



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

December 10, 2014

The Honorable Allison M. Macfarlane  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**SUBJECT: COMMISSION PAPER, INTEGRATION OF MITIGATING STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS AND THE REEVALUATION OF FLOODING HAZARDS**

Dear Chairman Macfarlane:

During the 620<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards (ACRS), December 4-6, 2014, we reviewed the Commission Paper, COMSECY-14-0037 "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards," dated November 21, 2014. We were also briefed by the staff on this matter during our 618<sup>th</sup> meeting, October 2-4, 2014. Our Fukushima Subcommittee reviewed draft material for this paper on November 20-21, 2014. During these reviews, we had the benefit of discussions with representatives of the NRC staff, the Nuclear Energy Institute, nuclear plant licensees, the Union of Concerned Scientists, and several members of the public. We also had the benefit of the documents referenced.

During our 620<sup>th</sup> meeting, we also reviewed preliminary language for the proposed Mitigation of Beyond-Design-Basis Events Rulemaking dated November 12, 2014 and November 26, 2014. We received a briefing on that topic during our 616<sup>th</sup> meeting, July 10, 2014, and our Fukushima Subcommittee reviewed that matter on November 20-21, 2014. This letter report does not address the proposed rulemaking. The staff informed us that their efforts on the rulemaking language continue to evolve, and they have obtained an extension for the submittal date. We will continue to discuss that matter with the staff and coordinate our review with their revised schedule.

**CONCLUSIONS AND RECOMMENDATIONS**

1. Regarding the three requested Commission affirmations in COMSECY-14-0037:
  - a. Position 1: We agree fully with the staff's recommendation. To provide confidence that the mitigating strategies developed in accordance with Order EA-12-049 achieve the desired objectives, there should be assurance that the associated equipment will remain available and the identified personnel responses are feasible under the reevaluated flooding hazard conditions.

- b. Position 2: This should not be affirmed. Separate affirmation of the use of targeted or scenario-specific mitigating strategies without the supporting context of an integrated assessment could be misinterpreted as endorsement of an ad hoc approach to address stylized hazards. Such strategies are a possible result of the process identified in Positions 1 and 3, and can be justified technically only by the integrated assessment process.
  - c. Position 3: We agree that the staff should revise the Recommendation 2.1 flooding assessments and integrate the Phase 2 decision-making into the development and implementation of mitigating strategies in accordance with Order EA-12-049 and the related rulemaking. The integration should be accomplished according to our Recommendation 2.
2. The staff should better define the scope and intent of the integrated assessments that are performed after development and implementation of mitigating strategies in accordance with Order EA-12-049. The assessments should evaluate a broad range of hazard scenarios for all pertinent plant equipment that is important to safety, including equipment identified in the mitigating strategies, and the corresponding personnel actions. Results from the assessments should be used to identify measures that effectively balance protection of normal plant safety systems with mitigation of damage to those systems.

## **BACKGROUND**

Fukushima Near-Term Task Force (NTTF) Recommendation 2.1 requires that licensees reevaluate the seismic and flooding hazards at their sites. The NRC staff has observed that past licensee analyses of flooding hazards and their identification of measures to protect against those hazards were often not derived from a consistent set of analytical tools and assumptions. They have further observed that in some cases changes in these assumptions within plausible ranges can produce significant changes in the predicted flooding levels. As a result, NRC has asked licensees for information that could be used to support new regulatory requirements for flooding protections. Licensees were requested to identify potential vulnerabilities based on all applicable external flooding sources using current methods, regulatory requirements, and guidance.

Licensees are currently submitting their updated evaluations of flooding hazards. Licensees are expected also to submit integrated assessments of plant responses to the updated flooding hazards. The NRC staff plans to use this information to determine if additional regulatory actions are needed for protection of the public health and safety.

In parallel with these activities, the Commission issued Order EA-12-049, "Requirements for Mitigation Strategies for Beyond-Design-Basis External Events". This order requires licensees to have strategies to cope with external events that affect all nuclear power

units on a site simultaneously, including the loss of all site AC power and the loss of normal access to the ultimate heat sink. Initial responses to such events are to use installed equipment and resources to assure core cooling, containment, and spent fuel pool cooling. Later, these safety functions can be accomplished using portable equipment available on the site. Still later, equipment and resources brought from external supplies can be used for long-term assurance of the above safety functions.

In response to the requirements of the Commission Order, the nuclear industry has developed the "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (NEI 12-06) and has created repositories of resources at two locations for use by licensees in the later stages of these events. Licensees are to implement their plans for coping with these events by December 31, 2016.

The many requirements and demanding schedules for development of measures to cope with extreme external events have placed high demands on resources available to both licensees and the NRC. As a result of discussions with the licensees and with the public, the NRC staff has developed a plan for integrating these activities that is described in COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards".

## **DISCUSSION**

In accordance with Phase 1 of NTTF Recommendation 2.1, licensees are currently evaluating their site-specific flooding hazards using present-day standards and guidance, and they are reporting those evaluations to the NRC. In addition to the hazard reevaluation, each licensee who determines that the hazard for its plant exceeds the current design-basis flood level was requested to describe interim actions that address the specific flooding issues identified by the reevaluation. The request for information and the related guidance also call for those licensees to perform an integrated assessment of the effects of higher flood levels on the nuclear power plant site. The integrated assessment was initially intended to evaluate the total plant response to the flood hazard, to identify vulnerabilities, and to develop actions to address them. The integrated assessment could consider multiple and diverse capabilities such as physical barriers, temporary protective measures, and operational procedures. The capabilities being developed and implemented as part of the mitigating strategies required by Order EA-12-049 could also be considered as part of the integrated assessment.

This process represents an ideal situation in which each licensee first determines the reevaluated site hazard, next identifies plant-specific vulnerabilities to that hazard, and then develops appropriate strategies to protect critical safety equipment from the hazard or provides additional defense-in-depth measures to mitigate the consequences from damage to that equipment.

Practical experience from the performance of complex analysis projects, as well as iterations and refinements that inevitably occur during their reviews, has led to concern that it could take many years to reach agreement on the results of the integrated assessments and their suggested plant improvements, including alternatives for mitigating the effects from extreme events. If nature should intervene and produce one of those events before action is taken to protect against it, we would have lost a real opportunity to improve safety.

The licensees, recognizing the concerns raised by the Fukushima events and responding to the NRC orders, are implementing the FLEX program. They are procuring FLEX equipment, identifying plant-specific mitigating strategies, developing and implementing associated procedures and training, and instituting the National SAFER Response Centers to distribute equipment to plants in need of support following extreme events. The flexibility of this initiative has the potential to help plants survive a wide variety of unexpected events. Therefore, it is reasonable for NRC to support early completion of this effort, while deferring the integrated assessments until the initial mitigating strategies and equipment are in place, with assurance that they are capable of operation following events that are at least as severe as the reevaluated flooding and seismic hazards.

We support the efforts to reevaluate the site-specific flooding hazards and to integrate decision-making for the development and implementation of mitigating strategies in accordance with Order EA-12-049. These efforts increase confidence in the capabilities of nuclear power plants to withstand the effects of severe external events, and they provide the following key advantages:

- Incentives for timely implementation, protection, and coordination of onsite equipment, personnel actions, and offsite resources to provide enhanced capability for response to flooding, seismic events, high winds, or other unanticipated severe events,
- Improved understanding of the capabilities of plant-specific structures, equipment, personnel, processes, and procedures needed to effectively implement strategies for the reevaluated flooding hazards, and
- Optimization of industry and NRC staff resources to focus attention on those facilities that, in spite of the identified mitigating strategies, may need additional improvements to fully address the reevaluated flooding hazard.

An integral part of the development and implementation of these mitigating strategies should be the assurance that needed equipment will remain available and expected personnel responses are feasible under the reevaluated flooding hazard conditions. Implementation of the mitigating strategies will provide plant personnel with improved flexibility to cope with a broad range of challenges and will enhance defense in depth against severe events that may disable normal plant safety functions.

Plant safety should not rely on mitigating strategies as a first line of defense. Therefore, once mitigating strategies have been defined and FLEX implementation plans have been developed, integrated assessments should be performed. This revised sequence will achieve the desired objectives. It will also retain the fundamental intent to develop a more complete examination of options that effectively balance protection of a plant's inherent safety systems with augmented strategies to cope with damage to those systems.

In practice, elements of these assessments may be developed and applied as licensees implement their plant-specific mitigating strategies. It is likely that those evaluations will be based primarily on the reevaluated hazard. The scope of the integrated assessments should evaluate the plant response for a broad range of hazard scenarios. They should not be limited by the assumptions and constraints imposed by the hazard reevaluation guidance. In particular, the assessments should examine the available margins for equipment survival as a function of hazard severity and identify corresponding options for core and spent fuel pool cooling. The results may reveal practical measures to improve the protection of equipment that is normally used to ensure plant safety and thereby reduce reliance on mitigating strategies. The assessments will also inform the licensee's and the NRC staff's understanding of hazard scenarios for which the identified strategies may provide only limited benefits.

#### **Requested Affirmations in COMSECY-14-0037**

In COMSECY-14-0037, the NRC staff asks the Commission to affirm the following positions:

1. Licensees for operating nuclear power plants need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events (Order EA-12-049 and related MBDBE rulemaking),
2. Licensees for operating nuclear power plants may need to address some specific flooding scenarios that could significantly damage the power plant site by developing targeted or scenario-specific mitigating strategies, possibly including unconventional measures, to prevent fuel damage in reactor cores or spent fuel pools, and
3. The staff should revise the Recommendation 2.1 flooding assessments and integrate the Phase 2 decision-making into the development and implementation of mitigating strategies in accordance with Order EA-12-049 and the related MBDBE rulemaking.

We agree fully with Position 1. To provide confidence that the mitigating strategies developed in accordance with Order EA-12-049 achieve the desired objectives, there should be assurance that the associated equipment will remain available and the identified personnel responses are feasible under the reevaluated flooding hazard conditions.

Without further elaboration by the staff, the scope and intent of the assessments that are addressed in Position 3 could be interpreted as simple confirmation that the identified mitigating strategies are sufficient to assure adequate plant safety for the reevaluated flooding hazard. We do not endorse that limited perspective. The integrated assessments that are performed after the mitigating strategies are implemented should evaluate the plant response to a broader range of hazard scenarios. The assessments for those scenarios should evaluate all pertinent plant equipment that is important to safety, as well as that identified in the mitigating strategies, and the corresponding personnel actions. The intent should be to examine the available margins for equipment survival and to identify a realistic complement of options for core and spent fuel pool cooling as a function of hazard severity. Results from the assessments should be used to identify measures that effectively balance protection of normal plant safety systems with mitigation of damage to those systems.

We do not understand why Position 2 requires separate attention and Commission affirmation. The integrated assessment process may identify extreme scenarios for which the normal plant safety equipment and the identified mitigation strategies provide limited benefits. The nature of those scenarios and the severity of their initiating hazards will depend on conditions that are very specific to each site and the design of its particular nuclear power units. Identification of those scenarios and the development of targeted or unconventional mitigation options to address them is a direct consequence of the integrated assessment process, and it is a fundamental principle of risk management. Separate affirmation of Position 2 without the supporting context of the integrated assessments could be misinterpreted as endorsement of an ad hoc approach to address stylized hazards, which should be avoided.

We look forward to our continuing interactions with the staff on all important matters related to the Fukushima efforts, including the draft rulemaking related to these mitigating strategies.

Sincerely,

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John W. Stetkar  
Chairman

## REFERENCES

1. COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards," November 21, 2014 (ML14238A616)
2. Preliminary Proposed Rule Language, "Mitigation of Beyond-Design-Basis Events Rulemaking," November 26, 2014 (ML14336A641)

3. Preliminary Proposed Rule Language, "Mitigation of Beyond-Design-Basis Events Rulemaking," November 12, 2014 (ML14316A297)
4. SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," July 12, 2011 (ML111861807)
5. Staff Requirements Memorandum to SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions following the Events in Japan," August 19, 2011 (ML112310021)
6. NRC Memorandum with Enclosures, "Draft 10 CFR 50.54(f) Letters for Implementing Near-Term Task Force Recommendations 2.1, 2.3, and 9.3," January 13, 2012 (ML12013A224)
7. Japan Lessons-Learned Project Directorate Interim Staff Guidance JLD-ISG-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding," Revision 0, November 30, 2012 (ML12311A214)
8. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, August 21, 2012 (ML12242A378)
9. Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012 (ML12054A735)
10. Mr. Tony Pietrangelo, Nuclear Energy Institute (NEI) Letter to Chairman Macfarlane, "Integration of Mitigating Strategies with Reevaluated External Hazards Information," November 4, 2013 (ML14309A544)
11. Consolidated Appropriations Act of 2012, Public Law 402

3. Preliminary Proposed Rule Language, "Mitigation of Beyond-Design-Basis Events Rulemaking," November 12, 2014 (ML14316A297)
4. SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," July 12, 2011 (ML111861807)
5. Staff Requirements Memorandum to SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions following the Events in Japan," August 19, 2011 (ML112310021)
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7. Japan Lessons-Learned Project Directorate Interim Staff Guidance JLD-ISG-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding," Revision 0, November 30, 2012 (ML12311A214)
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