



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

June 17, 2013

Mr. R.W. Borchardt  
Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**SUBJECT: PROPOSED RULEMAKING ON STATION BLACKOUT MITIGATION STRATEGIES**

Dear Mr. Borchardt:

During the 605<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards (ACRS), June 5-7, 2013, we discussed the staff's proposed approach to strengthening the station blackout rule as directed by SRM-SECY-11-0124. Our subcommittee on Regulatory Policies and Practices met with the staff on December 5, 2012, and April 23, 2013, to discuss NRC's initiative to strengthen the station blackout rule. We also had the benefit of the documents referenced, including regulatory basis document, "Rulemaking for Station Blackout Mitigation Strategies."

**CONCLUSIONS AND RECOMMENDATIONS**

1. There is sufficient regulatory basis to proceed with the development of a station blackout mitigation strategies rule to enhance reactor protection against the consequences of extended loss of all offsite and onsite ac power.
2. The staff should continue to explore the concept of a robust supplemental ac power source to be used to restore power following a beyond-design-basis external event.
3. Neither NEI 12-06 nor JLD-ISG-2012-01 provide sufficient guidance for evaluating the feasibility and reliability of the manual actions necessary to implement the mitigating strategies called for by Order EA-12-049. The guidance for the new mitigation strategies rule should address this issue.
4. Although Order EA-12-049 and the proposed new rule are intended to address beyond-design-basis external events, all considerations of "robustness" are expressed in terms of design basis events. The staff should consider the results from the ongoing integrated assessments of seismic, flooding, and high wind hazards to determine if the available margins for these hazards are adequate for the development of mitigating strategies.

5. Failure of decay heat removal capability as an independent or common cause event is not within the scope of the mitigating strategies order or the proposed mitigation strategies rule. An increase in scope to include loss of decay heat removal as a separate condition and not just as a consequence of extended loss of ac power should be considered as part of the staff efforts on Near Term Task Force (NTTF) Recommendation 1 and the Risk Management Task Force (RMTF) program development.
6. Further briefings with the staff will be needed to review and assess the technical adequacy and robustness of the mitigating strategies developed by licensees in response to Order EA-12-049.

## **BACKGROUND**

“Station blackout” is the loss of offsite ac power to the essential and nonessential electrical buses and the unavailability of the onsite ac power supplies, except for available ac power to buses fed by station batteries through inverters. Station blackout at a nuclear power plant is significant because it disables most of the systems relied on for core cooling. In 1988 the NRC issued the station blackout rule (10 CFR 50.63) requiring all licensees to demonstrate that their plant(s) can cope with and recover from station blackout. Regulatory Guide 1.155 provides a method for determining the required “coping” time. This time depends on both plant design and site conditions including: (1) the redundancy of the onsite emergency ac power system, (2) the reliability of the onsite emergency ac power sources, (3) the expected frequency of loss of offsite power, (4) the probable time to restore offsite power, and (5) the availability of an alternate ac (AAC) power source.

Most plants have coping times between 4 and 8 hours, the majority being 4 hours. The rule has increased focus on emergency diesel generator (EDG) reliability, and all licensees have established EDG reliability programs and monitor their effectiveness through their maintenance rule (10 CFR 50.65) programs.

Studies on the effectiveness of the station blackout rule indicate that the rule has resulted in a reduction in the risk from station blackout events. The technical analysis that supported the station blackout rule (NUREG-1032) determined that because of the robustness of plants’ design basis the core damage frequency from station blackout due to external events was sufficiently low that it did not need to be addressed in the rule. The events at Fukushima Daiichi, however, have changed that perception. The uncertainties associated with external events and their associated consequences indicate that consideration of a broader class of beyond-design-basis events is an important element of defense-in-depth. To address a wide range of possible scenarios, mitigation strategies should provide operators with the flexibility and the assets to engage in an effective course of action.

In a letter to the Commission dated October 13, 2011, we recommended that licensees provide “an assessment of capabilities to cope with an extended station blackout” and that performance-based criteria be considered to mitigate and manage an extended station blackout as an

alternative to specific coping times. In SRM-SECY-11-0124, the Commission directed the staff to proceed with an Advance Notice of Proposed Rulemaking, and encouraged the staff “to craft recommendations that continue to realize the strengths of a performance-based system as a guiding principle.” The Commission also indicated that the approach used to foster the development of site-specific mitigation strategies for the loss of large area event under the B.5.b program be used for addressing extended station blackout conditions.

## **DISCUSSION**

Our review of the staff’s regulatory basis document, “Rulemaking for Station Blackout Strategies,” indicates that there is sufficient basis to develop a station blackout mitigation strategies rule to enhance reactor safety for losses of all ac power. As described in the document, the mitigating strategies required by the rule would be consistent with Order EA-12-049, and would address limitations in the current rule including the capability to address the effects of:

- Station blackouts from external events
- Station blackouts at multiple unit sites
- Station blackouts that extend beyond the coping duration
- Failure of the AAC source
- Spent fuel pool cooling during extended station blackout
- Station blackouts that occur during any mode of operation

The mitigating strategies requirements would follow an approach similar to Order EA-12-049. The order and the new rule are intended to provide a substantial increase in defense-in-depth protection against station blackouts that extend beyond a plant’s coping time with current equipment and strategies.

Many of the mitigating strategies will depend on portable equipment that is not permanently installed. Neither NEI 12-06 nor JLD-ISG-2012-01 provide sufficient guidance on the evaluation of the feasibility and reliability of the manual actions needed to implement the mitigating strategies. The guidance for the new mitigating strategies rule should address this issue. NUREG-1852 discusses relevant methods for the evaluation of manual actions.

We look forward to working with the staff to review and assess the technical adequacy and robustness of the mitigating strategies developed by licensees in response to Order EA-12-049.

Although Order EA-12-049 and the proposed new rule are intended to address beyond-design-basis external events, all considerations of “robustness” are expressed in terms of design basis events. The staff should consider the results from the ongoing integrated assessments of seismic, flooding, and high wind hazards to determine if the available margins for these hazards are adequate for the development of mitigating strategies.

One critical feature of the current regulatory requirements for station blackout is the credit given for AAC sources. If an AAC source can be demonstrated by test to power the shutdown buses within 10 minutes of the onset of station blackout, a coping analysis is not required.

Approximately 38 sites utilize at least one AAC source. Order EA-12-049 does not credit these sources because they are not typically hardened against severe phenomena. The staff is considering the inclusion of a robust supplemental ac power source that could be credited as a mitigating feature in the new rule. Such a source would be electrically independent and potentially diverse in design from current ac power sources and physically located to minimize the likelihood of common cause failure from external events. It would have the capacity and capability to operate equipment necessary to maintain or restore core cooling, containment, and spent fuel pool cooling for all units on a site and be able to supply power through physically and electrically separate pathways to multiple distribution systems or motor control centers.

The staff should continue to explore the concept of a robust supplemental ac power source to be used to restore power following a beyond-design-basis external event. The benefits of the increased capability and reduced need for manual actions provided by such an installed power source should be balanced against the flexibility of portable sources to provide power and pumping capability.

Failure of the decay heat removal capability as an independent or common cause event is not within the scope of the mitigating strategies order or the proposed mitigation strategies rule, although Order EA-12-050 requires a hardened containment vent for BWRs with Mark I containments to provide an alternate means of heat removal for these plants. Past studies on providing additional alternate methods of decay heat removal considered, for example, feed and bleed cooling using a diverse high head injection pump, or depressurization of the primary system in order to capitalize on available low pressure systems including fire water. In addition, licensees could opt to install or make more robust a dedicated primary blow down system to achieve decay heat removal over a wide range of conditions. The risk significance of such measures is likely to be highly plant specific. An increase in scope to include loss of decay heat removal as a separate condition and not just as a consequence of extended loss of ac power should be considered as part of the staff efforts on NTF Recommendation 1 and the RMTF program development.

The proposed mitigation strategies rule will help strengthen station blackout mitigation capability at all operating and new reactors for design basis and beyond-design-basis external events. We look forward to future interactions with NRC staff on this matter.

Sincerely,

/RA/

J. Sam Armijo  
Chairman

## REFERENCES

1. NRC Regulatory Basis Document, "Rulemaking for Station Blackout Mitigation Strategies," April 2013 (ML13077A453)
2. Station Blackout (10 CFR 50.63) 53 FR 23203, June 21, 1988, 63 FR 50480 September 22, 1998
3. SECY-11-0124, "Recommended Actions to be Taken Without Delay from the Near Term Task Force Report," September 9, 2011 (ML11245A127)
4. SRM-SECY-11-0124, "Recommended Actions to be Taken Without Delay from the Near Term Task Force Report," October 18, 2011, (ML112911571)
5. NUREG-1032, "Evaluation of Station Blackout Accidents at Nuclear Power Plants, Technical Findings Related to Unresolved Safety Issue A-44," June 1988.
6. NUREG-1776, "Regulatory Effectiveness of the Station Blackout Rule," August 31, 2003 (ML032450542).
7. NRC Regulatory Guide 1.155, "Station Blackout," August 1988 (ML003740034)
8. NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012 (ML12054A736)
9. NRC Draft Interim Staff Guidance Rev 0, 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," Rev. 0, August 29, 2012 (ML12229A174)
10. NEI 12-06 [Rev0], "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," August 2012 (ML12242A378)
11. NUREG-1852, "Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire," October 31, 2007 (ML073020676)
12. ACRS Letter to the Commission, "Initial ACRS Review of (1) the NRC Near-Term Task Force Report on Fukushima and (2) Staff's Recommended Actions to be Taken without Delay," dated October 13, 2011(ML11284A136)

**REFERENCES**

1. NRC Regulatory Basis Document, "Rulemaking for Station Blackout Mitigation Strategies," April 2013 (ML13077A453)
2. Station Blackout (10 CFR 50.63) 53 FR 23203, June 21, 1988, 63 FR 50480 September 22, 1998
3. SECY-11-0124, "Recommended Actions to be Taken Without Delay from the Near Term Task Force Report," September 9, 2011 (ML11245A127)
4. SRM-SECY-11-0124, "Recommended Actions to be Taken Without Delay from the Near Term Task Force Report," October 18, 2011, (ML112911571)
5. NUREG-1032, "Evaluation of Station Blackout Accidents at Nuclear Power Plants, Technical Findings Related to Unresolved Safety Issue A-44," June 1988.
6. NUREG-1776, "Regulatory Effectiveness of the Station Blackout Rule," August 31, 2003 (ML032450542).
7. NRC Regulatory Guide 1.155, "Station Blackout," August 1988 (ML003740034)
8. NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012 (ML12054A736)
9. NRC Draft Interim Staff Guidance Rev 0, 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," Rev. 0, August 29, 2012 (ML12229A174)
10. NEI 12-06 [Rev0], "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," August 2012 (ML12242A378)
11. NUREG-1852, "Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire," October 31, 2007 (ML073020676)
12. ACRS Letter to the Commission, "Initial ACRS Review of (1) the NRC Near-Term Task Force Report on Fukushima and (2) Staff's Recommended Actions to be Taken without Delay," dated October 13, 2011(ML11284A136)

**Accession No:** ML13161A247      **Publicly Available** Yes      **Sensitive** No  
**Viewing Rights:**  NRC Users or  ACRS Only or  See Restricted distribution

<b>OFFICE</b>	ACRS	SUNSI Review	ACRS	ACRS	ACRS
<b>NAME</b>	CAntonescu	CAntonescu	CSantos	EMHackett	EMH for JSA
<b>DATE</b>	6/13/13 via email	6/13/13 via email	6/17/13	6/17/13	6/17/13

**OFFICIAL RECORD COPY**