Status Update on Other than Tier 1 Activities

This enclosure provides a synopsis of previously completed lessons-learned activities that are not part of the Tier 1 activities. The enclosure addresses the Near-Term Task Force (NTTF) recommendations and U.S. Nuclear Regulatory Commission (NRC or Commission) tasking items that were prioritized as Tier 2 or 3, as well as three activities that were not included within a tier.

ACTIONS TO ADDRESS TIER 2 AND 3 RECOMMENDATIONS

Items Addressed by Mitigation of Beyond-Design-Basis Events Rulemaking

In the staff requirements memorandum (SRM) to SECY-11-0137, "Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned," dated December 15, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML113490055), the Commission approved the staff's proposed prioritization of the NTTF's recommendations from SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011 (ADAMS Accession No. ML11186A950). The NTTF's recommendations included several separate rulemaking activities.

On January 25, 2013, the staff submitted COMSECY-13-0002, "Consolidation of Japan Lessons Learned Near-Term Task Force Recommendations 4 and 7 Regulatory Activities," dated January 25, 2013 (ADAMS Accession No. ML13011A034), to obtain Commission direction on several aspects of the rulemaking. These included combining NTTF Recommendations 4 and 7 and revising the rulemaking schedule to accommodate the Commission's direction to incorporate the lessons learned from implementation of Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012 (ADAMS Accession No. ML12054A735). The Commission approved the staff's proposal in the SRM to COMSECY-13-0002, dated March 4, 2013 (ADAMS Accession No. ML13063A548). This combined rulemaking activity was called the Station Blackout Mitigation Strategies (SBOMS) rulemaking.

In COMSECY-13-0010, "Schedule and Plans for Tier 2 Order on Emergency Preparedness for Japan Lessons-Learned," dated March 27, 2013 (ADAMS Accession No. ML12339A262), the NRC staff requested Commission approval to forgo issuing an order to implement the Tier 2 NTTF Recommendation 9.3 emergency preparedness items. Specifically, the staff found that these Tier 2 emergency preparedness items, which related to periodic training and exercises for multiunit and prolonged station blackout events, was being adequately addressed through implementation of Order EA-12-049, which also addressed emergency preparedness equipment and facilities. As such, a separate order was not necessary. The Commission approved the staff's recommendation in the SRM to COMSECY-13-0010, dated April 30, 2013 (ADAMS Accession No. ML13120A339).

In Enclosure 6 (ADAMS Accession No. ML14064A544) to SECY-14-0046, "Fifth 6-Month Status Update on Response to Lessons Learned from Japan's March 11, 2011, Great Tōhoku Earthquake and Subsequent Tsunami," dated April 17, 2014 (ADAMS Accession No. ML14064A523), the NRC staff proposed consolidating into a single rulemaking activity the SBOMS rulemaking (NTTF Recommendations 4 and 7); the Onsite Emergency Response Capabilities rulemaking (NTTF Recommendation 8); and portions of NTTF Recommendations 9, 10, and 11 that were already being addressed as part of Order EA-12-049

implementation. This combined rulemaking activity is called the Mitigation of Beyond-Design-Basis Events (MBDBE) rulemaking. In the SRM to SECY-14-0046, dated July 9, 2014 (ADAMS Accession No. ML14190A347), the Commission approved the consolidation of the rulemaking activities. Thus, the Tier 1 MBDBE rulemaking addresses the Tier 2 and 3 NTTF Recommendations 7.2-7.5, 9.1-9.4, 10.1, 10.2, and 11.1.

As discussed in Enclosure 1, the NRC staff provided the draft final MBDBE rule and associated guidance to the Commission on December 15, 2016, in SECY-16-0142, "Final Rule: Mitigation of Beyond-Design-Basis Events (RIN 3150-AJ49)" (ADAMS Accession No. ML16291A186).

Enhancements to the Capability to Prevent or Mitigate Seismically-Induced Fires and Floods

This lessons-learned activity originated from NTTF Recommendation 3 and was intended to evaluate potential enhancements to the capability to prevent or mitigate seismically-induced fires and floods (SIFFs). In the SRM to SECY-11-0137, the Commission directed the staff to start the development of probabilistic risk analysis methods to evaluate potential enhancements to plants' capabilities to prevent or mitigate SIFFs as part of Tier 1 activities. This categorization is consistent with the program plan for NTTF Recommendation 3 in Enclosure 3 (ADAMS Accession No. ML12208A210) to SECY-12-0095, "Tier 3 Program Plans and 6-Month Status Update in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Subsequent Tsunami," dated July 13, 2012 (ADAMS Accession No. ML12208A208) and Commission direction. The broader evaluation (i.e., beyond the development of probabilistic risk analysis methods) of potential enhancements to the capability to prevent or mitigate SIFFs remained a longer-term Tier 3 activity.

Since this activity has both a Tier 1 and a Tier 3 component, Enclosure 1 provides a more detailed status of this recommendation. As discussed in that enclosure, the Commission approved the staff's proposal to close this recommendation in the SRM to SECY-15-0137, "Proposed Plans for Resolving Open Fukushima Tier 2 and 3 Recommendations," dated February 8, 2016 (ADAMS Accession No. ML16039A175).

Expedited Transfer of Spent Fuel

In SECY-11-0137, dated October 3, 2011 (ADAMS Accession No. ML11272A111), the staff identified the need to evaluate expediting transfer of spent fuel to dry cask storage. In SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," dated February 17, 2012 (ADAMS Accession No. ML12039A103), the staff prioritized this as a Tier 3 issue because it required further staff study to determine whether regulatory action was warranted.

In the summer of 2011 the staff began a research project, "Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor." The resultant report, NUREG-2161, was completed in October 2013 (ADAMS Accession No. ML14255A365) and is commonly referred to as the spent fuel pool (SFP) study. The purpose of the SFP study was to provide additional information to help determine whether the accelerated transfer of spent fuel from the SFP to dry cask storage significantly reduces risks to public health and safety. The SFP study provides consequence estimates for a hypothetical SFP accident initiated by a low-likelihood seismic event at a reference plant for both a fully-loaded (high-density) and minimally-loaded (low-density) SFP. The SFP study contributed to the resolution of this Tier 3 issue by providing a measure of the change in

potential consequences resulting from a change in spent fuel storage density for a reference plant.

In COMSECY-13-0030, "Staff Evaluation and Recommendation for Japan Lessons-Learned Tier 3 Issue on Expedited Transfer of Spent Fuel," dated November 12, 2013 (ADAMS Accession No. ML13273A601), the staff's assessment concluded that the expedited transfer of spent fuel to dry cask storage would provide only a minor or limited safety benefit and that the expected implementation costs would not be warranted. The staff recommended that no further generic assessments be pursued related to possible regulatory actions to require the expedited transfer of spent fuel to dry cask storage and that this Tier 3 activity be closed. In the SRM to COMSECY-13-0030, dated May 23, 2014 (ADAMS Accession No. ML14143A360), the Commission approved the staff's recommendation. The Commission also directed the staff to complete a number of related activities. These follow-up actions have been completed, and this Tier 3 issue is closed.

The following briefly describes the related activities from the SRM and their resolution:

- Develop an information notice to inform licensees of the potential added safety benefit of adopting a "1×8" SFP loading configuration:

  – The NRC issued Information Notice 2014-14, "Potential Safety Enhancements to Spent Fuel Pool Storage," dated November 14, 2014 (ADAMS Accession No. ML14218A493).

- Modify the regulatory analysis in COMSECY-13-0030 to explain why the "1×8" configuration was not found to offer a substantial increase in safety:

  – An addendum to Enclosure 1 of COMSECY-13-0030, dated September 22, 2014 (ADAMS Accession No. ML14252A708), provided the required modification to the regulatory analysis.

- Evaluate whether to modify, through amendment or errata, the existing process for seismic hazard reevaluations to eliminate the SFP evaluation step:

  – The NRC staff concluded that an appropriate SFP seismic evaluation should be conducted for plants that "screen in" to conducting a seismic risk evaluation, as well as for plants that used the results of their individual plant examination of external events (IPEEE) analyses to "screen out" of the evaluation. (The IPEEE program did not analyze SFP structures, systems, and components.) All other plants that "screen out" will not conduct a SFP seismic evaluation.

- Provide an information paper detailing the staff's views and considerations about the treatment of limited-term operational vulnerabilities associated with the discharge of spent fuel from cores into pools:

  – SECY-14-0136, "Response to Commission Direction on Spent Fuel Pool Limited Term Operational Vulnerabilities," dated November 26, 2014 (ADAMS Accession No. ML14297A232), provided this information.

- Provide a technical overview of the operational and safety attributes of spent fuel rack designs used in other countries:

  – The NRC staff's response to SRM-M140106A and the SRM to COMSECY-13-0030, "Comparison of International Spent Fuel Management Policies and Rack Designs," dated August 1, 2014 (ADAMS Accession No. ML14108A244), gives the requested overview.

Remaining Tier 2 and 3 Recommendations

The NRC staff provided updated resolution plans for the open Tier 2 and 3 recommendations to the Commission in SECY-15-0137, dated October 29, 2015 (ADAMS Accession No. ML15254A008). These updated plans were developed in consideration of the safety benefit achieved through the Tier 1 recommendations and insights from related Commission decisions issued after the recommendations were established. In addition to including an evaluation of the open recommendations from the NTTF report, this paper also included an assessment of additional items discussed in SECY-11-0137 and approved by the Commission in the associated SRM. The items include:

- expansion of NTTF Recommendation 2.1 (seismic and flooding reevaluations) to include all natural external hazards (Tier 2);

- consideration of the need to expand the emergency planning zone beyond 10 miles (Tier 3);

- consideration of the need to pre-stage potassium iodide beyond 10 miles (Tier 3); and

- consideration of the need for enhanced instrumentation for beyond-design-basis events (Tier 3).

In SECY-15-0137, the staff placed each of the open recommendations into one of three groups:

- Group 1 recommendations were those that the staff concluded should be closed;

- Group 2 recommendations were those that the staff's initial assessment concluded should be closed, but for which the staff determined that additional stakeholder interaction was warranted prior to finalizing the staff's assessment; and

- Group 3 recommendations were those for which the staff had not yet completed its assessment.

In the SRM to SECY-15-0137, the Commission approved the resolution plans, including closure of the Group 1 items. In addition, for one of the three Group 3 recommendations (related to evaluations of natural hazards other than seismic and flooding), the Commission directed that the NRC staff inform the Commission no later than May 2016 of the results of Task 2, "Determine and apply screening criteria to appropriately exclude certain natural hazards from further generic evaluations, or exclude some licensees from considering certain hazards."

The staff documented completion of the assessments of the Group 2 recommendations in SECY-16-0041, "Closure of Fukushima Tier 3 Recommendations Related to Containment

Vents, Hydrogen Control, and Enhanced Instrumentation," dated March 31, 2016 (ADAMS Accession No. ML16049A079). These recommendations are now closed.

The staff documented the completion of the assessments of the Group 3 recommendations in two papers:

- SECY-16-0074, "Assessment of Fukushima Tier 2 Recommendation Related to Evaluation of Natural Hazards Other Than Seismic and Flooding," dated June 2, 2016 (ADAMS Accession No. ML16102A301); and

- SECY-16-0144, "Proposed Resolution of Remaining Tier 2 and 3 Recommendations Resulting from the Fukushima Dai-Ichi Accident," dated December 29, 2016 (ADAMS Accession No. ML16286A586).

SECY-16-0074 provides the staff's interim status update on the evaluation of natural hazards other than seismic and flooding and SECY-16-0144 provides the staff's final assessment of the three Group 3 recommendations. Based on its evaluation, the staff recommended the following:

- The NRC not initiate additional regulatory actions to address natural hazards other than seismic and flooding.

- The ongoing assessment of natural hazard information be addressed through the enhancement of internal processes to establish a more routine, proactive, and systematic program for identifying and evaluating new information related to external hazards, as described in Enclosure 2 of SECY-16-0144.

- The NRC not impose new requirements associated with real-time radiation monitoring onsite and within the emergency planning zones.

Based on the results of its evaluations, the staff recommended that the Commission approve development of process enhancements to address NTTF Recommendation 2.2 and closure of the three Group 3 recommendations. SECY-16-0144 is currently under Commission review.

OTHER SIGNIFICANT ACTIVITIES NOT WITHIN A TIER

Near-Term Task Force Recommendation 1—Regulatory Framework

This lessons-learned activity originated from NTTF Recommendation 1, to establish "a logical, systematic, and coherent regulatory framework for adequate protection that appropriately balances defense-in-depth and risk considerations." In the SRM to SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated August 19, 2011 (ADAMS Accession No. ML112310021), the Commission directed that NTTF Recommendation 1 be pursued independently of activities associated with the review of the other NTTF recommendations.

On December 6, 2013, in SECY-13-0132, "U.S. Nuclear Regulatory Commission Staff Recommendation for the Disposition of Recommendation 1 of the Near-Term Task Force Report" (ADAMS Accession No. ML13277A413), the NRC staff provided recommendations to move forward on three potential regulatory improvement activities to disposition NTTF Recommendation 1. Specifically, the staff developed the following three potential improvement

activities after evaluating the considerations underlying the NTTF's recommendation and consideration of the Risk Management Task Force's recommendations for power reactors:

(1) establishing a new design-basis extension category of events and requirements and associated internal NRC guidance, policies, and procedures;

(2) establishing Commission expectations for defense in depth through the development of a policy statement; and

(3) clarifying the role of voluntary industry initiatives in the NRC regulatory process.

In the SRM to SECY-13-0132, dated May 19, 2014 (ADAMS Accession No. ML14139A104), the Commission disapproved the staff's recommendations. The Commission directed that the objectives of improvement activities 1 and 2 be reevaluated in the context of Commission direction for a long-term risk management regulatory framework. The Commission directed that work on this framework and other interrelated activities should be treated outside the scope of the NRC's actions resulting from the accident at Fukushima Dai-ichi. With these decisions, NTTF Recommendation 1 was considered closed, with further activities to be considered as part of the risk management regulatory framework initiative.

On December 18, 2015, in SECY-15-0168, "Recommendations on Issues Related to Implementation of a Risk Management Regulatory Framework," dated December 18, 2015 (ADAMS Accession No. ML15265A488), the staff provided its recommendations on the risk management regulatory framework. The staff recommended that the Commission direct the staff to:

(1) maintain the existing regulatory framework for the nuclear power reactor safety program area; and

(2) refrain from developing an overarching, agencywide risk management policy statement.

With respect to these recommendations, the staff noted that the NRC will continue its long-held commitment to the defense-in-depth concept; to the regulation of nuclear reactor issues beyond the traditional design-basis events, where appropriate; and to the inclusion of the defense-in-depth concept as an essential component of risk-informed regulation. Ongoing staff activities to implement risk-informed approaches within NRC program areas will continue to move forward and are not impacted by the staff's recommendation against developing an agencywide risk management policy statement.

In the SRM to SECY-15-0168, dated March 9, 2016 (ADAMS Accession No. ML16069A370), the Commission approved the staff's recommendations. The Commission also agreed with the staff's conclusions that a formal design-basis extension category of requirements should not be established, and that a formal agencywide definition of, and criteria for, determining the adequacy of defense in depth should not be developed.

<u>Activities Not Within a Tier from Sources Other than the Near-Term Task Force</u>

The NRC staff has been, and continues to be, involved in other activities that support the implementation of lessons learned from the Fukushima accident. These activities, which are not included in any of the three tiers, include the following:

- funding and coordination of a study by the National Academy of Sciences (NAS);
- evaluating the applicability of Fukushima lessons learned to other NRC-regulated facilities;
- performing a comparison study of U.S. and Japanese regulatory requirements at the time of the accident; and
- cooperation with international organizations.

The following sections discuss these topics.

National Academy of Sciences Study

In the Energy and Water Development Appropriations Act of 2012, Congress mandated that the NRC fund an NAS study of the lessons learned from the accident at the Fukushima Dai-ichi nuclear plant. NAS carried out the study in two phases.

Phase 1 focused on the causes of the accident and safety-related lessons learned for improving nuclear plant systems, operations, and regulations exclusive of spent fuel storage. NAS published the Phase 1 report, "Lessons Learned from the Fukushima Dai-ichi Nuclear Accident for Improving Safety of U.S. Nuclear Plants (2014)," in July 2014.[1] The report documented various findings and recommendations. The staff documented its review of the Phase 1 recommendations in Enclosure 6 of SECY-15-0059, "Seventh 6-Month Status Update on Response to Lessons Learned from Japan's March 11, 2011, Great Tōhoku Earthquake and Subsequent Tsunami," dated April 9, 2015 (ADAMS Accession No. ML15069A444). In summary, the staff found that ongoing or planned NRC and industry activities adequately address the recommendations from Phase 1 of the NAS study.

Phase 2 of the study focused on spent fuel safety and security. NAS issued the Phase 2 report, "Lessons Learned from the Fukushima Dai-ichi Nuclear Accident for Improving Safety of U.S. Nuclear Plants: Phase 2 (2016)," in May 2016.[2] The Phase 2 report included several findings and recommendations and included a reevaluation of findings and recommendations from the previous NAS reports.[3] The staff documented its review of the Phase 2 recommendations in SECY-16-0100, "Staff Review and Response to National Academy of Sciences Study of the Lessons Learned From the Fukushima Nuclear Accident for Improving Safety and Security of U.S. Nuclear Power Plants," dated August 24, 2016 (ADAMS Accession No. ML16188A296). In summary, the staff found that recent staff reviews and assessments, and recent Commission decisions, address several of the NAS recommendations. The staff did not identify the need to initiate new activities or otherwise redirect resources to address recommendations in the Phase 2 report. On November 30, 2016, the NRC staff and NAS members briefed the Advisory Committee on Reactor Safeguards Fukushima Subcommittee on the NAS Phase 2 report and the NRC staff's assessment of the report. All NRC staff activities related to the NAS studies are complete.

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1 The NAS Phase 1 study may be found at https://www.nap.edu/catalog/18294/lessons-learned-from-the-fukushima-nuclear-accident-for-improving-safety-of-us-nuclear-plants.

2 The NAS Phase 2 study may be found at https://www.nap.edu/catalog/21874/lessons-learned-from-the-fukushima-nuclear-accident-for-improving-safety-and-security-of-us-nuclear-plants.

3 The NRC described its assessment and actions related to that study in a report to Congress issued in March 2005 (ADAMS Accession No. ML050280428).

Applicability of Lessons Learned to Other NRC Regulated Facilities

This lessons-learned activity originated from the SRM to COMGBJ-11-0002, "NRC Actions Following the Events in Japan," dated March 23, 2011 (ADAMS Accession No. ML110820875). The Commission directed the NRC staff to consider the applicability of lessons learned from the event to facilities other than operating power reactors. The associated licensees include research and test reactors; fuel cycle facilities; spent fuel storage and transportation licensees; decommissioning materials facilities and reactors; uranium-recovery facilities; low-level waste disposal facilities; irradiators; and radioactive materials licensees for medical, academic, and industrial uses.

The NRC staff completed the evaluation of the need to apply lessons learned from the accident to facilities other than operating power reactors and provided the results of that evaluation to the Commission in SECY-15-0081, "Staff Evaluation of Applicability of Lessons Learned from the Fukushima Dai-ichi Accident to Facilities Other than Operating Power Reactors," dated June 9, 2015 (ADAMS Accession No. ML15050A066). The NRC staff's evaluation noted two areas where work continued to ensure that Fukushima lessons learned are appropriately considered:

(1) On June 22, 2015, the NRC issued Generic Letter (GL) 2015-01, "Treatment of Natural Phenomena Hazards in Fuel Cycle Facilities" (ADAMS Accession No. ML14328A029). The NRC staff has received responses to the GL from all recipients and is preparing evaluation reports. As part of the closure process, the NRC staff is also independently verifying compliance with current NRC requirements, if necessary, using Temporary Instruction 2600/016, "Inspection of Activities Associated with NRC Generic Letter 2015-01," dated December 17, 2015 (ADAMS Accession No. ML15317A506). The NRC staff has closed the GL for four fuel cycle facilities and expects to complete and document the closure of the GL for the four remaining fuel cycle facilities by June 30, 2017.

(2) For the three research and test reactors that have thermal power ratings in excess of 2 megawatts thermal, the NRC staff performed further assessments to determine whether regulatory actions are necessary to mitigate certain beyond-design-basis external events. Specifically, the NRC staff requested additional information from licensees for the Massachusetts Institute of Technology reactor, the University of Missouri at Columbia reactor, and the National Bureau of Standards reactor to determine whether additional actions were necessary to mitigate beyond-design-basis external events. Based on the licensees' responses and staff analysis, the staff has concluded that current regulatory requirements for these facilities serve as a basis for reasonable assurance of adequate protection of public health and safety and that no further actions are necessary.

Comparison Study of U.S. and Japanese Regulations

In the SRM to SECY-12-0110, "Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission's Regulatory Framework," dated March 20, 2013 (ADAMS Accession No. ML13079A055), the Commission directed the NRC staff to document a comparison of U.S. and Japanese regulatory requirements that were in effect at the time of the accident, focusing on those areas most relevant to the sequence of events and accident mitigation capabilities at Fukushima, and to describe how those differences were factored into post-Fukushima actions taken by the NRC. In response to the SRM and to similar interest

expressed by various external stakeholders, the staff performed a comparison of regulatory requirements that were in effect in the United States and Japan at the time of the Fukushima accident. The comparison study was completed in November 2013 (ADAMS Accession No. ML13326A991). In summary, the NRC staff found that the United States and Japan had established similar design-basis requirements and guidance before the accident. However, the staff also identified differences in the approaches taken for beyond-design-basis events and severe accidents. The staff used the insights from this study when evaluating regulatory requirements and practices for post-Fukushima lessons-learned activities.

Continued Cooperation with International Organizations

The NRC staff has engaged and will continue to engage in various international activities related to the evaluation of and response to lessons learned from the Fukushima Dai-ichi accident. Activities include participation in several working groups within the International Atomic Energy Agency and the Nuclear Energy Agency (NEA) focused on efforts to better understand the accident and develop strategies to ensure nuclear power plants can more effectively cope with severe natural events. Bilateral exchanges continue to include Fukushima lessons learned as a topic of discussion. As an example, the NRC staff is participating in an NEA Committee on the Safety of Nuclear Installations (CSNI) study on lessons learned with regard to human and organizational factors from responding to events similar to that at Fukushima. CSNI will develop a report on the study so that these insights may be shared broadly with international stakeholders.