U.S. NUCLEAR REGULATORY COMMISSION

REGULATORY GUIDE 1.226, REVISION 0

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FLEXIBLE MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EVENTS

A. INTRODUCTION

Purpose

This regulatory guide (RG) identifies methods and procedures the staff of the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for nuclear power reactor applicants and licensees to demonstrate compliance with NRC regulations covering planning and preparedness for beyond-design-basis events as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities" (Ref. 1), Section 50.155, "Mitigation of beyond-design-basis events" (10 CFR 50.155).

This RG endorses, with clarifications, the methods and procedures promulgated by the Nuclear Energy Institute (NEI) in technical document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 4 (NEI 12-06, Revision 4) dated December 2016 (Ref. 2) as a process the NRC considers acceptable for meeting, in part, the regulations in 10 CFR 50.155. Additionally, this RG provides guidance for meeting the regulations in 10 CFR 50.155 that are in areas that are not covered in NEI 12-06.

Applicability

This RG applies to applicants and licensees subject to 10 CFR Part 50 and all applicants and licensees for a power reactor combined license under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (Ref. 3).

Applicable Regulations

- 10 CFR 50.155 requires nuclear power reactor licensees to develop, implement, and maintain strategies and guidelines to mitigate a Beyond-Design-Basis External Event (BDBEE)

Related Guidance

- RG 1.227, "Wide-Range Spent Fuel Pool Level Instrumentation," (Ref.). This RG endorses, with exceptions and clarifications, the methods and procedures promulgated by NEI in document NEI 12-02, "Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses

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Electronic copies of this regulatory guide, previous versions of this guide, and other recently issued guides are available through the NRC's public Web site under the Regulatory Guides document collection of the NRC Library at http://www.nrc.gov/reading-rm/doc-collections/. The regulatory guide is also available through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html, under ADAMS Accession No. ML19058A012. The regulatory analysis may be found in ADAMS under Accession No. ML19058A009. The associated draft guide DG-1301 may be found in ADAMS under Accession No. ML13168A031, and the staff responses to the public comments on the proposed rule and DG-1301 may be found under ADAMS Accession No. ML19058A007.

with Regard to Reliable Spent Fuel Pool Instrumentation'," Revision 1, dated August 2012 (Ref. 5), as a process the NRC staff considers acceptable for meeting certain regulations in 10 CFR 50.155.

Purpose of Regulatory Guides

The NRC issues RGs to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific problems or postulated events, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations and compliance with them is not required. Methods and solutions that differ from those set forth in RGs will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

Paperwork Reduction Act

This RG provides voluntary guidance for implementing the mandatory information collections in 10 CFR Parts 50 and 52 that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et. seq.). These information collections were approved by the Office of Management and Budget (OMB), control numbers 3150-0011 and 3150-0151. Send comments regarding this information collection to the Information Services Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the OMB reviewer at: OMB Office of Information and Regulatory Affairs (3150-0011 and 3150-0151), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street, NW Washington, DC 20503; e-mail: oira_submission @omb.eop.gov.

Public Protection Notification

The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

List of Abbreviations

The following abbreviations are used in this RG:

ac	alternating current
ADAMS	NRC Agencywide Documents Access and Management System
AFW	auxiliary feedwater
AMS	alternate mitigating strategy
ASCE	American Society of Civil Engineers
BDBEE	beyond-design-basis external event
CFR	*Code of Federal Regulations*
DG	draft regulatory guide
EFW	emergency feedwater
ELAP	extended loss of alternating current power
EOP	emergency operating procedure
EPRI	Electric Power Research Institute
ESBWR	economic simplified boiling-water reactor
ESEP	expedited seismic evaluation process

FLEX	diverse and flexible coping strategies
FR	*Federal Register*
FSAR	final safety analysis report
FSG	FLEX support guidelines
GL	generic letter
GMRS	ground motion response spectrum
HF	high frequency
HPCI	high pressure core injection
IAEA	International Atomic Energy Agency
IHS	IPEEE high-confidence-of-low-probability-of-failure spectrum
IPEEE	individual plant examination of external events
ISG	interim staff guidance
LLNL	Lawrence Livermore National Laboratory
LUHS	loss of normal access to the ultimate heat sink
NEA	Nuclear Energy Agency
NEI	Nuclear Energy Institute
NRC	U.S. Nuclear Regulatory Commission
NTTF	Near-Term Task Force
OECD	Organization for Economic Co-operation and Development
PGA	peak ground acceleration
RCIC	reactor core isolation cooling
RG	regulatory guide
RLE	review level earthquake
RLGM	review level ground motion
SAMGs	severe accident management guidelines
SEI	Structural Engineering Institute
SEL	seismic equipment list
SFP	spent fuel pool
SMA	seismic margin assessment
SPID	screening, prioritization, and implementation details
SRM	staff requirement memorandum
SPRA	seismic probabilistic risk assessment
SSC	structure, system, and component
THMS	targeted hazard mitigating strategy

B. DISCUSSION

Reason for Issuance

One of the primary lessons learned from the accident at the Fukushima Dai-ichi nuclear power plant was the significance of the challenge presented by a loss of multiple safety-related systems following the occurrence of a BDBEE. In the case of the Fukushima Dai-ichi accident, the loss of all alternating current power led to loss of core cooling, and ultimately to core damage and a loss of containment integrity. The design basis for U.S. nuclear plants includes bounding analyses with margin for external events expected at each site. Extreme external events (e.g., seismic events, external flooding, etc.) beyond those accounted for in the design basis, while unlikely, could present challenges to nuclear power plants.

In response to lessons learned from the Fukushima Dai-ichi accident, the NRC promulgated 10 CFR 50.155, "Mitigation of beyond-design-basis events," to improve the capability of nuclear power plants to address BDBEEs. As one method of addressing the challenges that may be presented by these types of events, this RG endorses, with clarifications as detailed in this RG, the principles and processes in NEI 12-06, Revision 4, as acceptable for use by applicants and licensees to define and deploy strategies that will enhance their ability to cope with conditions resulting from BDBEEs.

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 SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011 (Ref. 6). In staff requirement memorandum (SRM) to SECY-11-0093 (Ref. 7), the Commission directed the NRC staff to identify any actions that could, and in the staff's judgment should, be taken in the near term considering the wide range of regulatory tools available, and to prioritize those actions. The staff's response to this Commission direction is contained in SECY-11-0124, "Recommended Actions To Be Taken without Delay from the Near-Term Task Force Report," dated September 9, 2011 (Ref. 8), and SECY-11-0137, "Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned," dated October 3, 2012 (Ref. 9).

After receiving the Commission's direction in SRM-SECY-11-0124 (Ref. 10) and SRM-SECY-11-0137 (Ref. 11), the NRC conducted public meetings to discuss enhanced mitigation strategies intended to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities following a BDBEE. 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 (Ref. 12). FLEX was proposed as a strategy to fulfill the key safety functions of core cooling, containment integrity, and spent fuel cooling.

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" (Ref. 13), to the Commission, including a proposed order to implement enhanced mitigation strategies for BDBEEs. As directed by SRM-SECY-12-0025 (Ref. 14), the NRC issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for

Beyond-Design-Basis External Events," (Ref. 15) on March 12, 2012. On March 30, 2012, the Commission issued Memorandum and Order CLI-12-09 (Ref. 16), which included the requirements for mitigation strategies as a license condition for Virgil C. Summer Nuclear Station, Units 2 and 3. These requirements were subsequently included as license condition 2.D.(17) on both combined license NPF-93 (Ref. 17) and combined license NPF-94 (Ref. 18) for those units.

On May 4, 2012, NEI submitted NEI 12-06, Revision B (Ref. 19), to provide specifications for an industry proposed method 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 (Ref. 20). The strategies and guidance described in NEI 12-06 expand on those developed and implemented by the nuclear industry to address the limited set of BDBEEs involving the loss of a large area of the plant due to explosions and fire required pursuant to paragraph (hh)(2) of 10 CFR 50.54, "Conditions of licenses."

On May 31, 2012, the NRC issued a draft version of an interim staff guidance document, JLD-ISG-2012-01 (Ref. 21), and published a notice of its availability for public comment in the *Federal Register* (77 FR 33779), with the 30 day comment period running through July 7, 2012. The NRC received seven comments during this time, with the NRC addressing the comments as documented in "NRC Response to Public Comments, JLD-ISG-2012-01 (Docket ID NRC-2012-0068)" (Ref. 22).

On July 3, 2012, NEI submitted Revision C to NEI 12-06 (Ref. 23), incorporating many of the exceptions and clarifications included in the draft version of JLD-ISG-2012-01. On August 3, 2012, NEI submitted Draft Revision 0 to NEI 12-06 (Ref. 24) incorporating many of the remaining exceptions and clarifications. On August 21, 2012, NEI submitted Revision 0 to NEI 12-06 (Ref. 25) making various editorial corrections. The NRC reviewed the August 21, 2012 submittal of Revision 0 of NEI 12-06 dated August 2012 and endorsed it in JLD-ISG-2012-01 (Ref. 26) as a process the NRC considers acceptable for meeting the regulatory requirements with noted clarifications.

On August 25, 2015, NEI submitted Revision 1 to NEI 12-06 (Ref. 27), incorporating lessons learned in the implementation of Order EA-12-049 and alternative approaches taken by licensees for compliance to that order. Following a public webinar discussion of potential exceptions and clarifications on September 21, 2015, NEI submitted Revision 1A to NEI 12-06 (Ref. 28).

On October 30, 2015, the NRC staff issued a draft revision (Draft Revision 1) to JLD-ISG-2012-01 (Ref. 29) 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 Response 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 (Ref. 30).

On November 13, 2015, the NRC staff issued Draft Regulatory Guide (DG)-1301, "Flexible Mitigation Strategies for Beyond-Design-Basis Events" (Ref. 31), and published a notice of its availability for public comment in the *Federal Register* (80 FR 70609; November 13, 2015), with the comment period running through February 11, 2016 (90 days from its publication). The staff received three comments during this time, which it addressed as documented in "NRC Response to Public Comments—Final Rule: Mitigation of Beyond-Design-Basis Events" (Ref. 32).

On December 10, 2015, NEI submitted Revision 2 to NEI 12-06 (Ref. 33), incorporating many of the clarifications and additions included in the draft version of the revision to JLD- ISG-2012-01.

Section H.4.5 of NEI 12-06, Revision 2, notes that detailed guidance for mitigating strategies assessments (MSAs) for licensees having reevaluated seismic hazards more than twice their safe-shutdown earthquake is under development and expected to be available to support MSAs for those licensees. The NRC reviewed the December 10, 2015, submittal of Revision 2 of NEI 12-06 dated December 2015, and endorsed it in JLD-ISG-2012-01, Revision 1, (Ref. 34) dated January 22, 2016, with clarifications and additions, as a process the NRC considers acceptable for meeting the regulatory requirements.

On September 22, 2016, NEI submitted Revision 3 to NEI 12-06 (Ref. 35) to address 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, documentation and configuration control, and the provision of guidance in Section H.4.5 for the performance of MSAs for plants with reevaluated seismic hazard information greater than twice the plant's safe-shutdown earthquake. 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 a draft revision (Draft Revision 2) to JLD-ISG-2012-01 (Ref. 36) 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 6 comments during this time, which it addressed as documented in "NRC Response 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 8, 2017 (Ref. 37).

On December 12, 2016, NEI submitted Revision 4 to NEI 12-06 (Ref. 2) to clarify the provisions on availability/functionality of equipment relied upon for the mitigating strategies, while retaining the changes that had been proposed in Revision 3 to NEI 12-06. The NRC reviewed the December 12, 2016, submittal of Revision 4 of NEI 12-06 and endorsed it in JLD-ISG-2012-01, Revision 2, (Ref. 38) dated February 8, 2017, with clarifications, as a process the NRC considers acceptable for meeting the regulatory requirements of Order EA-12-049.

In 2019, the Commission issued the final Mitigation of Beyond-Design-Basis Events rule. The final rule did not contain several requirements that were in the proposed rule. As a result, portions of the NEI guidance developed to support the final rule are not necessary to comply with the final rule requirements. Accordingly, those portions of the NEI guidance, which include guidance to address reevaluated hazards, and the referenced guidance in NEI 12-01, "Guidelines for Assessing Beyond-Design-Basis Accident Response Staffing and Communication Capabilities," Revision 0 (Ref. 39), dated May 2012; NEI 13-06, "Enhancements to Emergency Response Capabilities for Beyond-Design-Basis Events and Severe Accidents," Revision 1 (Ref. 40), dated February 2016; and NEI 14-01, "Emergency Response Procedures and Guidelines for Beyond-Design-Basis Events and Severe Accidents," Revision 1 (Ref. 41), dated February 2016 are not endorsed by this RG. However, NEI 12-01, NEI 13-06, and NEI 14-01 provide useful information for both applicants and licensees.

In summary, the NRC promulgated 10 CFR 50.155 to, among other things, make the requirements of Order EA-12-049 generically applicable, taking into account lessons learned during the implementation of the order and input from stakeholders. This RG endorses, with clarifications and additions, NEI 12-06, Revision 4, as an acceptable method for applicants and licensees to demonstrate compliance with certain aspect of these regulatory requirements. NEI 12-06, Revision 4 was developed by NEI to incorporate lessons learned and additional alternative approaches to meet the requirements of Order EA-12-049. The guidelines in NEI 12-06, Revision 4 recommend a three-phase approach for mitigating BDBEEs. The initial phase makes use of installed equipment and resources to maintain or

restore key safety functions including core cooling, containment, and SFP cooling. The transition phase includes providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from offsite. The final phase includes obtaining sufficient offsite resources to sustain these functions indefinitely. The NRC intends to maintain JLD-ISG-2012-01, Revision 2, as long as Order EA-12-049 remains in effect.

External Documents Endorsed in This Guide

This RG endorses, in part, the use of one or more codes, standards, or guidance documents developed by external organizations. These codes, standards, and third-party guidance documents may contain references to other codes, standards, or third-party guidance documents ("secondary references"). If a secondary reference has itself been incorporated by reference into NRC regulations as a requirement, then licensees and applicants must comply with that standard as set forth in the regulation. If the secondary reference has been endorsed in an RG as an acceptable approach for meeting an NRC requirement, then the standard constitutes a method acceptable to the NRC for meeting that regulatory requirement as described in the specific RG. If the secondary reference has neither been incorporated into NRC regulations nor endorsed in an RG, the secondary reference is neither a legally-binding requirement nor a "generic" NRC-approved acceptable approach for meeting an NRC requirement. However, licensees and applicants may consider and use the information in the secondary reference, if appropriately justified, consistent with current regulatory practice, and consistent with applicable NRC requirements.

Harmonization with International Standards

The International Atomic Energy Agency (IAEA) has established a series of technical reports, safety guides and standards constituting a high level of safety for protecting people and the environment. IAEA guides present international good practices and identify best practices to help users striving to achieve high levels of safety. This RG and the NEI technical document endorsed by it contain guidance about BDBEE mitigation. With respect to this RG, the following international safety standards provide additional relevant information:

- IAEA Safety Standards Series No. SSR-2/1, Rev. 1, "Safety of Nuclear Power Plants: Design" (Ref. 42)

- IAEA Safety Standards Series No. NS-G-1.5, "External Events Excluding Earthquakes in the Design of Nuclear Power Plants" (undergoing revision as draft standard 498 (DS498)) (Ref. 43)

- IAEA Safety Standards Series No. NS-G-1.6, "Seismic Design and Qualification for Nuclear Power Plants" (to be combined with NS-G-1.5 in DS498) (Ref. 44)

- IAEA Safety Standards Series No. SSG-54, "Accident Management Programmes for Nuclear Power Plants" (Ref. 45)

Although the NRC has an interest in facilitating the harmonization of standards used domestically and internationally, the agency does not specifically endorse the IAEA Safety Standards listed above and is only acknowledging that these documents may be useful references for general information.

C. STAFF REGULATORY GUIDANCE

This RG endorses, with clarifications, the methods described in NEI 12-06, Revision 4, dated December 2016. The NRC staff has determined that the methods described in NEI 12-06, Revision 4, constitute procedures and processes generally acceptable to the NRC for demonstrating compliance with the regulatory requirements in 10 CFR 50.155, subject to the following clarifications and additions.

1. Development and Implementation Process

Sections 50.155(b) and (b)(1) require that applicants or licensees develop and implement strategies and guidelines to mitigate beyond-design-basis external events from natural phenomena that result in an loss of all alternating current power concurrent with either a loss of normal access to the ultimate heat sink (LUHS) or, for nuclear power plants with passive reactor designs, a loss of normal access to the normal heat sink. This section of the RG addresses developing and implementing the strategies and guidelines, and section C.4 addresses maintenance of the strategies and guidelines. The strategies and guidelines developed and implemented under sections 50.155(b) and (b)(1) must be capable of being implemented site-wide and must include maintaining or restoring core cooling, containment, and spent fuel pool cooling capabilities; and the acquisition and use of offsite assistance and resources to support those functions indefinitely, or until sufficient site functional capabilities can be maintained without the need for the mitigation strategies.

1.1. Establishment of Baseline Coping Capability

Section 1.3 of NEI 12-06, Revision 4, provides the objectives and guiding principles of the FLEX program that are responsive to 10 CFR 50.155(b) and (b)(1) and provide that plant-specific analyses will determine the duration of each phase, 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 10 CFR 50.155(b) and (b)(1). 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 rule.

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 10 CFR 50.155(b) and (b)(1). 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 an extended loss of ac power (ELAP) consisting of 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 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 of NEI 12-06, Revision 4, provide an acceptable method for licensees to follow to develop a baseline coping capability for mitigating an ELAP concurrent with either an LUHS or, for nuclear power plants with passive reactor designs, a loss of normal access to the normal heat sink with the following clarifications and addition:

a) 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), 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 that alternate ac sources, which may be included in meeting the specified durations of 10 CFR 50.63(a), are unavailable. 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.

b) The use of best-estimate analyses for establishing the baseline coping capabilities is appropriate in the context of the BDBEEs for 10 CFR 50.155(b). 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.

c) Consistent with the goal of mitigation strategies for BDBEEs, 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 decision making), 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, nor does the NRC endorse it as such.

    1. 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

The regulations in 10 CFR 50.155 do not contain specific requirements for a multiple phase approach to mitigating and recovering from a BDBEE as had been the case under Order EA-12-049. NEI 12-06, Revision 4, carries the definitions of the phases from that order forward as a conceptual framework for the development of the FLEX strategies. Maintenance of core and SFP cooling and containment functions requires overlap between the initiating times for the phases with the duration for which each licensee can perform the prior phases. 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 using a phased 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: NEI 12-06, Revision 4, Section 3.0, 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 onsite equipment. 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: NEI 12-06, Revision 4, Section 3.0, 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 onsite equipment augmented with additional equipment and consumables obtained from off-site until power, water, and coolant injection systems are restored or commissioned.

Staff Position: NEI 12-06, Revision 4, Section 3.0, provides an acceptable method for determining the baseline coping capabilities for the final phase. NEI 12-06, Revision 4, Section 12.2, provides an acceptable method for establishing the capability to obtain equipment

and consumables from off-site 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 RG discusses an acceptable approach to mitigating the effects of an ELAP. 10 CFR 50.155(b)(1) requires "[s]trategies and guidelines to mitigate beyond-design-basis external events from natural phenomena that are developed assuming a loss of all ac power…" rather than an ELAP. The difference between the conditions described in NEI 12-06 and those in 10 CFR 50.155(b)(1) is addressed through the development of contingency actions. Specifically, the damage state of a loss of all ac power condition concurrent with LUHS 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 10 CFR 50.155(b)(1) requirement for a loss of all ac power, including ac power from the batteries (through inverters), contingencies are included in the mitigation strategies 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.

NEI 12-06, Revision 4, Section 3.2.2 provides 17 guidelines for use in the development of the guidance and strategies under 10 CFR 50.155(b)(1). Guideline (2) of this section states:

> 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 of NEI 12-06, Revision 4 contain summaries of performance attributes for boiling-water and pressurized-water reactors respectively, and address Guideline (2) of NEI 12-06, Revision 4, Section 3.2.2 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 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, which are necessary to comply with the requirement in 10 CFR 50.155(b)(1) to mitigate a 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; 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 and Capability

Section 50.155(c)(1) requires that the equipment relied upon for the mitigation strategies and guidelines required by § 50.155(b)(1) have sufficient capacity and capability to perform the functions required by § 50.155(b)(1).

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 rule. 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 § 50.155(c)(1).

3. Reasonable Protection

Section 50.155(c)(2) requires that the equipment relied upon for the mitigation strategies required by § 50.155(b)(1) be reasonably protected from the effects of natural phenomena that are equivalent in magnitude to the phenomena assumed for developing the design basis of the facility.

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 the effects of natural phenomena. 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, and
- 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 of 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 of NEI 12-06, Revision 4, provide an acceptable method for the evaluation and equipment considerations to address the effects of external hazards in order 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 provides that, in the event of non-functionality of equipment that is reasonably protected from tornado winds and/or missiles by means of separation from redundant or alternate equipment, the redundant or alternate equipment continues to be deemed reasonably protected by means of separation.

Section 11.5.4.e and f 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, 11.5.4.e, and 11.5.4.f of NEI 12-06, Revision 4 provide an acceptable method for protecting the equipment from the effects of external hazards in order to satisfy that element of reasonable protection.

Prestaging of equipment under Section 11.5.4.f to reduce the risk of maintenance or outage activities for up to 45 days is acceptable as an exception to the stipulation of Sections 11.3.3 and 11.3.6 that prestaged equipment should be reasonably protected. The 45-day limit for this prestaging period begins when the first set of equipment is removed from its specified reasonable protection configuration. The prestaging period is complete when all sets of redundant or alternate equipment for a specific function are returned to a reasonable protection configuration that meets the criteria of this regulatory guide and NEI 12-06, Revision 4.

3.3. Deployment of Equipment

Sections 5 through 9 of NEI 12-06, Revision 4, discuss methods for transporting the equipment from the location in which it is stored to the location in which it would be used. These sections additionally discuss the connection of the equipment to structures, systems, and components (SSCs) necessary for completion of 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 and Appendix B 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 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 non-functional for any reason, with the duration of the acceptable time period being 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 non-functional 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 (Ref. 46), 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 non-functional 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 non-functional are limited to 14 days in order to avoid displacing maintenance actions for other safety-significant equipment or SSCs.

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

Sections 50.155(b) and (b)(1) require 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 § 50.155(b) receive 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 the EPRI technical report 3002000623, "Applications Center: Preventive Maintenance Basis for FLEX Equipment – Project Overview Report" (Ref. 47). The EPRI technical report 3002000623 was endorsed by NRC letter dated October 7, 2013 (Ref. 48).

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 § 50.155(b) and (b)(1).

5. Configuration Control

Sections 50.155(b) and (b)(1) require that applicants or licensees maintain strategies and guidelines to mitigate beyond-design-basis external events from natural phenomena that result in a loss of all ac power concurrent with either an LUHS or, for nuclear power plants with passive reactor designs, a loss of normal access to the normal heat sink.

Section 50.155(f) allows licensees to make changes to the implementation of the requirements of 10 CFR 50.155 without NRC approval provided that the licensee demonstrates that 10 CFR 50.155 continues to be met prior to making the change and maintains documentation of changes.

Section 11.8 of NEI 12-06, Revision 4, discusses the configuration control of the strategies and guidelines as well as the maintenance of an overall program document and record of changes.

Staff Position: Section 11.8 of NEI 12-06, Revision 4, provides an acceptable method for maintaining configuration control under 10 CFR 50.155(b)(1) and (f).

6. Coordination with Severe Accident Management Guidelines

In SRM-COMSECY-15-0065 (Ref. 49), the Commission directed the NRC staff to "ensure that any NRC-endorsed guidance for the proposed rule will provide for appropriate coordination of the FLEX support guidelines, extreme damage mitigating guidelines, and voluntarily maintained SAMGs [Severe Accident Management Guidelines] with the existing emergency operating procedures (EOPs) at each plant…."

Section 3.2.1.10 of NEI 12-06, Revision 4, provides criteria for the selection of parameters to be monitored as part of the minimum set of parameters necessary to support strategy implementation. These criteria include the ability to demonstrate the success of the strategies at maintaining the key safety functions, as well as indicating imminent or actual core damage to facilitate a decision to manage the response to the event within the EOPs and FSGs or within the SAMGs.

Section 11.4 of NEI 12-06, Revision 4 provides that FSGs will be used to supplement (not replace) the existing procedures that establish the command and control for the event. This section further provides that the existing command and control procedure structure will be used to transition to SAMGs if FLEX mitigation strategies are not successful.

Staff Position: Sections 3.2.1.10 and 11.4 provide appropriate coordination between the FSGs and SAMGs, retaining command and control direction as defined within the EOPs unless and until a licensee transitions to the use of SAMGs.

7. Guidance for AP-1000 Design

Appendix F of NEI 12-06, Revision 4, provides specific guidance for licensees with reactors of the AP-1000 design on how to satisfy provisions of the aforementioned regulations for sufficient offsite resources to sustain functions indefinitely.

Staff Position: The guidance of NEI 12-06, Revision 4, Appendix F, provides an acceptable means to meet the requirements of 10 CFR 50.155.

D. IMPLEMENTATION

The purpose of this section is to provide information on how applicants and licensees[1] may use this guide and information regarding the NRC's plans for using this RG. In addition, it describes how the NRC staff complies with the Backfit Rule found in 10 CFR 50.109, "Backfitting," and any applicable finality provisions in 10 CFR Part 52.

Use by Applicants and Licensees

Applicants and licensees may voluntarily[2] use the guidance in this document to demonstrate compliance with the underlying NRC regulations. Methods or solutions that differ from those described in this RG may be deemed acceptable if they provide sufficient basis and information for the NRC staff to verify that the proposed alternative demonstrates compliance with the appropriate NRC regulations. Current licensees may continue to use guidance the NRC found acceptable for complying with the identified requirements as long as their current licensing basis remains unchanged.

Licensees may use the information in this RG for actions that do not require NRC review and approval. Licensees may use the information in this RG or applicable parts to resolve regulatory or inspection issues.

Use by NRC Staff

The NRC staff does not intend or approve any imposition or backfitting of the guidance in this RG. The NRC staff does not expect any existing licensee to use or commit to using the guidance in this RG. The NRC staff does not expect or plan to request licensees to voluntarily adopt this RG to resolve a generic regulatory issue. The NRC staff does not expect or plan to initiate NRC regulatory action that would require the use of this RG without further backfitting or forward fitting consideration. Examples of such unplanned NRC regulatory actions include issuance of an order requiring the use of the RG, generic communications, or a rule requiring the use of this RG.

During regulatory discussions on plant-specific operational issues, the staff may discuss with licensees various actions consistent with staff positions in this RG, as one acceptable means of meeting the underlying NRC regulatory requirement. Such discussions would not ordinarily be considered backfitting. However, unless the facility license requires use of this RG, the staff may not represent to the licensee that the licensee's failure to comply with the positions in this RG constitutes a violation.

If a licensee believes that the NRC is either using this RG or requesting or requiring the licensee to implement the methods or processes in this RG in a manner inconsistent with the discussion in this Implementation section, then the licensee may file a backfit appeal with the NRC in accordance with the guidance in NUREG-1409, "Backfitting Guidelines" (Ref. 50), and the NRC Management Directive 8.4, "Management of Facility-Specific Backfitting and Information Collection" (Ref. 51).

1 In this section, "licensees" refers to holders of, and "applicants" refers to applicants for, licenses for nuclear power plants under 10 CFR Parts 50 and 52.

2 In this section, "voluntary" and "voluntarily" means that the licensee is seeking the action of its own accord, without the force of a legally binding requirement or an NRC representation of further licensing or enforcement action.

REFERENCES[3]

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2. Nuclear Energy Institute (NEI) document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 4, dated September 2016, Washington, DC. (ADAMS Accession No. ML16354B421)[4]

3. CFR, Title 10, "Energy," Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

4. U.S. Nuclear Regulatory Commission (NRC), Regulatory Guide (RG) 1.227, "Wide-Range Spent Fuel Pool Level Instrumentation," Washington, DC.

5. NEI, document NEI 12-02, "Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation'," Revision 1, dated August 2012, Washington, DC. (ADAMS Accession No. ML12240A307)

6. NRC, SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011, Washington, DC. (ADAMS Accession No. ML11186A950)

7. NRC, SRM-SECY-11-0093, "Staff Requirements – SECY-11-0093 – Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated August 19, 2011, Washington, D.C. (ADAMS Accession No. ML112310021)

8. NRC, SECY-11-0124, "Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," dated September 9, 2011, Washington, DC. (ADAMS Accession No. ML11245A158)

9. NRC, SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011, Washington, DC. (ADAMS Accession No. ML11272A111)

10. NRC, SRM-SECY-11-0124, "Staff Requirements - SECY-11-0124 - Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," dated October 18, 2011, Washington, DC. (ADAMS Accession No. ML112911571)

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3 Publicly available documents from the NRC are available electronically through the NRC Library on the NRC's public Web site at http://www.nrc.gov/reading-rm/doc-collections/. The documents can also be viewed on-line for free or printed for a fee in the NRC's Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone (301) 415-4737 or (800) 397-4209; fax (301) 415 3548; and e-mail pdr.resource@nrc.gov.

4 Publications from the Nuclear Energy Institute (NEI) are available at their Web site: http://www.nei.org/ or by contacting the headquarters at Nuclear Energy Institute, 1776 I Street NW, Washington DC 20006-3708, Phone: 202-739-8000, Fax 202-785-4019.

11. NRC, SRM-SECY-11-0137, "Staff Requirements - SECY-11-0137 - Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated December 15, 2011, Washington, DC. (ADAMS Accession No. ML113490055)

12. NEI, letter from Adrian Heymer (Nuclear Energy Institute) to David L. Skeen (NRC), "*An Integrated, Safety-Focused Approach to Expediting Implementation of Fukushima Dai-ichi Lessons Learned*," dated December 16, 2011, Washington, DC. (ADAMS Accession No. ML11353A008)

13. 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," dated February 17, 2012, Washington, DC. (ADAMS Accession No. ML12039A103)

14. 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," dated March 9, 2012, Washington, DC. (ADAMS Accession No. ML120690347)

15. 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, Washington, DC. (ADAMS Accession No. ML12054A736)

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22. NRC, Response to Public Comments on JLD-ISG-2012-01 (Docket ID NRC-2012-0068), dated August 29, 2012, Washington DC. (ADAMS Accession No. ML12229A253)

23. NEI, document 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision C, July 3, 2012, Washington, DC. (ADAMS Accession No. ML15027A542)

24. NEI, letter from Scott A. Bauer, NEI, to Steven D. Bloom, NRC, "Transmittal of Draft Revision 0 of NEI 12-06, 'Diverse and Flexible Coping Strategies (FLEX) Implementation

Guide,'" Draft Revision 0, August 3, 2012, Washington, DC. (ADAMS Accession No. ML12221A204)

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26. NRC, JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events," Revision 0, Issued August 2012, NRC, Washington, DC. (ADAMS Accession No. ML12229A174)

27. NEI, document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 1, dated October 2015, Washington, DC. (ADAMS Accession No. ML15244B006)

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29. 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," Draft Revision 1, dated October 30, 2015, Washington, DC. (ADAMS Accession No. ML15294A078)

30. 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, Washington, DC. (ADAMS Accession No. ML15357A147)

31. NRC, Draft Regulatory Guide (DG)-1301, "Flexible Mitigation Strategies for Beyond-Design-Basis Events," dated November 30, 2015, Washington, DC. (ADAMS Accession No. ML13168A031)

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45. IAEA SSG-54, "Accident Management Programmes for Nuclear Power Plants," Vienna, Austria, 2019

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47. Electric Power Research Institute (EPRI) technical report 3002000623, "Applications Center: Preventive Maintenance Basis for FLEX Equipment – Project Overview Report," Palo Alto, CA[6] (ADAMS Accession Number ML13276A573)

5 Copies of International Atomic Energy Agency documents may be obtained through its Web site: http://www.iaea.org/ or by writing the International Atomic Energy Agency, P.O. Box 100, Wagramer Strasse 5, A-1400, Vienna, Austria.

6 Copies of Electric Power Research Institute (EPRI) documents may be obtained by contacting the Electric Power Research Institute, 3420 Hillview Avenue, Palo Alto, CA 94304, Telephone: 650-855-2000 or on-line at http://www.epri.com.

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