levels allowed by technical specifications.
3. Consistent with the goal of mitigation strategies for BDBEE, the NRC endorses the validation method documented in Appendix E to NEI 12-06, Revision 4, as a method to (1) assess whether it is “feasible” (as the term is used in risk-informed decisionmaking), considering design-basis or reevaluated hazard conditions determined under the 10 CFR 50.54(f) request for information letter issued on March 12, 2012 [Reference 3] (as applicable), to execute tasks, manual actions, and decisions (i.e., human actions) required by the mitigation strategies described in NEI 12-06, Revision 4, and (2) support a conclusion that the strategies mitigate, to the extent practical, the adverse effects of BDBEEs on the ability of personnel to perform the required human actions. However, Appendix E to NEI 12-06, Revision 4, does not propose a method to assess whether required human actions are “reliable” (as the term is used in risk-informed decisionmaking), nor does the NRC endorse it as such.
 - a. Tasks, manual actions, or decisions performed more than 24 hours after the initiation of the event that have time constraints may be validated

using a Level A or Level B method that results in an estimate of the time required to complete the task or manual action or to make and communicate the decision in order to confirm that the time constraint can reasonably be met as specified in Section 3.2.1.7, principle 6, of NEI 12-06, Revision 4. Section 3.2.1.7, principle 6, states that “[s]trategies that have a time constraint to be successful should be identified and a basis provided that the time can reasonably be met.”

1.1.1. Phased Approach

Order EA-12-049 requires a three-phase approach for mitigating BDBEEs. The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment, and SFP cooling capabilities. The transition phase requires providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely. The NRC recognizes that for certain BDBEEs, the damage state could prevent maintenance of key safety functions using the equipment intended for particular phases. Under such circumstances, prompt initiation of the follow-on phases to restore core and SFP cooling and containment functions is appropriate.

Staff Position: NEI 12-06, Revision 4, provides an acceptable method for developing an approach to mitigate and cope with BDBEEs.

1.1.1.1. Initial Response Phase

The initial response phase will be accomplished using installed equipment. Licensees and applicants should establish and maintain current estimates of their capabilities to maintain core and SFP cooling and containment functions assuming a loss of all ac electric power to the essential and nonessential switchgear buses, except for those fed by station batteries through inverters. These estimates provide the time period in which the licensee should be able to initiate the transition phase and maintain or restore the key safety functions using portable onsite equipment. These estimates should be considered in selecting the storage locations for that equipment and the prioritization of resources to initiate their use.

Staff Position: Section 3.0 of NEI 12-06, Revision 4, provides an acceptable method for determining the baseline coping capabilities for the initial response phase.

1.1.1.2. Transition Phase

The transition phase will be accomplished by supplementing installed equipment with portable equipment stored on site. The strategies for this phase must be capable of maintaining core cooling, containment, and SFP cooling capabilities (after their restoration, if applicable) from the time they are implemented until they can be supplemented by offsite resources in the final phase. The duration of the transition phase should provide sufficient overlap with both the initial and final phases to account for the time it takes to install equipment and for uncertainties.

Staff Position: Section 3.0 of NEI 12-06, Revision 4, provides an acceptable method for determining the baseline coping capabilities for the transition phase.

1.1.1.3. Final Phase

The final phase will be accomplished using the portable equipment stored on site, augmented with additional equipment and consumables obtained from off site, to sustain the functions of core cooling, containment, and SFP cooling indefinitely.

Staff Position: Section 3.0 of NEI 12-06, Revision 4, provides an acceptable method for determining the baseline coping capabilities for the final phase. Section 12.2 of NEI 12-06, Revision 4, provides an acceptable method for establishing the capability to obtain offsite equipment and consumables until power, water, and coolant injection systems are restored or commissioned. This provides an acceptable method to sustain the listed functions indefinitely when coupled with the restoration or commissioning of power, water, and coolant injection systems.

1.2. Contingencies for Loss of All Alternating Current Power

Section 1.3 of NEI 12-06, Revision 4, defines an ELAP as a “loss of off-site power, emergency diesel generators and any alternate ac source but not the loss of ac power from buses fed by station batteries through inverters.” (Footnote omitted.) Section 1.1 of this interim staff guidance discusses an acceptable approach to mitigating the effects of an ELAP. Item (2) in Attachments 2 and 3 of Order EA-12-049 requires that the strategies developed and implemented in response to the order “be capable of mitigating a...loss of all ac power...” rather than an ELAP. The difference between the conditions described in NEI 12-06 (ELAP) and Attachments 2 and 3 of Order EA-12-049 (loss of all ac power) is addressed through the development of contingencies. Specifically, the damage state of a loss of all ac power condition concurrent with LUHS in Order EA-12-049 was implemented first through the assumption of an ELAP to the onsite emergency ac buses, while allowing ac power from the inverters to be assumed available, in order to establish event sequence and the associated times for when mitigation actions would be assumed to be required. Secondly, to address the Order EA-12-049 requirement for a loss of all ac power, including ac power from the batteries (through inverters), the mitigation strategies include contingencies to enable actions to be taken under those circumstances (e.g., sending operators to immediately take manual control over a non-ac-powered core cooling pump). These contingencies, which are discussed below, could be implemented if ac power fed by station batteries through inverters is not available.

Section 3.2.2 of NEI 12-06, Revision 4, provides 17 guidelines for use in developing the guidance and strategies under Order EA-12-049. Guideline (2) of this section states the following:

Plant procedures/guidance should recognize the importance of AFW/HPCI/RCIC/IC during the early stages of the event and direct the operators to invest appropriate attention to assuring its initiation and continued, reliable operation throughout the transient since this ensures decay heat removal.

The risk of core damage due to ELAP can be significantly reduced by assuring the availability of auxiliary feedwater (AFW) (emergency feedwater (EFW) at some plants), high pressure core injection (HPCI), reactor core isolation cooling (RCIC), or isolation condensers (IC),

particularly in the first 30 minutes to one hour of the event. Assuring that one of these systems has been initiated to provide early core heat removal, even if local initiation and control is required is an important initial action. A substantial portion of the decay and sensible reactor heat can be removed during this period. The availability of AFW/HPCI/RCIC/IC can be improved by providing a reliable supply of water, monitoring turbine conditions (particularly lubricating oil flow and temperature), bypassing automatic trips, and maintaining nuclear boiler/steam generator water levels. These actions help ensure that the core remains adequately covered and cooled during an ELAP event.

Appendices C and D to NEI 12-06, Revision 4, contain summaries of performance attributes for boiling-water and pressurized-water reactors, respectively, and address Guideline (2) of Section 3.2.2 of NEI 12-06, Revision 4, by specifying that procedures/guidance will include local manual initiation of AFW/EFW/HPCI/RCIC/IC.

Section 5.3.3 of NEI 12-06, Revision 4, describes interface considerations for seismic events and expands on this contingency to specify that the strategies and guidelines should include the following:

...a reference source for the plant operators that provides approaches to obtaining necessary instrument readings to support the implementation of the coping strategy. Such a resource could be provided as an attachment to the plant procedures/guidance. Guidance should include critical actions to perform until alternate indications can be connected and on how to control critical equipment without associated control power.

This reference source should include control room and non-control room readouts and should also provide guidance on how and where to measure key instrument readings using a portable instrument (e.g., a Fluke meter) at a location that does not rely on the functioning of intervening electrical equipment (e.g. I/E convertors, analog to digital converters, relays, etc.) that could be adversely affected by BDB [beyond-design-basis] seismic events. An instrument reading should be obtained at the closest accessible termination point to the containment penetration or parameter of measurement, as practical.

Staff Position: Guideline (2) of Section 3.2.2 of NEI 12-06, Revision 4, and the provisions in Appendices C and D to NEI 12-06, Revision 4, for manual initiation of AFW/EFW/HPCI/RCIC/IC, coupled with the provisions in Section 5.3.3 of NEI 12-06, Revision 4, for the development of guidance on obtaining instrument readings and controlling critical equipment without the associated power, provide an acceptable method for licensees to develop the contingencies for the loss of all ac power that are necessary to comply with the requirement in Order EA-12-049 to mitigate an extended loss of all ac power. The need for the contingencies in Section 5.3.3 of NEI 12-06, Revision 4, to show compliance with the condition of loss of all ac power is not limited to seismically induced events; instead, it is a necessary element of compliance for that requirement regardless of the initiating event. Because Section 5 of NEI 12-06, Revision 4, is applicable to all power reactor licensees, conformance to Section 5.3.3 of NEI 12-06, Revision 4, can provide the capabilities necessary to meet that element regardless of the initiating event.

2. Equipment Capacity

Order EA-12-049 requires that the equipment relied upon for the mitigation strategies must have sufficient capacity to simultaneously maintain or restore core cooling, containment, and SFP cooling capabilities for all the power reactor units on a site subject to the order.

Section 3.2.1.12 of NEI 12-06, Revision 4, provides that there should be a basis for plant equipment relied upon to support implementation of the mitigating strategies to perform its function.

Guideline (16) in Section 3.2.2 of NEI 12-06, Revision 4, provides guidance for the minimum number of sets of equipment a licensee should have in order to achieve reasonable assurance that the equipment will be available in sufficient quantity to have the capacity necessary to comply with the order. This includes guidance for the provision of spare hoses and cables in a quantity that is either (1) equivalent to 10 percent of the total length of each type of hose or cable necessary or (2) of sufficient length and sizing to replace the single longest run needed to support any single strategy.

Sections 11.1 and 11.2 of NEI 12-06, Revision 4, provide guidance on the quality attributes and equipment design a licensee may use to achieve reasonable assurance that the individual pieces of equipment have the capability to perform the functions they are intended for in the FLEX strategies.

Staff Position: Section 3.2.1.12, Guideline (16) of Section 3.2.2, and Sections 11.1 and 11.2 of NEI 12-06, Revision 4, provide an acceptable method to demonstrate compliance with Order EA-12-049.

3. Reasonable Protection

Order EA-12-049 requires licensees to provide reasonable protection for the equipment relied upon for the mitigation strategies required by the order from the external events.

Appendix A to NEI 12-06, Revision 4, defines reasonable protection as “[s]toring on-site FLEX equipment in configurations such that no one external event can reasonably fail the site FLEX capability (N) when the required FLEX equipment is available.”

Staff Position: NEI 12-06, Revision 4, provides an acceptable approach for reasonably protecting equipment from external events. This approach includes the following:

- identification of the natural phenomena for which reasonable protection is necessary
- determination of the method of protection to be used
- establishment of controls on functionality of the equipment
- provision of a method of transporting the portable equipment from its storage location to the site in which it will be used

Individual elements of reasonable protection are discussed below.

3.1. Evaluation of External Hazards

Section 4 of NEI 12-06, Revision 4, discusses the overall methodology for identifying external hazards and evaluating their impact. Appendix B to NEI 12-06, Revision 4, discusses the identification of external hazards for which licensees should provide reasonable protection. Sections 5 through 9 of NEI 12-06, Revision 4, discuss the evaluation of the effects of natural phenomena to meet the baseline coping capability.

Staff Position: Sections 5 through 9 and Appendix B to NEI 12-06, Revision 4, provide an acceptable method for the evaluation and equipment considerations to address external events to satisfy that element of reasonable protection.

3.2. Protection from External Hazards

Sections 5 through 9 of NEI 12-06, Revision 4, discuss methodologies for the protection of the equipment. The methods of protection comprise (1) physical protection of the equipment, (2) protection by relocation of the equipment from a position in which a licensee may have indication of an impending hazard, and (3) provision of multiple, redundant pieces of equipment or methods to accomplish a function, stored in diverse locations to ensure that at least one method of accomplishing that function will survive an event of a localized nature such as a tornado missile impact.

Section 11.5.4.b.i of NEI 12-06, Revision 4, provides that, in the event of nonfunctionality of equipment that is reasonably protected from tornado winds or missiles (or both) by means of separation from redundant or alternate equipment, the redundant or alternate equipment continues to be deemed reasonably protected by means of separation.

Sections 11.5.4.e and f of NEI 12-06, Revision 4, discuss the programmatic controls for the protection of the equipment from external hazards, providing limited durations for which equipment may be out of its normal reasonable protection configuration for maintenance, testing, risk reduction for plant maintenance or outage activities, or other reasons.

Staff Position: Sections 5 through 9, 11.5.4.b.i, 11.5.4e, and 11.5.4.f of NEI 12-06, Revision 4, provide an acceptable method for protecting the equipment from external events to satisfy that element of reasonable protection.

3.3. Deployment of Equipment

Sections 5 through 9 of NEI 12-06, Revision 4, discuss methods for transporting the equipment from its storage location to the location in which it would be used. These sections also discuss the connection of the equipment to structures, systems, and components (SSCs) necessary to complete the deployment of the equipment from storage to a state in which it can supplement the functions of the installed SSCs.

Staff Position: Sections 5 through 9 of NEI 12-06, Revision 4, provide an acceptable method for deployment of the equipment in order to satisfy that element of reasonable protection.

3.4. Programmatic Controls for Functionality

Section 11.5.4 of NEI 12-06, Revision 4, discusses the programmatic controls for FLEX equipment and connections between that equipment and permanently installed SSCs. These controls include limited time periods in which the equipment and connection points may be nonfunctional for any reason, or not in the specified reasonable protection configuration (i.e., per the Final Integrated Plan or Program Document). The duration of the acceptable time period is based on the ability of the licensee to accomplish the intended function of the equipment by other means.

When a licensee cannot accomplish the intended function of the equipment by other means, durations for which the equipment is nonfunctional are limited to periods comparable to those allowed by technical specifications for safety-related SSCs with similar functions (e.g., the completion times allowed for restoration of turbine-driven auxiliary feedwater trains in Limiting Condition for Operation 3.7.5, "Auxiliary Feedwater (AFW) System," of NUREG-1431, "Standard Technical Specifications—Westinghouse Plants," Volume 1, "Specifications," Revision 4.0, issued April 2012 [Reference 4], which range from 24 hours to 7 days).

When a licensee can accomplish the intended function of the equipment by other means (e.g., the equipment is spare equipment beyond the minimum necessary to accomplish the intended function), durations for which the equipment is nonfunctional are limited to 90 days based on a normal plant work cycle of 12 weeks to avoid displacing maintenance actions for other safety-significant equipment or SSCs.

When a licensee is able to accomplish the intended function of the equipment by other means, but that means is not protected from all possible effects of natural phenomena, durations for which the equipment is not in its specified reasonable protection configuration (or until compensatory actions must be implemented to justify a temporary reasonable protection configuration) are limited to 14 days in order to avoid displacing maintenance actions for other safety-significant equipment or SSCs. Similarly, FLEX equipment may be pre-staged for up to 45 days to reduce the risk of maintenance or outage activities.

Similar controls are applied to connection points for the equipment to installed SSCs.

Staff Position: Section 11.5.4 of NEI 12-06, Revision 4, provides an acceptable method for controlling durations for which the equipment is nonfunctional or not in its specified reasonable protection configuration to satisfy those elements of reasonable protection.

4. Equipment Maintenance

Order EA-12-049 requires that licensees maintain guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities. This necessitates that the equipment relied on for the mitigation strategies under Order EA-12-049 receives adequate maintenance such that it is capable of fulfilling its intended function.

Section 11.5 of NEI 12-06, Revision 4, discusses the maintenance and testing of the equipment. Section 3.2.1.13 discusses the Electric Power Research Institute (EPRI) program developed for maintenance of the equipment, which is documented in EPRI Report 3002000623, "Nuclear Maintenance Applications Center: Preventive Maintenance Basis for FLEX Equipment—Project Overview Report," issued

September 2013 [Reference 5]. The NRC endorsed EPRI Report 3002000623 in a letter dated October 7, 2013 [Reference 6].

Staff Position: Sections 11.5 and 3.2.1.13 of NEI 12-06, Revision 4, provide an acceptable method for maintaining the equipment relied on for the mitigation strategies under Order EA-12-049.

5. Configuration Control

Order EA-12-049 requires that licensees maintain the guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities.

Section 11.8 of NEI 12-06, Revision 4, discusses the configuration control of the guidance and strategies as well as the maintenance of an overall program document and record of changes. Section 11.8.3.a.iii of NEI 12-06, Revision 4, includes wording that corresponds to that of proposed 10 CFR 50.155(f) on change control, as published in the *Federal Register* (80 FR 70610, 70645, November 13, 2015, as modified by 80 FR 74717, November 30, 2015). Because the Commission has not made a decision about that proposed change control provision, the NRC staff does not take a position on the acceptability of Section 11.8.3.a.iii.

Staff Position: Section 11.8 of NEI 12-06, Revision 4, provides an acceptable method for maintaining the guidance and strategies required under Order EA-12-049. As discussed above, the NRC staff does not take a position on the provisions of Section 11.8.3.a.iii.

6. Treatment of Reevaluated Hazards under the 10 CFR 50.54(f) Requests for Information of March 12, 2012

Order EA-12-049 requires licensees to provide reasonable protection for the equipment relied on for the mitigating strategies from external events. As a result of the reevaluations of flood and seismic hazards under the NRC letter dated March 12, 2012, issued under 10 CFR 50.54(f), some licensees have identified issues with the level of protection that would be considered reasonable. As affirmed by the Commission in SRM-COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards," dated March 30, 2015 [Reference 7], "[l]icensees for operating nuclear power plants need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events (Order EA-12-049 and related [mitigation of beyond-design-basis events] MBDBE rulemaking)." Guidance in this section is intended to align with treatment under the MBDBE rulemaking.

6.1. Treatment of Reevaluated Seismic Hazards

Appendix H to NEI 12-06, Revision 4, discusses a method to assess the results of the seismic hazard reevaluations with respect to the guidance and strategies required by Order EA-12-049.

6.1.1. (Modified) Mitigating Strategies

Sections H.4.1, H.4.2, and H.4.4 of Appendix H to NEI 12-06, Revision 4, discuss a method to assess or modify the mitigating strategies to show they provide reasonable protection from the new seismic hazard information, referred to as mitigating strategies seismic hazard information.

Section H.4.5 of Appendix H to NEI 12-06, Revision 4, discusses several methods to assess the capability of a facility to mitigate the effects of the mitigating strategies seismic hazard information.

Staff Position: Sections H.4.1, H.4.2, H.4.4, and H.4.5.2 (when combined with Section H.4.5.6) of Appendix H to NEI 12-06, Revision 4, provide appropriate methods to assess or modify the mitigating strategies to show that they remain capable of mitigating the new seismic hazard information, referred to as mitigating strategies seismic hazard information, with the following clarification. In addition to the raceways (cable trays and conduit) and nuclear steam supply system components (piping and vessels) listed as classes of high-capacity equipment and systems established in EPRI report NP-6041-SL, "A Methodology for Assessment of Nuclear Plant Seismic Margin," Revision 1, dated August 1, 1991 [Reference 8], as having sufficient seismic capacities relative to the ground motion response spectrum (GMRS) for plants using Section H.4.4 and therefore not requiring additional evaluations to demonstrate ruggedness, Table 2-4 of EPRI NP-6041-SL provides that buried tanks also have sufficient seismic capacity and limits evaluations of those tanks to evaluation of piping connections. The potential for misalignment of piping connections due to soil failures impacting buried tanks associated with the Expedited Seismic Evaluation Process equipment list should be considered in Section H.4.4, Step 3, as a seismic failure mechanism that could potentially affect the FLEX strategies. Soil failure evaluations are not needed for structures that are considered inherently or sufficiently rugged relative to the GMRS levels for plants using Section H.4.4.

The method described in Section H.4.4 of NEI 12-06, Revision 4, is applicable for the following facilities:

- those facilities for which Section H.4.3 is applicable as documented in Section 6.1.2 of this interim staff guidance
- Beaver Valley Power Station, Units 1 and 2, Renewed License Nos. DPR-66 and NPF-73
- Calvert Cliffs Nuclear Power Plant, Units 1 and 2, Renewed License Nos. DPR-53 and DPR-69
- Catawba Nuclear Station, Units 1 and 2, Renewed License Nos. NPF-35 and NPF-52
- Cooper Nuclear Station, Renewed License No. DPR-46
- Davis-Besse Nuclear Power Station, Unit 1, License No. NPF-3

- Donald C. Cook Nuclear Plant, Units 1 and 2, Renewed License Nos. DPR-58 and DPR-74
- Dresden Nuclear Power Station, Units 2 and 3, Renewed License Nos. DPR-19 and DPR-25
- Edwin I Hatch Nuclear Plant, Units 1 and 2, Renewed License Nos. DPR-57 and NPF-5
- Fermi, Unit 2, Facility Operating License No. NPF-43
- LaSalle County Station, Units 1 and 2, Facility Operating License Nos. NPF-11 and NPF-18
- McGuire Nuclear Station, Units 1 and 2, Renewed License Nos. NPF-9 and NPF-17
- Monticello Nuclear Generating Plant, Unit 1, License No. DPR-22
- Perry Nuclear Power Plant, Unit 1, License No. NPF-58
- Point Beach Nuclear Plant, Units 1 and 2, Renewed License Nos. DPR-24 and DPR-27
- Seabrook Station, Unit 1, Facility Operating License No. NPF-86
- Three Mile Island Nuclear Station, Unit 1, Renewed License No. DPR-50
- Watts Bar Nuclear Plant, Units 1 and 2, Facility Operating License Nos. NPF-90 and NPF-96
- Wolf Creek Generating Station, Unit 1, Renewed License No. NPF-42

Sections H.4.5.4 and H.4.5.5, of NEI 12-06, Revision 4 (for instances in which the seismic probabilistic risk assessment incorporates the strategies and guidelines required under Order EA-12-049), in combination with Section H.4.5.6, provide appropriate methods to assess or modify the mitigating strategies to show that they remain capable of mitigating the new seismic hazard information, referred to as mitigating strategies seismic hazard information.

6.1.2. Alternate Mitigating Strategies

Section H.4.3 of Appendix H to NEI 12-06, Revision 4, discusses a method to develop an alternate mitigating strategy (AMS) to address the mitigating strategies seismic hazard information. This includes a modification of the general criteria and baseline assumptions included in Section 3.2.1 of NEI 12-06, Revision 4, to exclude consideration of losses such as an ELAP, LOOP, or LUHS unless caused by the seismic hazard.

Sections H.4.5.3, H.4.5.4, and H.4.5.5, in combination with Section H.4.5.6, of NEI 12-06, Revision 4, discuss methods to develop an AMS to address the mitigating strategies seismic hazard information.

Staff Position: The method described in Section H.4.3 of NEI 12-06, Revision 4, for development of an AMS that provides a capability to mitigate the BDBEE is an acceptable method of providing reasonable protection when the hazard level for the AMS is identified. The protection of onsite power sources and normal access to the ultimate heat sink from the seismic hazard is an acceptable method of mitigating a simultaneous loss of all ac power and LUHS.

The method described in Section H.4.3 of NEI 12-06, Revision 4, is applicable for the following facilities:

- Arkansas Nuclear One, Units 1 and 2, Renewed License Nos. DPR-51 and NPF-6
- Brunswick Steam Electric Plant, Units 1 and 2, Renewed License Nos. DPR-71 and DPR-62
- Byron Station, Units 1 and 2, Renewed License Nos. NPF-37 and NPF-66
- Fort Calhoun Station, Unit 1, Renewed License No. DPR-40
- James A. FitzPatrick Nuclear Power Plant, Renewed License No. DPR-59
- Millstone Power Station, Units 2 and 3, Renewed License Nos. DPR-65 and NPF-49
- Salem Nuclear Generating Station, Units 1 and 2, Renewed License Nos. DPR-70 and DPR-75
- Susquehanna Steam Electric Station, Units 1 and 2, Renewed License Nos. NPF-14 and NPF-22

The methods described in Sections H.4.5.3, H.4.5.4, and H.4.5.5, in combination with Section H.4.5.6, of NEI 12-06, Revision 4, to develop an AMS that provides a capability to mitigate the BDBEE are acceptable methods of providing reasonable protection when the hazard level for the AMS is identified. The protection of onsite power sources and normal access to the ultimate heat sink from the seismic hazard is an acceptable method of mitigating a simultaneous loss of all ac power and LUHS.

6.2. Treatment of Reevaluated Flooding Hazards

Appendix G to NEI 12-06, Revision 4, discusses a method to assess the results of the flooding hazard reevaluations with respect to the guidance and strategies required by Order EA-12-049.

6.2.1. (Modified) Mitigating Strategies

Sections G.4.1 and G.4.2 of Appendix G to NEI 12-06, Revision 4, discuss a method to assess or modify the mitigating strategies to show that they provide reasonable protection from the new flooding hazard information, referred to as mitigating strategies flood hazard information.

Staff Position: Sections G.4.1 and G.4.2 of Appendix G to NEI 12-06, Revision 4, provide appropriate methods to assess or modify the mitigating strategies to show that they remain capable of mitigating the new flooding hazard information, referred to as mitigating strategies flood hazard information.

6.2.2. Alternate Mitigating Strategies

Section G.4.3 of Appendix G to NEI 12-06, Revision 4, discusses a method to develop an AMS to address the mitigating strategies flood hazard information. This includes a modification of the general criteria and baseline assumptions included in Section 3.2.1 of NEI 12-06, Revision 4, to exclude consideration of losses such as an ELAP, LOOP, or LUHS unless caused by the flood hazard.

Staff Position: The method described in Section G.4.3 of NEI 12-06, Revision 4, for development of an AMS that provides a capability to mitigate the BDBEE is an acceptable method of providing reasonable protection when the hazard level for the AMS is identified. The protection of onsite power sources and normal access to the ultimate heat sink from the flood hazard is an acceptable method of mitigating a simultaneous loss of all ac power and LUHS.

6.2.3. Targeted Hazard Mitigating Strategies

Section G.4.4 of Appendix G to NEI 12-06, Revision 4, discusses a method to develop targeted hazard mitigating strategies (THMS) to address the mitigating strategies flooding hazard information. This includes a modification of the general criteria and baseline assumptions included in Section 3.2.1 of NEI 12-06, Revision 4, to exclude consideration of losses such as an ELAP, LOOP, or LUHS unless caused by the flood hazard.

Staff Position: The method described in Section G.4.4 of NEI 12-06, Revision 4, for development of a THMS that provides a capability to mitigate the BDBEE is an acceptable method of providing reasonable protection for the reevaluated flooding hazard when the hazard level for the THMS is identified. The protection of onsite power sources and normal access to the ultimate heat sink from the flood hazard is an acceptable method of mitigating a simultaneous loss of all ac power and LUHS.

7. **Guidance for AP1000 Design**

Appendix F to NEI 12-06, Revision 4, provides specific guidance for licensees with reactors of the AP1000 design on how to satisfy provisions of Order EA-12-049, Attachment 3, for the final phase (for sufficient offsite resources to sustain functions indefinitely).

Staff Position: The guidance of Appendix F to NEI 12-06, Revision 4, provides an acceptable means to meet the requirements of Order EA-12-049 or license conditions imposing similar requirements.

REFERENCES

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2. Nuclear Energy Institute (NEI), NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 4, December 2016 (ADAMS Accession No. ML16354B421).
3. NRC, "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," March 12, 2012 (ADAMS Accession No. ML12053A340).
4. NRC, NUREG-1431, "Standard Technical Specifications—Westinghouse Plants," Volume 1, "Specifications," Revision 4.0, April 2012 (ADAMS Accession No. ML12100A222).
5. Electric Power Research Institute (EPRI),¹ Report 3002000623, "Nuclear Maintenance Applications Center: Preventive Maintenance Basis for FLEX Equipment—Project Overview Report," Palo Alto, CA, September 2013 (ADAMS Accession No. ML13276A573).
6. NRC (Jack R. Davis), Letter to NEI (Joseph E. Pollock), Maintenance and Testing Endorsement Letter in Regard to Mitigation Strategies Order EA-12-049, October 7, 2013 (ADAMS Accession No. ML13276A224).
7. NRC, SRM-COMSECY-14-0037, "Staff Requirements—COMSECY-14-0037—Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards," March 30, 2015 (ADAMS Accession No. ML15089A236).
8. EPRI, Report NP-6041-SL, "A Methodology for Assessment of Nuclear Plant Seismic Margin," Revision 1, Palo Alto, CA, August 1, 1991. Available at <http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=NP-6041-SLR1>.

¹ Copies of EPRI documents may be obtained by contacting the Electric Power Research Institute, 3420 Hillview Avenue, Palo Alto, CA 94304, telephone 650-855-2000, or online at <http://my.epri.com/portal/server.pt>.