



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

January 17, 2017

Dr. Dennis C. Bley, Chairman
Advisory Committee on
Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: RESPONSE TO THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS LETTER, "CLOSURE OF FUKUSHIMA RECOMMENDATIONS RELATED TO EVALUATION OF NATURAL HAZARDS OTHER THAN SEISMIC AND FLOODING, PERIODIC CONFIRMATION OF NATURAL HAZARDS, AND REAL-TIME RADIATION MONITORING," DATED DECEMBER 13, 2016

Dear Dr. Bley:

I am responding to your letter dated December 13, 2016 (Agencywide Documents Access Management System (ADAMS) Accession No. ML16341B333), in which the Advisory Committee on Reactor Safeguards (ACRS) provided its evaluation of the U.S. Nuclear Regulatory Commission (NRC) staff's assessment of Fukushima-related recommendations regarding the evaluation of natural hazards other than seismic and flooding, ongoing assessment of natural hazards, and real-time radiation monitoring.

The staff appreciates the Committee's insights and used them in developing 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). The NRC staff's response to each of the six conclusions in your letter is provided below.

ACRS Conclusion 1

Additional regulatory actions related to high winds and wind-driven missiles, snow and ice loads, failures of downstream dams, low water conditions due to a seiche or tsunami, and other conditions that result in degraded intake water quality or air quality cannot be justified.

NRC Staff Response:

The NRC staff acknowledges the Committee's agreement with the results of the staff's evaluation of these hazards.

The staff also notes that the ACRS previously reviewed the staff's evaluations of all natural hazards other than high winds and snow and ice loads documented in 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. ML16102A297). The ACRS review was documented in a separate letter dated May 17, 2016 (ADAMS Accession No. ML16130A254). The staff responded to the May 17, 2016, ACRS letter on June 17, 2016 (ADAMS Accession No. ML16145A015). Based on that evaluation and the more recent

evaluation of high winds and snow and ice loads, the staff concludes that additional regulatory actions, beyond those already planned or being implemented, are not justified for natural hazards other than seismic and flooding.

ACRS Conclusion 2

The staff should ensure that the integrated procedures and guidelines for implementation of plant-specific diverse and flexible (FLEX) strategies contain adequate guidance for actions to trip affected operating equipment and reduce major heat loads if the plant experiences a loss of all cooling water with continued availability of alternating current (ac) power.

NRC Staff Response:

The staff agrees with the ACRS's assessment, which is provided in the body of the December 13, 2016, letter, that in light of the low frequency of loss-of-all-cooling-water events with continued availability of ac power, and the capability of FLEX strategies to restore alternate cooling, additional regulatory action cannot be justified in this area. One concern discussed in the body of the December 13, 2016, ACRS letter pertains to a scenario in which the reactor coolant pumps (RCPs) continue to run without cooling, leading to a failure of the RCP seals. Another scenario discussed in that letter is one in which ac power remains available, such that large loads could continue to operate and the requirements for cooling plant equipment and rooms may be more limiting than those assumed for concurrent loss of the ultimate heat sink (UHS) and loss of ac power. In such a scenario, the ACRS notes that the corresponding time windows for personnel response may be shorter than those assumed in the baseline FLEX guidance associated with Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012 (ADAMS Accession No. ML12054A735).

Most plants have procedural guidance, such as abnormal operating procedures (AOPs), that would be used to respond to the loss or degradation of the UHS (e.g., lowering UHS level or loss of heat sink pumps). That guidance includes instructions on when to trip the reactor and when to secure other major heat loads cooled by closed loop cooling systems (such as component cooling water) which are ultimately cooled by the UHS. Such instructions would include steps to trip the RCPs for pressurized water reactors (PWRs). If not addressed by a specific AOP for loss or degraded UHS, plants generally have AOPs to respond to loss or degradation of closed loop cooling systems that similarly address when to trip the reactor and when to secure major loads cooled by the respective system.

Room cooling analyses used to develop the FLEX guidance for compliance with Order EA-12-049 assume that some heat sources, such as high-voltage energized switchgear and electrical pumps, are not in operation. However, FLEX equipment and procedures still provide additional capabilities to address scenarios involving loss of the UHS without loss of ac power. These capabilities include development of temperature limits for important locations in the plant and provisions to provide for temporary cooling (e.g., through fans or through opening doors and hatches) or otherwise mitigate high temperature conditions (e.g., through opening electrical panels or removing ceiling tiles). This guidance would be available to operators following such an event.

In addition, although chillers that are either directly or indirectly cooled by the UHS may not be available, the electrically-powered fans in the heating, ventilation, and air conditioning systems for important rooms, such as the control room and emergency core cooling system pump

rooms, would remain available for circulating air and removing heat from these rooms under the conditions postulated in the ACRS's letter. These were not assumed to be available for the analyses that support compliance with Order EA-12-049.

Finally, the guidelines for the mitigation strategies that were developed in response to Order EA-12-049 provide additional capabilities to address a loss of UHS and already include the necessary guidance to prioritize (in the order of most preferred to least preferred) the use of available onsite water sources and installed pumps or FLEX pumps, as needed. In addition to having FLEX equipment and procedures, under the scenario discussed in the ACRS's letter, licensees would continue to have power available to risk-important, electrically-powered pumps, such as the motor driven auxiliary feedwater pumps in a PWR, that are not considered available for the purposes of compliance with the order.

In summary, the staff continues to conclude that existing procedures are sufficient to address loss or degradation of the UHS, and that the mitigation strategies implemented in response to Order EA-12-049 provide additional capabilities to address such an event. Therefore, the staff concludes that this issue is adequately addressed without the need for additional regulatory actions.

ACRS Conclusion 3

At sites which are vulnerable to conditions that may adversely affect the plant cooling water quality, the staff should review the plant-specific FLEX strategies to ensure that alternative sources of clean water are readily available, or the FLEX equipment has adequate filtration capabilities.

NRC Staff Response:

The staff agrees with the ACRS's assessment, which is provided in the body of the December 13, 2016, letter, that based on current knowledge and operating experience, realistic risk-informed evaluations would show that additional regulatory actions related to UHS water quality issues cannot be justified. The staff notes that in the body of the December 13, 2016, letter, the ACRS clarified that the basis for this concern is degraded UHS water quality that persists for an extended period of time.

The existing FLEX guidance includes prioritization of makeup water sources based on cleanliness. Such sources of water include stored water (e.g., water stored in condensate storage tanks or boiling water reactor wet wells), municipal sources of water, or onsite wells. Licensees will transition to use of the UHS as a makeup source only after depleting other cleaner water sources. A number of licensees have performed analyses to determine how long they can use the various water sources, such as well water or river water, before they need to align filtration units (including deionization or reverse osmosis units). These analyses have determined that scaling and the resultant reduced heat transfer (the limiting factor) becomes a concern after approximately 72 to 100 hours of boiling off the untreated water sources. The staff notes that filtration units are available from the National Strategic Alliance for FLEX Emergency Response (SAFER) Centers and that they can be delivered within this timeframe. The staff also notes that the use of cleaner water sources first would further extend the time available to obtain and initiate filtration capabilities.

Based on existing plant capabilities and the additional capabilities provided in response to Order EA-12-049, the staff concludes that this issue is adequately addressed and that additional regulatory actions are not warranted.

ACRS Conclusion 4

At sites which are vulnerable to conditions that may adversely affect the plant intake air quality for an extended period of time, the staff should review the plant-specific FLEX strategies to ensure that needed ventilation will remain available, and emergency generators or FLEX generators have adequate filtration capabilities.

NRC Staff Response:

The short-term mitigation strategies provided in response to Order EA-12-049 generally rely on installed steam-driven systems and stored water sources (e.g., condensate storage tanks) for the first phase of event response, followed by the use of portable pumps when steam-driven equipment becomes unavailable. Thus, immediate reliance on FLEX diesel generators is typically not needed. As part of the response to Order EA-12-049, licensees are required to maintain FLEX diesel generator functionality consistent with the FLEX strategies. In the event a plant is susceptible to intake air quality issues, the plant has additional capabilities to address the concern (e.g., provisions for additional air filtration capabilities). This includes having sufficient equipment to address all functions at all units on site, plus one additional spare. The additional spare provides an onsite source of replacement capability that would allow licensees to address either replacing, or removing and cleaning, a clogged air filter. The staff notes that FLEX equipment is typically robust commercial grade equipment designed for construction or remote sites and as such, it would be expected to operate in dusty environments. Lastly, the staff notes that FLEX strategies include the ability to obtain additional resources from nearby nuclear power plants or the National SAFER Centers, including air filters for FLEX equipment.

Based on existing plant capabilities and additional capabilities provided in response to Order EA-12-049, the staff concludes that this issue is adequately addressed and that additional regulatory actions are not warranted.

ACRS Conclusion 5

The staff's proposed resolution of Near-Term Task Force (NTTF) Recommendation 2.2 should be modified as follows:

- The scope of external hazards to be assessed by the External Hazards Center of Expertise (EHCOE) should be expanded to include man-made hazards, except for intentional acts.
- The assessment process should contain a requirement for periodic reporting of the staff's state of knowledge about all external hazards.

NRC Staff Response:

Addition of Man-Made Hazards to Ongoing Assessment Process

While the NRC staff has concluded that enhancements to existing processes are warranted to address natural hazards, the staff concludes that existing regulatory processes have been

shown to be sufficient to address changes in man-made hazards without the need for similar enhancements. Following the October 19, 2016, ACRS Fukushima Subcommittee meeting, the staff made changes to Enclosure 2 of SECY-16-0144 to provide a basis for why the proposed framework does not include man-made hazards.

The staff's assessment that man-made hazards do not need to be included in the proposed framework for the ongoing assessment of natural hazards is consistent with the discussion of man-made hazards found in SECY-16-0074. The discussion found in Appendix A of that Commission paper notes that the NRC staff submitted the consideration of man-made hazards to the NRC's Generic Issues (GI) Program by memorandum dated September 9, 2013 (ADAMS Accession No. ML12328A180). By a memorandum dated January 17, 2014 (ADAMS Accession No. ML14016A193), the NRC staff concluded that the proposed GI did not satisfy several criteria for acceptance into the program.

The January 17, 2014, memorandum discusses guidance found in Nuclear Energy Institute (NEI) guidance document NEI 98-03, Revision 1, "Guidelines for Updating Final Safety Analysis Reports," dated June 1999 (ADAMS Accession No. ML003779028), which is endorsed by the NRC in Regulatory Guide 1.181, "Content of the Updated Final Safety Analysis Report in Accordance with 10 CFR [Title 10 of the *Code of Federal Regulations*] 50.71(e)," dated September 1999 (ADAMS Accession No. ML992930009). NEI 98-03, Revision 1, states that licensees should evaluate potentially significant changes in the site environs (e.g., a new natural gas line within the site boundary or a major new industrial facility near the plant site) to determine if notification of the NRC and an update of the updated final safety analysis report are required. As documented in the January 17, 2014, memorandum, the GI Program staff concluded that current regulatory programs, processes, and guidance provide ample mechanisms to address man-made hazards; as such, man-made hazards were found not to meet the criteria for acceptance into the program.

Different treatment of natural and man-made hazards is appropriate due to fundamental differences in the characteristics of changes that may arise for the two hazard groups. For all hazards, 10 CFR 50.9, "Completeness and accuracy of information," requires licensees to "notify the Commission of information identified by the applicant or licensee as having for the regulated activity a significant implication for public health and safety or common defense and security." As articulated in the NTTF report, information related to natural hazards typically evolves gradually over time due to changes in the state of knowledge of natural phenomena and associated assessment tools. This creates challenges for identifying new and significant information and has led to the need for enhancements to existing processes and the resulting proposed framework for ongoing assessment of new natural hazards information.

Conversely, in the case of man-made hazards, changes tend to be discrete, well-defined, and site-specific (e.g., construction of a new facility or pipeline in the vicinity of a plant). Methods for identifying and assessing the potential impact of man-made hazards on nuclear facilities are generally well understood and mature. Construction of new facilities that may create significant man-made hazards typically includes regulatory and permitting activities (involving Federal, State, or local governments) that help identify the new man-made hazards, trigger evaluation, and ensure appropriate assessment of man-made hazards that may be introduced after the initial siting of a nuclear facility. As a result, site-specific changes in man-made hazards are generally readily identified. In addition, NRC's subject matter experts in assessment of man-made hazards are part of the EHCOE and those experts will support assessment of the significance of new man-made hazard information (other than those associated with intentional acts) when identified as part of existing processes.

Recent examples of NRC's evaluation of man-made hazards includes the assessment of the new proposed natural gas pipeline passing within close proximity of the Indian Point nuclear power plant and the assessment of potential impact from the modification of a liquefied natural gas terminal near the Calvert Cliffs nuclear power plant. These hazards were identified through existing processes including intergovernmental engagement and interaction with members of the public.

Based on existing processes that adequately address man-made hazards, the staff concludes that this issue is adequately addressed and that additional changes to the framework outlined in Enclosure 2 of SECY-16-0144 are not needed. As discussed above, the staff made changes to Enclosure 2 to provide a basis for why the proposed framework does not include man-made hazards.

Periodic Reporting

The staff recognizes the importance of having a defined structure and process to ensuring successful execution of the proposed framework. Moreover, staff agrees that performance of certain activities, such as technical engagement activities and development of summary reports on a defined or periodic schedule, provides important institutional structure. To provide this structure, the proposed framework will be institutionalized through an office instruction developed and maintained by the EHCOE. The staff will supplement this office instruction with additional documents (e.g., additional office instructions, user need requests, or research plans), as needed. The office instruction(s) will provide details regarding:

- roles and responsibilities;
- expected structure and minimum periodicity of technical engagement and coordination activities;
- conduct of the information aggregation and assessment processes;
- procedures to ensure timely updates to the cumulative information record and knowledge base; and
- periodic reporting.

As a result of ACRS interactions, NRC staff modified SECY-16-0144 to better emphasize that the effective implementation of the proposed framework will be ensured by institutionalizing and clearly documenting the systematic process in an office instruction.

ACRS Conclusion 6

Regulatory requirements for real-time radiation monitoring capability using fixed-station monitors onsite and within the Emergency Planning Zone at each site are not warranted. Decisions regarding augmentation of current offsite radiation monitoring capabilities are best left to the licensee, local, and State authorities who are most directly involved with implementing the emergency response plans.

D. Bley

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NRC Staff Response:

The NRC staff acknowledges the Committee's agreement with the staff's conclusion.

The staff appreciates the time and effort that the ACRS has devoted to working with the staff on identifying and resolving lessons learned from the Fukushima accident.

Sincerely,

/RA/

Victor M. McCree
Executive Director
for Operations

cc: Chairman Burns
Commissioner Svinicki
Commissioner Baran
SECY

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 Response ML16343A806 *via email**

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