



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

September 29, 2015

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Leonard D. Wert, Acting Regional Administrator  
Region II

Cynthia D. Pederson, Regional Administrator  
Region III

Marc L. Dapas, Regional Administrator  
Region IV

FROM: William M. Dean, Director */RA/*  
Office of Nuclear Reactor Regulation

SUBJECT: TREATMENT OF SEISMIC AND FLOODING HAZARD  
REEVALUATIONS IN THE DESIGN AND LICENSING BASIS OF  
OPERATING POWER REACTORS

The purpose of this memo is to provide information in response to questions on the treatment of post-Fukushima seismic and flooding hazard reevaluations within an operating nuclear power plant's licensing basis. Licensees are performing flooding and seismic reevaluations in response to the March 12, 2012, request for information issued under Title 10 of the *Code of Federal Regulations* (10 CFR), 50.54(f) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340). Recent U.S. Nuclear Regulatory Commission (NRC) policy decisions have helped refine the expected regulatory treatment of these hazards and how activities to address Fukushima lessons learned are being resolved. This memo is intended to provide information to the regional staff on those decisions and the path forward.

The NRC is requiring reevaluations to be completed by each licensee using updated seismic and flooding hazard information and present-day guidance and methods. The purpose of the reevaluations is to determine whether additional regulatory actions are warranted to ensure continued public health and safety. The reevaluations called for by the 10 CFR 50.54(f) letter do not revise the design basis of the plant even if such hazard information is estimated to exceed the plant's current design basis. NRC licensees and NRC staff are continuing their assessments of these reevaluated hazards, and although some reevaluated hazards are estimated to exceed the design basis seismic or flood event for the reactor, NRC staff has not identified an immediate safety concern for any plant. This is based on NRC staff's preliminary

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evaluation of the revised hazard and, in some cases, the interim actions that licensees have taken or plan to take to address these reevaluated hazards.

Concerns expressed by some NRC staff and other interested stakeholders include:

- effects of the seismic and flooding reevaluation results on the assessment of equipment operability required by a given facility's technical specifications, and
- how to ensure that lessons learned from inspections associated with beyond-design-basis event requirements, such as the station blackout (SBO) rule (10 CFR 50.63, "Loss of All Alternating Current Power") and loss of large areas of the plant caused by explosions or fire (10 CFR 50.54(hh)(2)), are considered.

The enclosure to this memo offers detailed information in response to these concerns. Regarding the effects of seismic and flooding reevaluation results on the assessment of equipment operability, the enclosure to this memo notes the following:

- The flooding and seismic hazard reevaluations are generally considered to be "beyond" the current design and licensing basis of operating plants. This position is described in letters to licensees dated March 1, 2013, regarding flooding hazard reevaluations (ADAMS Accession No. ML13044A561) and February 20, 2014, regarding seismic hazard reevaluations (ADAMS Accession No. ML14030A046). Therefore, unless an error is identified in the current design or licensing basis during the performance of the requested flooding and seismic hazard reevaluation, the NRC staff does not expect that licensees would assess the operability of the affected structures, systems, or components (SSCs) against the reevaluated hazards. If an error is discovered, licensees need to evaluate if the situation is reportable pursuant to 10 CFR 50.72 and 50.73, and determine whether aspects of 10 CFR 50.9, concerning the requirement to provide complete and accurate information to the NRC, are applicable.
- There is the potential that as a result of the NRC's review of the reevaluated hazards, the agency may determine that these hazards should be considered design-basis events for a facility through the NRC's backfit process. The result would be a change in either the design-basis flood or seismic event, as further discussed in the enclosure. Otherwise the reevaluated flooding and seismic levels are beyond-design-basis events. Only if the NRC takes an action such as changing the design-basis event in accordance with 10 CFR 50.109 would the reevaluated hazards affect operability decisions for affected SSCs at the subject operating reactor.
- NRC staff is in the process of codifying, through rulemaking, a requirement that licensees provide capabilities to mitigate the beyond-design-basis flood and seismic events identified through the hazard reevaluations. As drafted in the proposed rulemaking, operating power reactor licensees must maintain this capability in a manner similar to other beyond-design-basis events (e.g., SBO and loss of large areas of the plant caused by explosions or fire). Typically, beyond-design-basis events do not meet the 10 CFR 50.36(c)(2)(ii) requirements for inclusion of the associated SSCs in a plant's

technical specifications, including consideration of Criterion 4 that requires SSCs which operating experience or probabilistic risk assessment has shown to be significant to public health and safety to be placed in technical specifications. Only in limited cases have technical specifications been developed to address beyond-design-basis events and thereby impacted operability decisions (e.g., some functions required to respond to an anticipated transient without scram, a beyond-design-basis event, are captured in some plant's technical specifications).

The above positions are consistent with a September 1, 2015, letter to licensees regarding the flooding hazard reevaluations (ADAMS Accession No. ML15174A257). That letter discusses the NRC's approach and expected interactions with licensees related to flood hazard reevaluations, including their use in: (1) supporting the Mitigation of Beyond-Design-Basis Events (MBDBE) rulemaking efforts by having licensees assess their mitigating strategies ability to address the reevaluated flooding hazards, and (2) evaluating whether additional regulatory actions are warranted to ensure continued public health and safety in accordance with Phase 2 of the 10 CFR 50.54(f) letter on the flooding reevaluation activity. For seismic hazard reevaluations, NRC staff is also developing guidance documents addressing the use of these reevaluations in the MBDBE rulemaking efforts. NRC staff will, if necessary, prepare a seismic hazard reevaluation letter to licensees similar to the September 1, 2015, flooding hazard reevaluation letter.

In summary, only if the NRC decides to backfit a plant so that a reevaluated hazard becomes a design-basis event would future operability determinations for safety-related components have to be judged against the reevaluated hazard. However, expected requirements currently proposed under the MBDBE rulemaking would result in licensees needing to consider the reevaluated hazard when assessing the functionality of some SSCs. Related programmatic controls for SSCs within the scope of the proposed rule will be described in guidance documents being prepared by the industry and NRC staff.

Regarding the concern about incorporating lessons learned from inspections associated with beyond-design-basis event requirements, headquarters staff will continue to engage regional staff as regulations and guidance documents are developed in response to the reevaluated hazards. This includes development of inspection procedures and guidance for treatment of inspection findings under the Reactor Oversight Process, as well as development of regulatory guidance associated with programmatic controls for unavailability, equipment maintenance, and configuration control for mitigating strategies. The Office of Nuclear Reactor Regulation recognizes the important role that the regions have in inspection and oversight of the Fukushima lessons-learned activities. This memo supplements ongoing interactions established with the regions to communicate the status of Fukushima lessons-learned activities and other items of interest (e.g., biweekly phone calls, regional counterparts meetings, senior management meetings).

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Questions of this memo can be directed to Joseph Sebrosky at 301-415-1132 or [Joseph.Sebrosky@nrc.gov](mailto:Joseph.Sebrosky@nrc.gov) and William Reckley at 301-415-7490 or [William.Reckley@nrc.gov](mailto:William.Reckley@nrc.gov). General questions on Fukushima lesson-learned activities should be referred to NRR's Division of Inspection and Regional Support or Japan Lessons-Learned Division.

Enclosure:  
Regulatory Treatment of Flooding  
and Seismic Reevaluations

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**ADAMS Accession No: ML15127A401**

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## Regulatory Treatment of Flooding and Seismic Reevaluations

This enclosure provides a discussion of the U.S. Nuclear Regulatory Commission (NRC) staff's regulatory treatment of flooding and seismic reevaluations being performed in response to the March 12, 2012, request for information issued under Title 10 of the *Code of Federal Regulations* (10 CFR), 50.54(f) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340). The enclosure provides a background discussion of: (1) the terminology related to nuclear plant licensing, (2) how this terminology relates to the flooding and seismic reevaluations, and (3) the steps the Office of Nuclear Reactor Regulation (NRR) is taking regarding hazard reevaluations and how these efforts are being coordinated with the NRC's regional offices.

### **Background**

A discussion of the terminology related to nuclear plant licensing and the relationships between the licensing basis, design-bases, design-basis events or design-basis accidents, and beyond-design-basis accidents or events is provided below. Additional information on this topic can be found in Enclosure 1 of COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards" (ADAMS Accession No. ML14328A170).

The ***licensing basis*** of a plant is the most comprehensive set of requirements, information, and documents that capture:

- legally-binding regulatory requirements on the licensee (e.g., regulations, orders, license conditions)
- mandated documents and programs developed and maintained in accordance with regulatory requirements (e.g., final safety analysis report)
- regulatory commitments provided by the licensee in official correspondence (see the definition of current licensing basis in 10 CFR 54.3, "Definitions")

An important subset of the licensing basis is the design-bases information, defined in 10 CFR 50.2, "Definitions," which includes the specific functions and reference bounds for the design of plant structures, systems, and components (SSCs).

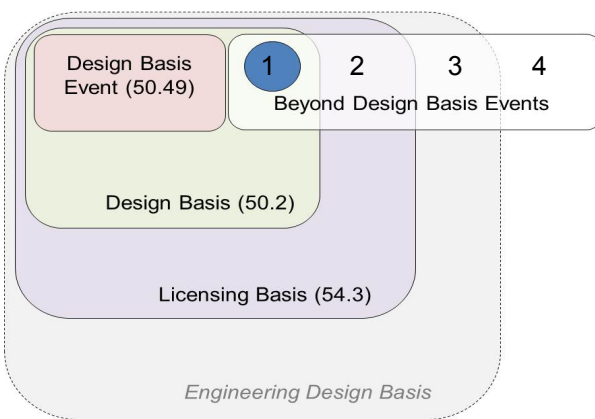
Guidance related to design-basis information for SSCs is provided in Appendix B to Nuclear Energy Institute 97-04, "Design Bases Program Guidelines," which is endorsed in Regulatory Guide 1.186, "Guidance and Examples for Identifying 10 CFR 50.2 Design Bases."

***Design-basis events*** or ***design-basis accidents*** consist of those events and accidents that the NRC has required licensees to consider when identifying safety-related SSCs needed to provide key safety functions. The definition of design-basis events is provided in 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants". The safety-related SSCs credited for responding to or protecting against design-basis events generally correlate to those controlled by a plant's technical specifications and, as such, are subject to operability evaluations if the ability of the SSC to function under design-basis

Enclosure

accident conditions is called into question.<sup>1</sup> Some safety-related SSCs not only protect against design-basis events, but also serve to support power production or provide capabilities to address beyond-design-basis events, such as station blackout (SBO) or loss of large areas of the plant because of explosions or fires. The design-basis (functions and reference bounds for design) of specific SSCs can include information related to design-basis events, beyond-design-basis events, or both. The ability of SSCs to address beyond-design-basis events is often described in terms of functionality to provide distinction from issues related to operability and technical specifications.

Figure 1 provides a stylized representation of the relationships between various elements of the design and licensing basis for such SSCs. As illustrated, the design basis for these SSCs include design-basis events, which in turn require the SSCs to be safety-related, as well as beyond-design-basis events. The quality and treatment requirements for the beyond-design-basis event response would be established by the requirements imposing the beyond-design-basis event or related guidance and would not necessarily be in accordance with those required for safety-related SSCs found in 10 CFR 50 Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.” Figure 1 indicates that beyond-design-basis events may also result in some measures that do not affect the design basis of the SSCs, but would be part of the facility’s licensing basis. Examples include licensee’s commitments in response to the March 12, 2012, 10 CFR 50.54(f) letter to include interim actions because the reevaluated seismic or flood hazard is greater than the design-basis event for the site.



Note that beyond-design-basis events might warrant:

1. Establishment of design-basis requirements for affected SSCs (e.g., mitigating strategies for flooding reevaluations).
2. A feature or action documented in the licensing basis (e.g., flooding enhancement or interim action captured as regulatory commitment in 10 CFR 50.54(f) response).
3. Inclusion in licensee programs (engineering design basis) outside of regulatory controls (e.g., flood protection for SSCs not important to safety for asset protection reasons).
4. No action or documentation (e.g., event considered not credible).

Figure 1. Design and Licensing Basis for Nuclear Power Plants

<sup>1</sup> Only in limited cases have technical specifications been developed to address beyond-design-basis events and thereby impacted operability decisions (e.g., some functions required to respond to an anticipated transient without scram, a beyond-design-basis event, are captured in some plant’s technical specifications by invoking Criterion 4 in 10 CFR 50.36(c)(2)(ii) that addresses SSCs which operating experience or probabilistic risk assessment has shown to be significant to public health and safety). The generic activities currently underway do not cite this provision or otherwise propose to address the reevaluated external hazards within plants’ technical specifications.

An example of how the elements fit together is offered below using a hypothetical plant, external flooding events, and an auxiliary feedwater system consisting of one train using an alternating current (ac) driven pump and one train using a turbine driven pump. Both trains are used to address anticipated operational occurrences and other design-basis events involving the failure of plant equipment. Therefore, both trains are categorized as safety related equipment, included in technical specifications, and are able to operate during the defined design-basis flood (i.e., design-basis event in Figure 1). A review of the established design basis for each train would therefore include pumping capacities and other safety features reflected in the final safety analysis report (FSAR) as well as needed protections against external flooding hazards up to the design-basis flood. The design basis for equipment within one or both trains may also include functional requirements to address a beyond-design-basis event such as an SBO (Point 1 in Figure 1). For this example, the turbine-driven train is assumed to be used within the licensee's mitigating strategies developed to address beyond-design-basis flooding events. In accordance with draft guidance documents, mitigating strategies for the example plant will be assessed against the reevaluated flooding hazards and licensee actions could involve plant changes to protect the turbine-driven auxiliary feedwater pump from more extreme flooding conditions. Such added measures to address the reevaluated flooding hazard would not need to be categorized as safety related and would not affect technical specifications or operability criteria, but would introduce new functionality requirements for the turbine-driven train. In addition, each train of the auxiliary feedwater system is likely to have testing or inspection-related features defined within the licensing basis for the plant, but the descriptions of these features are considered to be supporting information and not within the design basis for the system (Point 2 in Figure 1). Some licensee commitments or interim actions to address specific flooding concerns (e.g., local intense precipitation) could likewise introduce licensing basis information without affecting the design basis for plant SSCs. The licensee may also establish controls or capabilities for the auxiliary feedwater system that go beyond regulatory requirements (e.g., uses to support plant startup operations) and which would be captured in their own plant documentation (Point 3 in Figure 1).

### **Treatment of Flooding and Seismic Reevaluations**

The specific manner in which the flooding and seismic reevaluations will be captured in the licensing basis for operating nuclear power plants is being considered through ongoing work by the staff and interactions with the Commission. Examples in this area include:

- COMSECY-14-0037, dated November 21, 2014 (ADAMS Accession No. ML14238A616): This paper provided the Commission with information and recommendations for coordinating requirements to implement mitigation strategies for beyond-design-basis external events with actions to address reevaluated flooding hazards.



- Staff requirements memorandum (SRM) for COMSECY-14-0037, dated March 30, 2015 (ADAMS Accession No. ML15089A236): This SRM affirmed that licensees for operating nuclear power plants need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events. The SRM also directed the NRC staff to complete several additional actions, including developing guidance to clarify how the NRC will decide whether further regulatory actions are necessary.<sup>2</sup>
- SECY-15-0065, “Proposed Rulemaking: Mitigation of Beyond-Design-Basis Events (RIN 3150-AJ49)” (ADAMS Accession No. ML15049A201): Per Commission direction the proposed rule will require licensees to address the reevaluated seismic and flooding hazards within their mitigating strategies for beyond-design-basis events. The current schedule for providing the final rule package to the Commission is December 2016.
- COMSECY-15-0019, “Closure Plan for the Reevaluation of Flooding Hazards for Operating Nuclear Power Plants” (ADAMS Accession No. ML15153A105): The closure plan that is provided in this paper addresses the March 30, 2015, SRM to COMSECY-14-0037.

As described above, only if the NRC takes an action such as requiring a licensee to treat the reevaluated seismic or flooding reevaluations as “design-basis events” would there be any change to SSC operability requirements.<sup>3</sup> The NRC would have to address backfitting under 10 CFR 50.109, “Backfitting,” to impose this change on currently operating nuclear power plants.

Results from the reevaluation of seismic and flooding hazards indicate that for some plants, these new calculated hazards exceed the design-basis hazard information documented in the plant’s current licensing basis. After the issuance of the March 12, 2012, request for information, the NRR Office Director issued letters to operating power reactor licensees clarifying that the NRC generally considers these reevaluations to be “beyond” the current design/licensing basis of operating plants. This clarification can be found in a March 1, 2013, flooding hazard reevaluation letter (ADAMS Accession No. ML13044A561) and a February 20, 2014, seismic hazard reevaluation letter (ADAMS Accession No. ML14030A046). As discussed in these letters, absent specific regulatory action, the information being provided

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<sup>2</sup> The March 12, 2012, 10 CFR 50.54(f) request for information includes a process for implementing the hazard reevaluations in two phases. Phase 1 includes reevaluating the seismic and flooding hazards and Phase 2 involves NRC staff determining whether additional regulatory actions are necessary to provide additional protection against the updated hazards.

<sup>3</sup> The NRC has, in the past, adopted regulations requiring licensees and applicants to address certain events and accidents, but without considering them as “design-basis events/accidents.” Examples include the NRC’s regulations for SBO and loss of large areas of the plant because of explosions or fires. This regulatory approach was discussed in COMSECY-14-0037.

by licensees in response to the NRC's request for information would generally<sup>4</sup> remain outside the design basis of these plants, and thus would not be required to be considered in determining the operability or functionality of SSCs.<sup>5</sup>

COMSECY-14-0037 describes the staff's proposed approach for addressing the reevaluated flooding hazards and how the reevaluated flooding hazard at a particular site might affect the design basis of specific SSCs. Specifically, COMSECY-14-0037 discusses two primary expected outcomes from the flooding hazard reevaluations: (1) support requirements for mitigating strategies (Order EA-12-049<sup>6</sup> and the related Mitigation of Beyond-Design-Basis Events (MBDBE) rulemaking), and (2) support consideration of additional regulatory actions beyond requirements associated with mitigating strategies. The Commission affirmed in the SRM for COMSECY-14-0037 that licensees will need to address mitigation capability for a reevaluated flooding hazard if the reevaluated hazard is greater than the plant's current design-basis flooding event.<sup>7</sup>

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<sup>4</sup> Both the March 1, 2013, and February 20, 2014, letters note that licensees are expected to make judgements regarding operability on a case-by-case basis. The letters further note that if an error is identified in the current design or licensing basis during the performance of the flooding and seismic reevaluations, the NRC staff expects that licensees would assess the operability of affected SSCs. In addition, such an error would need to be evaluated to determine if the situation is reportable pursuant to 10 CFR 50.72 and 50.73 and whether aspects of 10 CFR 50.9, concerning the requirement to provide complete and accurate information to the NRC, are applicable. The fact that a reevaluated hazard calculated using more recent methods or data exceeds the current design basis seismic or flooding event does not by itself mean there was an error in the previous calculations.

<sup>5</sup> Some licensees may have included regulatory commitments associated with the interim actions within their responses to the request for information made under 10 CFR 50.54(f). Such commitments are considered part of the "licensing basis," but are implemented and maintained using licensees' administrative controls (see Regulatory Issue Summary 2000-017, "Managing Regulatory Commitments Made by Power Reactor Licensees to the NRC Staff" (ADAMS Accession No. ML003741774)).

<sup>6</sup> Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," was issued on March 12, 2012 (ADAMS Accession No. ML12054A735).

<sup>7</sup> The staff is developing a rule associated with mitigation of beyond-design-basis events. The proposed rule was provided to the Commission on April 30, 2015 (ADAMS Accession No. ML15049A201). As part of that rule, the staff proposed to codify a requirement that licensees implement capabilities to mitigate an extended loss of alternating current power and challenges to heat removal functions, and that these capabilities be deployable under reevaluated hazard conditions. In an August 27, 2015, SRM (ADAMS Accession No. ML15239A767) the Commission approved this portion of the draft proposed rule for publication in the *Federal Register*.

Based on the Commission's direction in the SRM for COMSECY-14-0037, mitigating strategies are required to be available under reevaluated seismic and flood hazard conditions. As such, it is expected that the development of these strategies will involve changes to each plant's licensing basis and the design basis of affected SSCs, similar to those associated with other beyond-design-basis events. In addition, in accordance with 10 CFR 50.109, the NRC may require plant modifications or procedure changes beyond those associated with protection of mitigating strategies equipment to ensure continued public health and safety from the reevaluated hazard.<sup>8</sup> For example, in a case where a flooding scenario has a relatively high estimated frequency and an associated high probability of the flooding event leading to core damage, the NRC staff may find that reliance on mitigating strategies alone is not sufficient and flood protection or mitigation requirements beyond those that would be required by the mitigating strategies order and MBDBE rule may be warranted (e.g., through a requirement to modify the plant to protect safety-related SSCs). Future Commission decisions and staff activities related to this SRM and the MBDBE rulemaking will determine how the NRC staff moves forward on these issues.

The above positions are consistent with those discussed in a September 1, 2015, letter from the Director of NRR to licensees regarding the flooding hazard reevaluations (ADAMS Accession No. ML15174A257). This letter discusses the NRC's approach and expected interactions with licensees related to flood hazard reevaluations, including their use in: (1) supporting the MBDBE rulemaking efforts by having licensees assess their mitigating strategies ability to address the reevaluated flooding hazards, and (2) evaluating whether additional regulatory actions are warranted to ensure continued public health and safety in accordance with Phase 2 of the 10 CFR 50.54(f) letter on the flooding reevaluation activity. For seismic hazard reevaluations, NRC staff is developing guidance documents addressing the use of these reevaluations in the mitigation of beyond-design-basis rulemaking efforts. NRC staff will, if necessary, prepare a seismic hazard reevaluation letter to licensees similar to the September 1, 2015, flooding hazard reevaluation letter.

In summary, if the NRC decides to backfit a plant so that a reevaluated hazard becomes a design-basis event (and not just reflected in the design-basis for affected SSCs or within an appropriate licensing basis document) then future operability determinations for safety-related components would have to be judged against the reevaluated hazard. However, expected requirements under the proposed MBDBE rule would result in licensees needing to consider the reevaluated hazard when assessing the functionality of some SSCs. Related programmatic controls for SSCs within the scope of the MBDBE rule will be described in guidance documents being prepared by the industry and NRC staff.

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<sup>8</sup> The Commission disapproved the proposal in COMSECY-14-0037 to integrate the plant-specific backfit determinations into the mitigating strategies activities and instead provided direction to the staff on how to complete the plant assessments and backfit determinations related to flooding hazard reevaluations.

## **Next Steps**

NRR will continue to coordinate and collaborate with the regional offices as part of implementation of lessons learned from the accident at Fukushima Dai-ichi. This outreach includes biweekly calls between the regional offices and headquarters, during which status of lessons learned activities may be discussed, with particular emphasis on issues of interest to the regions. Going forward, this outreach will also include updates on the following items:

- development of regulatory guidance associated with treatment of reevaluated hazards;
- development of regulatory guidance associated with programmatic controls for unavailability, equipment maintenance, and configuration control for mitigating strategies, including appropriate treatment of the mitigating strategies equipment under the Maintenance Rule (10 CFR 50.65);
- development of inspection procedures and guidance for treatment of inspection findings in the Significance Determination Process under the Reactor Oversight Process; and
- guidance documents and activities being completed in response to the SRM for COMSECY-14-0037, including those associated with the flood hazard reevaluation integrated assessments and decision-making associated with further regulatory actions.

In addition, NRR is evaluating various knowledge management initiatives associated with Fukushima lessons-learned initiatives, including training and documentation of regulatory decisionmaking.