

## Comments on Station Blackout Mitigation Strategies Regulatory Basis and Draft Rule Concepts

### General Comments

The industry agrees with the NRC's statement on page 20 of the draft regulatory basis that the "staff considers it to be reasonable to assume as a starting point that the impacts of a potential rule would largely be the same as those currently being incurred as a result of the implementation of Order EA-12-049." Given the similarities between the goals of the rulemaking contemplated and EA-12-049, and the extensive industry efforts already underway to comply with EA-12-049, NEI believes the rulemaking should be primarily focused on codifying requirements substantially similar to those that will be implemented as a result of compliance with EA-12-049 in order to minimally impact completed implementation actions. It is entirely appropriate, however, to include improvements or additional flexibility as a result of lessons learned from implementing the Order.

The industry believes that the current station blackout (SBO) rule contained in 10 CFR § 50.63 should not be modified as part of this rulemaking. The existing SBO rule was the subject of an extensive regulatory and backfit analysis,<sup>1</sup> has adequately protected public health and safety, and is well understood by both the industry and NRC. Successful implementation of the existing rule has meaningfully reduced the risk of core damage associated with extended loss of alternating current ("ac") power. Industry recommends that regulatory requirements that address extremely low probability, beyond-design-basis external events resulting in the need to cope with station blackout over periods of time exceeding the coping durations imposed by the existing SBO rule should be dealt with in a separate section of the regulations. The industry agrees that during a SBO (10 CFR 50.63) event a decision needs to be made as to whether or not to deploy the Extended Loss of ac Power mitigating strategies depending on the progression of the SBO event and, in fact, this provision is contained in Section 3.2.2(1) of NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide. Despite this fact, the SBO capability and basis is significantly different from the ELAP capability and basis, and, for this reason, should be addressed separately in the regulations.

NEI agrees that the rule should be performance-based rather than prescriptive. The draft regulatory basis discusses many details of a proposed rule as though each of those details belong in the rule itself. While NEI agrees that many of those details need to be addressed, NEI believes most of those details more appropriately belong in associated guidance rather than the rule itself.

### Specific Comments

The following are specific comments on the draft document noticed in the *Federal Register* on April 10, 2013.

The comments below are organized around the topics identified in Appendix A of the draft Regulatory Basis Document.

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<sup>1</sup> "Regulatory/Backfit Analysis for the Resolution of Unresolved Safety Issue A-44, Station Blackout," NUREG-1109, June 1988.

## 1. Draft Regulatory Basis - Title

The NRC staff intends to title this new regulation such that it conveys the central focus of the requirements. Accordingly, the title should reflect that the new requirements are fundamentally addressing two situations:

1. Extended loss of all ac power conditions resulting from beyond-design-basis external events where it is unlikely ac power will be recovered in the short term.
2. Station blackout conditions that stem from loss of offsite power events with multiple onsite failures of emergency power sources that extend longer than the specified durations of 50.63.

The NRC staff could entitle this effort: Extended Loss of All Alternating Current Power Conditions from Station Blackout and Beyond-Design-Basis External Events.

### **Industry Comments**

*The proposed title includes a description of the causal factors of the Extended Loss of All Alternating Current Power (ELAP). It is not necessary to include the causal factors in the title of the proposed regulation. As discussed in Item 3 (Definitions) below, the definition of ELAP should address the conditions that constitute an ELAP and provide adequate differentiation with a SBO as defined for 10 CFR 50.63. The title of the regulation should be Extended Loss of ac Power Mitigation Strategies. The word "all" should not be used in the title due to the provision in the proposed rule for ac power from inverters fed by safety-related batteries, as well as, for supplemental ac power sources as discussed in Item 6 below.*

## 2. Draft Regulatory Basis - Applicability

The NRC staff anticipates that the new provisions should apply to all power reactors, both from a design and operation perspective. The new regulation may reflect some of the following requirements:

1. The requirements to develop, implement, and maintain mitigation strategies would apply to all operating power reactor license and combined license holders (part 50 and part 52) because these requirements would need to reflect aspects of the detailed plant design, which might not be known until the later stages of construction.
2. Design requirements, including requirements that relate to the need to have connections for portable equipment, protection of portable equipment, and maintenance and testing of equipment would be directed to operating license applicants and licensees (Part 50).
3. Design requirements, including requirements that relate to protection of the equipment, could be addressed by design certification holders and applicants, or combined license holders or applicants, depending on the nature of the requirement and the equipment relied upon for mitigation. Requirements that relate to the need to have connections for portable

equipment could be addressed by design certification holders and applicants. Requirements that involve the protection of portable equipment could be addressed by either the design certification holders or applicants or combined license holders or applicants. Lastly, requirements for maintenance and testing of equipment would be directed to the combined license holders or applicants.

4. Requirements for design certification holders and applicants in item 3 of this section would equally apply to standard design approval and manufacturing license holders and applicants.
5. Cessation of the requirements would be keyed to when a licensee decides to terminate operations (under 10 CFR 50.82 and 10 CFR 52.110) and provides the NRC with the applicable certifications. When a licensee certifies that it has permanently removed the fuel from the reactor vessel, the mitigation strategies requirements, with the exceptions of those applicable to maintaining or restoring spent fuel pool cooling, would end. The remainder of the requirements could be terminated when the fuel is removed from the spent fuel pool and is stored in dry conditions in accordance with Commission requirements under 10 CFR part 72 or when all nuclear fuel for the reactor unit is permanently removed from the site (10 CFR part 73).

### **Industry Comments**

*NEI agrees that the new rule provisions should be applicable to all power reactors. The specific requirements applicable to new power reactor designs, however, should be provided in the endorsed guidance associated with the rule as has been done currently in Appendix F of NEI 12-06 for the AP1000 design. The distinction as to how and by whom (i.e., design certification applicant or holder, or combined license applicant or holder) the requirements are met does not need to be specified in the rule applicability.*

### **3. Draft Regulatory Basis - Definitions**

The NRC staff intends to define a new term that would apply to the new requirements: extended loss of all ac power (ELAP). The intent is for the defined term to support the establishment of clear requirements and also more clearly delineate the differences between the new requirements and those that currently reside in 10 CFR 50.63. The definition of ELAP as currently envisioned would include:

1. A complete loss of ac power to the essential and non-essential switchgear buses.
2. Loss of offsite electric power system concurrent with turbine trip.
3. Unavailability of the onsite emergency ac power sources and offsite ac power sources for a duration that is longer than the specified duration determined in accordance with 10 CFR 50.63.
4. Unavailability and potential non-recoverability of the offsite power source and onsite emergency and alternate ac power sources (with the exception of supplemental ac power sources per number 7 of this "Definitions" section) for beyond-design-basis external events.

5. Exception: Initially ac power from inverters fed by safety-related batteries could be assumed available to support development of the strategies, provided this equipment is reasonably protected including the portions of the distribution system that are used.
6. Exception: Supplemental ac power sources that meet the new requirements (which would be specified in the new section) would be allowed to restore ac power.
7. Exception: Portable equipment that meets the new requirements would be allowed to maintain or restore functions.

There is a significant challenge to establishing requirements for what are fundamentally unbounded events (i.e., beyond-design-basis external events). This definition would provide a sufficient description of a damage state that enables, from a practical standpoint, the development of strategies and guidance that in turn are intended to mitigate that condition through the use of an approach that uses both installed and portable equipment to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities. An ELAP differs from a station blackout as envisioned under 10 CFR 50.63 in several fundamental ways. For beyond-design-basis external events, ac power may not be restored for a long period of time from either onsite or offsite. Additionally, such events are expected to impact the entire reactor site and the severe conditions associated with such events can adversely impact structures, systems, and components on the site. Accordingly, the definition is intended to support development of mitigation strategies that provide additional means to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities, simultaneously, for an indefinite period of time, for the entire reactor site.

An additional consideration on the use of an ELAP definition is not to unduly constrain the proposed provisions. A key attribute of sound strategies is the incorporation of contingency measures that provide alternate means for successfully maintaining or restoring functions should the event result in failures or potential challenges to the mitigation strategies. For example, the primary means for hooking up a portable pump may not be available due to failures or event conditions, and so the mitigation strategies should employ backup approaches for equipment connections. Another example is if the event results initially in a more severe condition such that dc power is also lost. In this circumstance, the alternate measure might involve local manual actions to operate a turbine-driven pump.

The ELAP condition, as a direct consequence, causes all ac-powered pumps to fail due to a loss of ac power to the essential and nonessential buses, which typically leads to a loss of capability to remove heat to the ultimate heat sink due to reliance on ac-powered pumps to move water. So while EA-12-049 identified the loss of normal access to the ultimate heat sink as a separate condition, it is viewed as a direct consequence of an ELAP for active plants having piping considered to be robust for external events. However, for passive plants, loss of normal access to the normal heat sink resulting from non-safety related pipe failures may challenge the long term core cooling, containment, and SFP cooling capabilities as identified in the Order.

Finally, the NRC staff believes there is merit to offering additional design flexibility not allowed by EA-12-049. As discussed below, these provisions would allow for use of robust supplemental ac sources to restore power following beyond-design-basis events.

### **Industry Comments**

*The NRC intends to define an extended loss of all ac power (ELAP). ELAP in NEI 12-06 is an acronym for extended loss of ac power (the word "all" is not included). The acronym needs to be consistent. NEI does not believe the word "all" is appropriate since NEI 12-06 states that ac power to buses fed by station batteries through inverters is not lost. Additionally, the proposed provision for supplemental ac sources in the draft regulatory basis creates an exception to the use of "all" that may be avoided if "all" is not used.*

*In item 3 above, the inference is that ELAP actions are taken when the coping duration of the SBO has expired. In fact, the ELAP analyses may require actions to be taken prior to the completion of the SBO coping duration in order to ensure their success. Section 3.2.2(1) of NEI 12-06 addresses the need to procedurally direct a timely decision on when an SBO condition has become an ELAP condition. In addition, item 3 should also include unavailability of any alternate ac source along with unavailability of onsite emergency ac power sources and offsite ac power sources.*

*Item 4 above should refer to number 6 in the Definitions section as opposed to number 7.*

*The last phrase of item 5 above should use the words from NEI 12-06 to be more accurate. The phrase currently says "provided this equipment is reasonably protected including the portions of the distribution system that are used" and NEI 12-06 says, "provided they are protected consistent with current station design." Additionally, the first phrase of the exception treats the availability of ac power from inverters more speculatively than NEI 12-06 which says it is available and not just initially.*

*The paragraph that starts "An additional consideration..." discusses contingency measures that are included in NEI 12-06. NEI 12-06 provides a baseline coping strategy that is supported by analyses to demonstrate its success at maintaining the key safety functions. The guidance also includes contingency measures in case the initial conditions are different from those assumed in the baseline strategy. These contingency measures or capabilities are available to be used but are not part of the analysis for the baseline coping strategies. As such, these contingency capabilities may or may not maintain or restore key safety functions under particular circumstances. The paragraph in question implies that they would be successful.*

*In the penultimate paragraph of this section of the draft regulatory basis, the second sentence states, "So while EA-12-049 identified the loss of normal access to the ultimate heat sink as a separate condition, it is viewed as a direct consequence of an ELAP for active plants having piping considered to be robust for external events." The loss of normal access to the ultimate heat sink requirement as implemented in NEI 12-06 is not limited to a consequence of the loss of ac power. However, if the loss of normal access to the ultimate heat sink was only due to loss of ac power, mitigating strategies would be appropriate to restore power to these pumps. Since all plant designs are not the same, it would be appropriate to allow licensees to use the proposed consequential-failure approach with the appropriate justification.*

#### **4. Draft Regulatory Basis - Mitigating Strategies Requirements**

The NRC staff currently intends that the new section would contain requirements for licensees to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel cooling capabilities for an ELAP condition. The NRC staff anticipates that these provisions would contain elements such as:

1. Requirements to develop, implement, and maintain guidance and strategies to maintain core cooling, containment, and spent fuel cooling capabilities for ELAP at all of the licensee's units on a site, and to restore such capabilities if one or more is lost.
2. The mitigating strategies would be adapted for implementation in each mode (as defined in the technical specifications for each unit).
3. The mitigating strategies would use or rely upon equipment of sufficient design and capacity, given consideration to the nominal conditions that could be expected, so that core cooling, containment, and spent fuel pool cooling functional capabilities can be maintained or restored for ELAP conditions.
4. The mitigating strategies would consider contingencies for when the primary means of accomplishing a function is lost or challenged.
5. The mitigating strategies would be integrated into the existing plant procedures and guidance for station blackout conditions, so that if a loss of all ac power event exceed the specified duration determined pursuant to 10 CFR 50.63 (or for licensees that use an alternate ac power source, if that source also fails), the mitigation strategies would be implemented to maintain or restore core cooling, containment, and spent fuel pool cooling.
6. The mitigating strategies would accommodate and use offsite assistance and resources to enable the functional capabilities to be indefinitely sustained.
7. The strategies would consider, and plan for, damage to the transportation infrastructure resulting from a beyond-design-basis external event that could adversely impact transportation to the site of offsite resources necessary to maintain the functional capabilities (i.e., core cooling, containment, and spent fuel pool cooling).

8. The strategies and supporting procedures would be in accordance with the requirements of the Recommendation 8 rulemaking "Onsite Emergency Response Capabilities," which is intended to integrate emergency operating procedures, severe accident mitigation guidelines, extensive damage mitigation guidelines, and the new mitigating strategies that would be required by this rulemaking.

Currently, the NRC intends to maintain an approach, consistent with EA-12-049, that is fundamentally performance-based and does not prescriptively establish minimum time periods for the different phases associated with implementation of the mitigation strategies. Instead, licensees would be required to develop their strategies such that the phases overlap and, as a result, the key functions are maintained or can be restored. However, the NRC staff also recognizes that there may be merit to having a baseline minimum capacity for withstanding ELAP conditions during the first portion of the response, which relies on installed equipment and recognizes a need for event assessment and reduces reliance on human action in the event. The staff NRC expects that EA-12-049 implementation feedback will further inform this issue.

The NRC is currently intending to continue to use the terminology "guidance and strategies" in the new rule provisions recognizing that this language has been used extensively since 2002 (Section B.5.b of the Interim Compensatory Measures Order, EA-02-026, issued on February 25, 2002, and in follow-on regulatory actions and guidance including 10 CFR 50.54(hh)(2)). However, the NRC also notes that it has historically used the term "guidance" to refer to NRC approved or endorsed approaches (i.e., regulatory guidance) for complying with regulations, rather than as a requirement itself (such as is done under 50.54(hh)(2), in which licensees are required to formulate "guidance"). Stakeholders are welcome to provide feedback on the benefit of defining "guidance and strategies" or using different terminology in order to avoid any confusion that might stem from this usage, or whether stakeholders feel this terminology is well understood and does not require definition.

The NRC currently intends to require that mitigation strategies be developed such that they can be implemented "in all modes," and the NRC would simply refer the licensee's existing technical specifications to define what "mode" means. Stakeholders are welcome to provide feedback on whether there is a benefit to defining this terminology for this specific set of requirements, which the NRC recognizes is fundamentally a beyond-design-basis event situation and therefore creates potential confusion when references are made to technical specifications.

### **Industry Comments**

*The essence of the numbered items above is incorporated into the endorsed guidance in NEI 12-06. To avoid any unintended consequences from a new set of terminology, the language in the rule should align with that endorsed in NEI 12-06.*

*With regard to Item 4 in the list, NEI 12-06 addresses primary and alternate strategies or connection points and also addresses contingencies if the initial conditions of the event are different from the baseline assumptions. Primary and alternate strategies and connection points are distinct from*

*contingencies and that distinction needs to be retained. In addition, see the comments in Section 3 above regarding contingencies.*

*With regard to Item 5 in the list, see the comments in Section 3 above related to Section 3.2.2(1) of NEI 12-06.*

*Minimum baseline capability- The draft regulatory basis states that the "staff also recognizes that there may be merit to having a baseline minimum capacity for withstanding ELAP conditions during the first portion of the response, which relies on installed equipment." Currently, neither Order EA-12-049 nor the endorsed guidance in NEI 12-06 requires a minimum capacity to withstand ELAP conditions during Phase 1 using installed equipment. To add such a requirement in the rulemaking would result in a significant change to the strategies plants are currently in the process of implementing in response to the Order and could impact existing capabilities and strategies in place for 10 CFR 50.63. The performance-based approach currently being implemented requires each licensee to justify their ability to deploy the mitigating strategies in the time required by their site-specific analysis. Per NEI 12-06, the "Justification for the duration of each phase will address the on-site availability of equipment, the resources necessary to deploy the equipment consistent with the required timeline, anticipated site conditions following the beyond-design-basis external event, and the ability of the local infrastructure to enable delivery of equipment and resources from off-site."*

*In the last paragraph of this section the NRC states that they intend to require that mitigation strategies be developed such that they can be implemented "in all modes." Based on the experience gained in the implementation of Order EA-12-049, NEI suggests use of alternate wording to avoid confusion. The alternate wording would be can be implemented "for an event initiating from any mode (as defined by technical specifications) or condition with fuel in the reactor or spent fuel pool."*

*Guidance and strategies- When referring to guidance endorsed by the NRC such as NEI 12-06, NEI prefers the use of the term "endorsed guidance." When referring to "guidance and strategies" in, for example, FLEX support guidelines, then the term guidelines should be used instead of guidance.*

## **5. Draft Regulatory Basis - Design Requirements**

The NRC staff currently intends for the new regulation to contain design requirements applicable to the equipment used to mitigate ELAP conditions. Though in some cases the elements described below may reside in supporting guidance (to avoid unnecessarily prescriptive requirements), these requirements may include:

1. Equipment used for the mitigation of ELAP conditions would be designed to perform its functions as relied upon in the mitigation strategies.

2. Portable equipment relied upon in the mitigating strategies for the mitigation of ELAP conditions would be independent from installed structures, systems, and components credited in the safety analysis to accomplish the same functions.
3. Portable equipment relied upon in the mitigating strategies would be designed, stored, and protected to minimize common cause and common mode failure with installed structures, systems, and components credited in the safety analysis for the same function. This would include the need to provide protection of portable equipment from the effects of beyond-design-basis external events.
4. Portable equipment relied upon in the mitigating strategies would be designed, staged, and deployed to minimize the potential for damage or impairment to safety-related structures, systems, and components.
5. There would be a requirement to have sufficient sets of portable equipment to enable the equipment to be removed from service for maintenance.
6. Equipment relied upon in the mitigating strategies for the mitigation of ELAP conditions would be designed to permit periodic inspection and testing to enable its functional performance to be tested periodically.
7. A test program would be established to assure that equipment relied upon in the mitigating strategies for the mitigation of ELAP conditions will perform satisfactorily in service, and this test program would be performed in accordance with written test procedures that incorporate the acceptance limits.

The objective of the design requirements would be to have an appropriate level of assurance that SSCs relied upon in the mitigating strategies to mitigate ELAPs are designed to have a capability and capacity to function for the expected conditions, to be protected from the effects of beyond-design-basis external events, and to have an appropriate level of maintenance and testing to conclude that there is assurance that the equipment remains functional and available. A key element of these requirements would involve protection of this equipment from the effects of beyond-design-basis external events. The principal focus is towards portable equipment because installed equipment that would be initially relied upon (not powered from the onsite emergency ac power system and therefore potentially available such as turbine-driven pumps) would typically be designed to safety-related standards and as such would be protected by design from external events (per GDC-2) and therefore considered to have reasonable protection. This could be satisfied in part by having multiple sets of equipment stored in different locations to increase the likelihood that sufficient portable equipment remains available for event mitigation. However, the NRC staff recognizes that new reactors, through design and siting, can significantly reduce the risk associated with external events (e.g., location of a new reactor on a dry site can remove external flooding as a significant risk consideration), and as such the staff believes there is merit to having framework flexibility to allow for approaches that rely to a greater extent on engineered features, including flexibility for a supplemental ac power source as discussed below.

With regard to testing, the staff notes that mitigation of ELAP events places heavy reliance on batteries, and as such, testing would need to provide assurance that batteries will function for the conditions and time periods required. Additionally, the NRC staff is considering whether there needs to be (in guidance or requirements) specific limits on a minimum condition for batteries (such as a minimum voltage or some other more applicable parameter) such that when, and if, ac power is recovered, there is sufficient battery capacity to support the actions needed to provide ac power to the emergency buses and/or the associated motor control centers, including reenergizing emergency diesel generator exciter fields to allow starting the generators.

### **Industry Comments**

*Design requirements for the portable equipment have been established in the endorsed guidance in NEI 12-06. These design requirements are being used in the current implementation of Order EA-12-049. To develop a substantially different list of design requirements at this point as proposed in the list provided above, would result in significant and unwarranted changes when the rule becomes effective. The design requirements discussed in this section should align with those contained in NEI 12-06, and, ultimately, should reside in that guidance document and not in the rule.*

*Throughout this section of the draft rule concepts the use the terms "equipment" and "portable equipment" are used interchangeably. The design requirements should apply to portable equipment that will be deployed as part of a mitigation strategy. It should be made clear that these design requirements do not apply to installed equipment relied upon in Phase 1 which has its own design requirements.*

*Item 2- This design requirement should be revised to clarify that portable equipment will be used in the mitigating strategies for the mitigation of ELAP conditions without discussion of it being independent from installed structures, systems and components. FLEX strategies are based on the use of portable equipment with reliance on portions of installed structures, systems, and components to accomplish functional requirements. Use of the term independent in the context of portable equipment and mitigating strategies can cause confusion since the mitigating strategies are not accomplished completely independent of installed structures, systems and components.*

*Item 3- The NRC discusses the protection of portable equipment and states that, "This would include the need to provide protection of portable equipment from the effects of beyond-design-basis external events." Protecting portable equipment from the effects of beyond-design-basis external events has no bounds. The language used in NEI 12-06 that "support equipment will be reasonably protected from applicable external events" should be used to maintain the concept of reasonable protection.*

*Batteries - The mitigating strategies do address the use of portable equipment to recharge batteries and/or supply the dc buses while the battery still remains functional. Success of the strategies depends on maintaining a functional dc bus. As such, dc power would be available for actions necessary to restore ac power. Individual plant strategies will justify the use of the batteries during*

*Phase 1 and the timeline for deployment of portable equipment to recharge the batteries or provide power to the dc bus.*

*Specific limits should not be established for a minimum condition for batteries such that when, and if, ac power is recovered, there is sufficient battery capacity to support the actions needed to provide ac power to the emergency buses and/or the associated motor control centers. The FLEX mitigating strategies provide for indefinite coping by use of portable power and pumps, including portable generators to recharge station batteries, therefore, addressing restoration of ac power is not necessary. Furthermore, the endorsed guidance in NEI 12-06 states that, "Recovery of the damaged plant is beyond the scope of FLEX capabilities as the specific actions and capabilities will be a function of the specific condition of the plant and these conditions cannot be known in advance."*

#### **6. Draft Regulatory Basis - Design Flexibility to Use a Supplemental AC Power Source**

Currently, the NRC staff envisions that the new requirements could provide more engineering flexibility than EA-12-049 requirements and allow for the supplemental ac power source(s) to be used to restore power following a beyond-design-basis external event. Supplemental ac power source(s) would be subject to requirements that contain the following:

1. The supplemental ac power source would be required to be electrically independent from the emergency ac power sources.
2. The supplemental ac power source may be required to be diverse in design from the normal emergency ac power sources.
3. The supplemental ac power source would be required to be physically located to minimize the potential for common cause failure stemming from external events, where warranted, based on the nature and magnitude of the external events applicable to that site.
4. The supplemental ac power source(s) would be required to have sufficient combined capacity and capability to operate the equipment necessary to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities following a beyond-design-basis external event for each reactor unit at a site.
5. The supplemental ac power source would be required to have the capability to supply power through physically and electrically separate pathways to multiple electrical distribution systems or motor control centers that provide power to the equipment important to maintaining or restoring core cooling, containment, and spent fuel pool cooling capabilities.
6. The supplemental ac power source would be required to be designed for, and protected from, the effects of external events with margin at least equivalent to that of all SSCs to which the supplemental ac source supplies power.
7. The supplemental ac power source would be required to be designed to interact with connected SSCs to minimize the potential for damage to both the connected SSCs and itself.

The NRC staff recognizes the advantages of having an installed capability to restore power following events that lead to ELAP conditions. Such a design capability would reduce the reliance on human action. At a high level, the design requirements the NRC staff would place on this power source would be intended to provide assurance that it would be available following beyond-design-basis external events. Accordingly, the design requirements are intended to ensure a level of protection for the supplemental ac power source from event effects that meets or exceeds the level of protection of the equipment that this power source would supply. A key objective for the supplemental ac power source is that it be able to withstand extreme events, while recognizing that at some point these extreme events would destroy the powered equipment. Accordingly, there is a practical limit to protection for the supplemental ac power source beyond which there is little or no safety benefit. The supplemental power source would need to be electrically independent from the class 1E emergency ac power sources to minimize the likelihood of adverse interactions and consequential failures between the power sources. Also, locating the supplemental power sources physically away (within practical limits) from the unit's class 1E emergency ac power sources would reduce the likelihood that adverse effects from a beyond-design-basis external event could cause the complete failure of all the ac power sources. Whether physical separation is needed and beneficial would depend on the nature and magnitude of the external events that impact the site.

Use of a supplemental ac power source would reduce, but not eliminate, reliance on mitigation strategies. Beyond-design-basis external events can have catastrophic impacts on the offsite ac power system, and as a result, the final phase of the mitigation strategies associated with the use of offsite assistance and resources to replenish consumables on site would appear to be needed in all cases. Additionally, the severity of these events may mean that manual actions to align the supplemental ac power source may not be taken for some period of time, so that an initial reliance on installed equipment and portable equipment may still be required until the supplemental ac power source can be used to restore ac power.

### **Industry Comments**

*This section discusses general requirements for use of supplemental ac sources, however, additional clarification is needed that use of supplemental ac power sources would be an option and not a requirement.*

*While the provision for the use of supplemental ac power sources belong in the rule, the specifications and protection requirements for such equipment belong in the guidance and not in the rule. These requirements have already been established in the endorsed guidance in NEI 12-06. To develop a substantially different list of design requirements at this point could result in significant and unwarranted changes.*

*Items 4 and 5 imply that the supplemental ac source must be capable of restoring power to equipment necessary to maintain or restore all three key safety functions. Use of the supplemental ac power source should also be allowed for individual strategies for any of the key safety functions.*

*Item 5- This item states that the supplemental ac power source "would be required to have the capability to supply power through physically and electrically separate pathways...." NEI 12-06 stipulates the provision of primary and alternate methods to repower key equipment. The proposed wording should be consistent with NEI 12-06 for consistency.*

*Item 6 states the supplemental ac source would need "to be designed for, and protected from, the effects of external events..." Designed for and protected from are redundant requirements. The phrase should say "designed for or protected from" the effects of external events.*

*Item 6 also states, the supplemental ac power source would be designed "with margin at least equivalent to that of all SSCs to which the supplemental ac source supplies power." This appears to be saying the supplemental ac source would need to be designed to current plant design requirements for safety-related equipment which does not align with the provisions for the mitigating strategies being implemented under Order EA-12-049. This pedigree for this equipment, however, raises an important question about its intended use. Specifically, it is not clear if the proposed provision for supplemental ac sources in the rule is meant to reduce the likelihood of having to deploy the mitigating strategies capabilities implemented under the Order (i.e., as a preventive measure) or as an option to the mitigating strategies capabilities implemented under the Order (i.e., as a mitigative measure). If it is the former, then the pedigree of the equipment would not seem to matter because it is backed up by mitigating strategies that will maintain or restore key safety functions indefinitely. Various discussions of the supplemental ac sources throughout the draft regulatory basis appear to support either conclusion and warrant further clarification.*

*NEI supports the use of supplemental ac sources for both preventive and mitigative purposes. Section 2.1 of NEI 12-06 states, "While initial approaches to FLEX strategies will take no credit for installed ac power supplies, longer term strategies may be developed to prolong Phase 1 coping that will allow greater reliance on permanently installed, bunkered or hardened ac power supplies that are adequately protected from external events."*

## **7. Draft Regulatory Basis - Control of Changes**

The NRC believes that there is a need to include a change control requirement in the draft rule in recognition that the guidance and strategies apply to beyond-design-basis situations and the current change control requirements of 10 CFR 50.59 may not be effective under such circumstances. The NRC staff believes that change control would involve elements such as:

1. Licensees could make changes to the strategies and equipment required by the new provisions without obtaining a license amendment pursuant to 10 CFR 50.90, provided no existing requirements are triggered that result in the need for prior NRC approval, and only if the licensee performs and retains an evaluation that shows that the guidance, strategies and supporting equipment, as changed, continue to meet the new mitigation strategy requirements.

2. Licensees would be required to retain an auditable record of each change to the guidance, strategies, and supporting equipment.

The intent of the change control is to ensure that the mitigating strategies continue to be able to achieve their objectives (i.e., maintaining or restoring core cooling, spent fuel pool cooling, and containment capabilities following beyond-design-basis external events). Of course changes to the facility would continue to be addressed under existing requirements, but the issue is whether the NRC should be involved with the approval of a change to the mitigation strategies or the equipment relied upon in the mitigation strategies. This is in recognition that these requirements were issued in EA-12-049 as being necessary for ensuring continued adequate protection of public health and safety. Currently the NRC staff has concluded that controlling the configuration of the strategies and supporting equipment is appropriate. Changes that enhance mitigation or that enhance the protection of structures, systems, and components, for example, would not need prior NRC review and approval.

External stakeholders are encouraged to provide feedback and suggest better ways of achieving this objective.

### **Industry Comments**

*The endorsed guidance in NEI 12-06 contains a change process in Section 11.8. This change process requires the documentation of changes including the justification that the changes continue to meet the requirements and also address the potential for changes to require prior NRC approval if they are not consistent with the endorsed guidance.*

*The change process that appears to be envisioned in the draft regulatory basis could result in many changes that remain in compliance with the endorsed guidance requiring prior NRC approval. The draft regulatory basis states, "Currently the NRC staff has concluded that controlling the configuration of the strategies and supporting equipment is appropriate. Changes that enhance mitigation or that enhance the protection of structures, systems, and components, for example, would not need prior NRC review and approval." This implies that any change that is not an enhancement, even though it remains compliant with the endorsed guidance, could require prior NRC approval.*

## **8. Draft Regulatory Basis - Link with the Current 10 CFR 50.63 Requirements**

The NRC staff currently intends that the new requirements would be linked with the current station blackout requirements in 10 CFR 50.63. The requirements would be amended to indicate that in the event of a station blackout that exceeds the specified duration determined in accordance with 10 CFR 50.63, or failure or unavailability of an alternate ac source used to comply with 10 CFR 50.63 during a station blackout, the requirements of 10 CFR 50.xxx (i.e., the mitigation strategy requirements that are the subject of this rulemaking) will be implemented.

A central objective for this new regulation would be to ensure continuity with current requirements in 10 CFR 50.63. For station blackout events, the mitigation strategies would be implemented when those events extend beyond a licensee's capability to withstand and recover from a station blackout as required by 10 CFR 50.63 (or for licensees that use an alternate ac power source, if that source also fails or is unavailable). At the implementation level, the mitigation strategies would connect into the emergency operating procedure for station blackout conditions. Specifically, when operators are not able to restore ac power from either offsite or onsite power sources, operators would presumably take actions to implement the mitigation strategies. Accordingly, linking the current station blackout requirements residing in 10 CFR 50.63 with the new requirements is viewed by the NRC as aligning the regulations with the implementation of these requirements at the plant level.

As this rulemaking proceeds, the NRC may conclude that for new reactors the station blackout mitigating strategies requirements make the 10 CFR 50.63 coping determination irrelevant (i.e., always result in more bounding requirements to be able to cope with station blackout conditions). If this occurs, then additional changes to 10 CFR 50.63 may be required so that new reactor designs are not unnecessarily performing 10 CFR 50.63 specified duration determinations.

### **Industry Comments**

*The implication of the intended approach is that ELAP mitigating strategies are implemented subsequent to SBO actions. In fact, time zero for both events is the same. As such, the endorsed guidance in Section 3.2.2(1) of NEI 12-06 addresses the determination needed to implement the correct actions. This guidance is being integrated with the SBO procedures.*

*As stated earlier, the industry believes that the current station blackout (SBO) rule contained in 10 CFR § 50.63 should not be modified as part of this rulemaking. There are fundamental differences between the assumed events, the endorsed guidance and the implemented capabilities that warrant separation of the regulatory requirements. The appropriate "linking" of SBO with ELAP occurs in the procedures.*

## **9. Draft Regulatory Basis - Implementation**

The NRC staff envisions several different implementation scenarios depending on the status of the license or application, and dependent on the licensing process being used:

1. Current licensees subject to the requirements of EA-12-049 or the equivalent license conditions are not expected to have significant implementation challenges, and would not be required to re-submit information that was already provided for review in response to EA-12-049 or the equivalent license condition.
2. Combined license holders in the pre-10 CFR 52.103(g) finding stage, would need to complete full implementation of the requirements (e.g., complete installation of equipment and development and implementation of guidance and strategies) prior to initial fuel load.

3. Combined license applicants who reference a design certification that has not been updated to meet the new rule would need to address the equipment requirements in their applications.
4. Operating license and combined license applicants whose applications are under NRC review would need to supplement their applications within 6-12 months with the required information.
5. Design certification, standard design approval, and manufacturing license applicants would need to address the equipment requirements in their applications.
6. Current design certification holders would not need to amend their design certifications but would need to address equipment requirements in renewal applications.
7. All other future license, design certification, and design approval applicants would need to address the applicable requirements in their applications.

The NRC staff intends to follow its cumulative effects of regulations procedures throughout this rulemaking, and during the final rulemaking phase expects to explore with external stakeholders whether there remain any implementation challenges that can and should be accommodated in the final rule's implementation requirements.

#### **Industry Comments**

*The proposed implementation scenarios are appropriate. NEI agrees that the impact on current licensees subject to Order EA-12-049 should not have significant implementation challenges and they should not be required to resubmit information already provided.*

### **10. Draft Regulatory Basis - Additional Questions for Stakeholder Consideration**

The following are additional questions that are intended to solicit additional feedback from external stakeholders to support the NRC staff's effort to assemble a proposed rule, supporting statement of considerations, and regulatory analysis containing the elements described in this appendix.

1. Should the agency consider a broader rule that combines the current 10 CFR 50.54(hh)(2) and 10 CFR 50.63 with the proposed rule into a single regulatory framework, potentially enhancing efficiency and effectiveness and reducing the cumulative effects of regulation?

#### **Industry Comments**

*The NRC should not consider combining the current requirements of 10 CFR 50.54(hh)(2) and 10 CFR 50.63 with the proposed rule. While there are some similarities among the existing rules and draft rule, there are significant differences among the two existing rules and the requirements of Order EA-12-049, which provides more robust coping strategies than those required by 50.54(hh)(2). Any change to the existing rules by incorporation with the proposed new rule, would result in unnecessary reviews and administrative changes by each site, even if there was no change to the substance of each rule. Additionally, any*

*substantial change, such as combining strategies or use of equipment, would require analysis and potential significant changes to plant strategies, procedures, training programs, and implementation, with no added safety benefit.*

2. New reactors and their siting will be evaluated with up-to-date knowledge of external events (per GDC-2). Further, they may have better and more robust designs reflecting the operating experience of the current generation of reactors with respect to station blackout mitigation. Therefore, the NRC requests comment on the application of station blackout mitigating strategies requirements to new reactors:

- a) Should new reactor designs be required to have station blackout ac power sources that are designed for external events (e.g., safe shutdown earthquake, flooding, and wind) and have sufficient capacity to shutdown the reactor? Should new reactor designs be required to include additional margin for flooding or other external events?

*Industry Comments*

*New reactor designs should not be required to have station blackout ac power sources that are designed for external events, however, the regulatory requirements should be structured to recognize and appropriately credit the enhanced capabilities of new plant designs. New reactor designs need to meet the new ELAP requirements but they do not need additional margins for flooding or other external events.*

- b) If so, should the NRC allow credit (i.e., allowing these ac sources to re-energize safety buses) under ELAP conditions, or should there be requirements for portable equipment as a diverse means to maintaining or restoring the key functions regardless of whether there are ac sources capable of re-energizing safety buses?

*Industry Comments*

*The regulatory requirements should be structured to recognize and appropriately credit the enhanced capabilities of new plant designs. The NRC should allow credit for supplemental ac sources once it is determined how these sources can be applied (i.e., preventive and/or mitigative).*

- c) What station blackout mitigation strategy requirements should be applied to small modular reactors?

*Industry Comments*

*The regulatory requirements should be structured to recognize and appropriately credit the enhanced capabilities of the small modular reactor designs. Similar to the way the Order requirements were tailored in Appendix F of NEI 12-06 to the AP1000 design, provision should be made to tailor the requirements as the designs are certified.*

- d) The NRC is considering requiring a design certification applicant to address the first portion of the mitigative response with installed equipment and connections to allow for maintenance of functions, and then have the remaining scope (i.e., the portion of the response that is more reliant on portable equipment) be the responsibility of a combined license applicant. What are stakeholder views on the appropriate division of requirements between a design certification and a combined license?

*Industry Comments*

*To the extent that installed design features may be credited, these could be part of a standard design. Future designers could include these features in a design certification application. Developing mitigative strategies for deploying portable equipment may be addressed more effectively by a combined license applicant, considering site- and plant-specific features.*

- e) What information about mitigation strategies and the equipment to be used should be included in the final safety analysis report? Where should other supporting information be located?

*Industry Comments*

*The ELAP mitigation strategies should be described in a similar manner as the Mitigating Strategies Document requirement in 52.80(d). The inclusion of ELAP mitigation strategies in the FSAR should be consistent with regulatory guidance for existing plant designs.*

- f) For the combined license process, how should implementation be phased with application for a combined license, combined license issuance, and fuel load?

*Industry Comments*

*The mitigative strategies would not be necessary prior to fuel load. Implementation could be treated as an operational program described in the combined license application, with a commitment to implement the program prior to fuel load.*

3. How should human reliability be considered for beyond-design-basis external events for which there is an undefined damage state and potentially severe conditions under which human actions would be required?

*Industry Comments*

*Human reliability is being addressed through time line validation activities, training, placarding of portable equipment and staffing analyses to ensure adequate staff will be available to deploy the mitigating strategies in time to maintain or restore key safety functions.*

4. The NRC understands that licensees may incur impacts as a result of station blackout mitigation strategies requirements already imposed under Order EA-12-049 or as a result of the proposed rule contemplated in this regulatory basis document. The NRC requests feedback on the costs associated with the specific station blackout mitigation strategies and related activities, regardless of whether they arise as a result of the Order or the rule. The NRC specifically requests information addressing the following questions. In your response, please indicate whether the information applies to (a) operating reactor licensees, (b) applicants, (c) design certification licensees/applicants, or (d) other (specify).

**Industry Comments**

*The comments below address industry impacts to operating reactor licensees associated with the current scope of mitigating strategies planned in accordance with NEI 12-06, unless otherwise specified. Impacts as a result of differences between the proposed rule and the existing Order (including endorsed guidance) would be speculative pending further clarification.*

- a) What specific equipment (and quantity of specific equipment) will licensees or applicants need to procure in order to comply with station blackout mitigation strategies requirements? If applicable, please specify whether the specific equipment will be shared by multiple units at a site or by multiple sites in a region. What are the capital and maintenance costs associated with the equipment?

**Industry Comments**

*The specific type and quantities of equipment required by a licensee is based upon plant specific design and response strategies in accordance with NEI 12-06. This equipment typically consists of on-site water pumps, ac power sources, communications equipment, and miscellaneous equipment (e.g., hoses, cables, air compressors, etc.). Equipment may be shared between units on the same site. The cost of this onsite equipment varies by licensee. Additionally, each site will incur expenses to have access to off-site equipment and resources that will be shared among licensees.*

- b) What plant modifications (i.e., beyond the equipment described above) will licensees or applicants need to make in order to comply with station blackout mitigating strategies requirements? What are the estimated costs associated with these plant modifications? Will these plant modifications extend the duration of plant outages when they are installed? If so, by how much calendar time?

**Industry Comments**

*The scope and number of modifications required by a licensee is based upon plant specific design and response strategies in accordance with NEI 12-06. Modifications primarily address the addition of connection points for portable equipment and the*

*construction of facilities for the purpose of providing reasonable protection of portable equipment. In some cases, modifications to extend the capability of existing plant installed equipment may be included. Connections to installed plant equipment will require equipment outages, and may rely on unit outages for accessibility. Due to the expedited nature of compliance, work during unit outages may impact outage schedules. The cost of modifications varies by licensee.*

- c) What changes to procedures will licensees or applicants likely need to make in order to comply with station blackout mitigation strategies requirements? What are the estimated costs associated with developing these procedure changes? Would operational costs be affected, and if so, at what estimated cost?

*Industry Comments*

*The actual scope and number of procedures affected is based upon plant specific procedure structures and processes. The requirements for programmatic controls and an approach for operating procedure changes are provided in NEI 12-06. A significant amount of procedure impact is expected by all licensees. The cost of modifications varies by licensee.*

- d) What training are licensees or applicants likely to purchase or develop to comply with station blackout mitigation strategies requirements? In what format will this training be given and to what types and numbers of workers at what duration and frequency? What is the estimated cost to purchase or develop the training?

*Industry Comments*

*The actual scope and impact of training will vary by site depending upon plant specific design and response strategies in accordance with NEI 12-06. The industry is working together to identify common training approaches for affected individuals based upon their role (e.g., decision maker, responder, general employee, etc.) The cost of development and delivery of this training has not yet been determined.*

- e) What other types of activities are anticipated, and what are the estimated costs associated with the activities?

*Industry Comments*

*Many other activities are required to support implementation of the Order that may not be directly related to equipment, modifications, procedures and training. The industry has engaged NEI, EPRI, INPO and the Owner's Groups to develop regulatory/operational/ technical guidelines, common analyses, testing, benchmarking, inspections, reviews, etc. Licensees have participated in the industry issues and similarly initiated site specific studies, reviews, agreements with external agencies, etc. The direct and indirect costs of these additional activities have not been specifically quantified.*

- f) What benefits will be gained as a result of station blackout mitigation strategies requirements?

Industry Comments

*The benefit of the mitigation strategies is the further reduction of the already low probability of core damage due to a station blackout event. The benefits to a site beyond the direct response to an event are plant specific. The design and response strategies described in NEI 12-06 are intended to provide diverse capabilities when existing plant capabilities are lost. As such, the strategies may not provide any additional direct operational benefit. Plant specific designs may include enhancements to plant installed equipment that could provide benefits such as operator burden reduction, MSPI reduction, etc. The connections to plant equipment may also yield tactical and risk reduction benefits during system or unit outages.*

**11. Other Industry Comments**

Regulatory Basis Section 3.1, Table 1, Acceptable Options- in the EA-12-049 column it states, "Use of installed equipment that is safety-related is assumed for the initial phase." The equipment relied on for the initial phase does not need to be safety-related. Section 3.2 of NEI 12-06 states that "installed equipment that is designed to be robust with respect to design basis external events is assumed to be fully available."

In Regulatory Basis Section 7, Conclusion, it states, "Additionally, the SBO rule addresses maintaining or restoring SFP cooling." This should state "does not address maintaining or restoring SFP cooling."