August 15, 2012

Dr. J. Sam Armijo, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: DISPOSITION OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS' RECOMMENDATIONS RELATED TO DRAFT INTERIM STAFF GUIDANCE DOCUMENTS IN SUPPORT OF TIER 1 ORDERS

Dear Dr. Armijo:

The purpose of this letter is to provide the Advisory Committee on Reactor Safeguards (ACRS) with the results of the U.S. Nuclear Regulatory Commission staff's (NRC or the staff) review and evaluation of the recommendations from the ACRS letter dated July 17, 2012. In that letter, the ACRS recommended that the staff reconsider the measures to be taken to comply with the requirements contained in the three Tier 1 Fukushima Orders. The ACRS recommended that modifications be made to the following draft interim staff guidance (ISG) documents:

- JLD-ISG-2012-01, "*Compliance with Order EA-12-049, Requirements for Mitigation Strategies for Beyond-Design-Basis External Events"*
- JLD-ISG-2012-02, "*Compliance with Order EA-12-050, Reliable Hardened Containment Vents"*
- JLD-ISG-2012-03, "*Compliance with Order EA-12-051, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation"*

The staff reviewed the ACRS's recommendations and considered them in its decision-making process for finalizing the ISG documents. The staff agrees with a number of recommendations which are addressed in the guidance. The staff's considerations for each recommendation are provided below.

<u>JLD-ISG-2012-01, "*Compliance with Order EA-12-049, Requirements for Mitigation Strategies for Beyond-Design-Basis External Events"*</u>

ACRS recommendation:

The special allowance that permits only a single backup for FLEX equipment serving multiple units should be reconsidered.

Staff response:

The provision that this recommendation addresses, contained on page 28 of Nuclear Energy Institute (NEI) document 12-06, "*Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,*" is quoted below (emphasis added):

> In order to assure reliability and availability of the FLEX equipment required to meet these capabilities, *the site should have sufficient equipment to address all functions at all units on site, plus one additional spare*, i.e., a N+1 capability, where "N" is the number of units on-site. Thus, a two-unit site would nominally have at least three portable pumps, three sets of portable ac/dc power supplies, three sets of hoses & cables, etc. It is also acceptable to have a single resource that is sized to support the required functions for multiple units at a site (e.g., a single pump capable of all water supply functions for a dual unit site). In this case, the N+1 could simply involve a second pump of equivalent capability. In addition, it is also acceptable to have multiple strategies to accomplish a function (e.g., two separate means to repower instrumentation). In this case the equipment associated with each strategy does not require N+1. The existing 50.54(hh)(2) pump and supplies can be counted toward the N+1, provided it meets the functional and storage requirements outlined in this guide. The N+1 capability applies to the portable FLEX equipment described in Tables 3-1 and 3-2 (i.e., that equipment that directly supports maintenance of the key safety functions). Other FLEX support equipment only requires an N capability.

NEI 12-06 currently allows a single onsite system to supply all water needs for an entire site as long as it is of sufficient capacity. NEI 12-06 also allows the backup equipment required to meet the N+1 criteria to be a single system. The reasoning behind specifying one additional spare for the equipment is to allow for a random failure of the equipment. NEI 12-06 further specifies, on page 57, that the equipment be stored "such that no one external event can reasonably fail the site FLEX capability (N)," which could result in the provision of additional spares. The staff believes that taking exception to the spare equipment scheme as it is laid out in NEI 12-06 could have the unintended consequence of prohibiting the use of a single system to supply make-up water for multiple functions and units. Use of a single system for multiple cooling functions is faster and simpler to set up and operate than using a separate system for each cooling function. Additionally, the use of a single system could reduce the complexity of providing multiple suction hoses to the water source, thereby potentially reducing risk as well as the hazards of numerous temporary hoses. The staff agrees that the relative risks of these schemes should be considered and will examine the approaches proposed by the licensees in their integrated plans to ensure that these risks are acceptable.

ACRS recommendation:

The staff should provide guidance to address the use, or development if necessary, of appropriate standards for FLEX quality requirements.

Staff response:

The staff agrees with this recommendation. The American Nuclear Society (ANS) has also proposed the development of such consensus standards by letter dated July 2, 2012 (Agencywide Document Access and Management System (ADAMS) Accession No. ML12192A164). The staff will work with ANS and stakeholders towards this goal as a parallel effort to issuing the ISG on compliance with the Order.

ACRS recommendation:

Hazard evaluations should also account for correlated damage that is caused by extreme natural events that may adversely affect FLEX equipment availability or mitigation strategies.

Staff response:

The staff agrees with a portion of the discussion and notes that it is addressed in the guidance. The screening out of a particular hazard due to its characterization as “not a natural phenomenon” has been removed from later versions of NEI 12-06. Order EA-12-049 includes a requirement for maintenance of the strategies and guidance such that any new information will be taken into account for its effect on the availability and feasibility of FLEX equipment, as specified in NEI 12-06’s section on methodologies for configuration control. The staff notes that correlated damage, such as seismically induced flooding and fires, is the subject of the Near-Term Task Force Recommendation 3, which has been designated as a Tier 3 action item as specified in SECY-11-0037 and its associated staff requirements memorandum (SRM). If the resolution of this Tier 3 activity provides new information, licensees will be required to take this information into account to ensure mitigation strategies can still be implemented.

JLD-ISG-2012-02, “*Compliance with Order EA-12-050, Reliable Hardened Containment Vents”*

ACRS recommendation:

The staff should review the requirement that venting system be able to accommodate decay heat levels up to 1 percent of licensed/rated thermal power to assure that it addresses an appropriate range of scenarios.

Staff response:

The design of the hardened wetwell vent system is consistent with Generic Letter 89-16, “*Installation of a Hardened Wetwell Vent*.” The staff has focused on events that would lead to a slower pressurization of containment, since the venting capacity is based on a post-scram decay heat load.

The requirements for the reliable hardened vent support the strategies associated with prevention of core damage by removing heat from the containment and, thus, preventing a long-term overpressure failure of containment. However, core cooling must be provided by other systems. The reliable hardened vent capacity is based on conditions of constant heat input at a rate equal to 1 percent of rated thermal power and containment pressure equal to the primary containment pressure limit (PCPL). This determination is based on the following: (1) the torus suppression capacity is typically sufficient to absorb decay heat generated during the first three hours following the shutdown of the reactor, and (2) decay heat is typically less than 1 percent of rated thermal power three hours following shutdown of the reactor, and continues to decrease to well under 1 percent thereafter. Even in the scenario where vessel injection is coming from the suppression pool and safety relief valves are blowing down to the suppression pool, it would take more than 3 hours for the suppression pool to reach PCPL. If an alternative, cooler source of vessel injection can be established during the elapsed time, the time to reach PCPL would be extended even more.

The staff believes that whether the heat-absorbing capacity of the suppression pool is slightly more or less than three hours will not significantly impact the venting strategies. However, the licensees will be requested to evaluate how the decay heat absorbing capacity of their suppression pools fits into their venting strategies and, if required, to increase the venting capacity to an appropriate level.

ACRS recommendation:

The staff should provide a clearer definition of "seismically rugged design."

Staff response:

The staff agrees with the recommendation. The staff revised the definition of "seismically rugged design" to clarify that the hardened containment ventilation system (HCVS) must be designed to meet the plant's design basis earthquake, but may be constructed with commercial quality components and materials beyond the second containment isolation barrier. The definition now reads as follows:

> "Seismically rugged design"—A term often used to describe the design of components beyond the second containment isolation barrier to ensure that the HCVS is able to remain functional following a design basis seismic event. While the design and construction must meet the plant's design basis earthquake seismic requirements, licensees may use commercial grade components and materials beyond the second containment isolation barrier and are, thus, not required to qualify piping, supports and other related components in accordance with NRC requirements for safety related SSCs [structure, system, and component], including Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."

JLD-ISG-2012-03, "*Compliance with Order EA-12-051, Compliance with Order EA-12-051, Reliable Spent Fuel Pool (SFP) Instrumentation"*

ACRS recommendation:

The ISG should be modified to specify that the resolution of SFP water level measurements be adequate to detect pool draining quickly and accurately.

Staff response:

In Attachment 3 to SRM 12-0025, "*Staff Requirements-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*," the Commission specified that the purpose of the SFP instrumentation order was to establish a reliable means of remotely monitoring wide-range SFP levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis external event. In SRM 11-0124, "*Recommended Actions to be Taken Without Delay from the Near-Term Task Force Report,"* the Commission encouraged the staff to use a regulatory approach founded on performance-based requirements that would foster development of the most effective and efficient, site-specific strategies. Accordingly, the staff

specified performance requirements for the SFP instruments that provide adequate criteria to satisfy the goals of the Order.

The Order specifies the capability to determine SFP level within broad ranges based on the effects that level has on selection of emergency actions to mitigate the event. The NEI guidance associated with the Order, NEI 12-02, "*Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation'*," provides different degrees of resolution depending on the level range in the SFP. The guidelines of NEI 12-02 specify an instrumentation resolution of at least 1 foot between the top of the pool to approximately 10 feet or less above the top of the fuel racks.

The low decay heat rate and large coolant inventory in the SFP ensure pool conditions would change slowly. The criteria for the SFP pool instrumentation allow for determination of the initial pool damage state for most fuel cooling scenarios during the first couple of hours following an initiating event, and rapid drain down events could be assessed from observation based on deviation from the expected level early in the event. For example, a leak rate equivalent to the large makeup capacity specified in NEI 06-12, "*B.5.b Phase 2 & 3 Submittal Guideline*," revision 2, would result in a rate of level loss of about 2 to 5 feet per hour, depending on pool size. Conversely, a loss of forced cooling event would not result in any significant loss of inventory until the pool heats up to saturation conditions over several hours to days, and then the rate of inventory loss would be much less than 1 foot per hour. Thus, the progression of an SFP accident is slow enough that specified minimum instrument channel performance will allow responders to determine SFP status quickly and accurately enough to support effective prioritization of event mitigation and recovery actions following a beyond-design-basis external event.

ACRS recommendation:

The ISG should be modified to specify direct measurement of temperature in the SFP.

Staff response:

Extreme external events beyond those accounted for in the design basis are highly unlikely but, as shown at Fukushima, could present challenges to nuclear power plants. The purpose of Order EA-12-051, "*Order Modifying Licenses with Regard to Reliable Spent Fuel Poll Instrumentation" (Effective Immediately),* is to provide reliable and available indication to plant personnel so they can effectively prioritize emergency actions. Maintenance of an adequate water level alone satisfies the essential safety functions of containment, cooling, and shielding for the SFP; therefore, instrumentation monitoring of the SFP level is sufficient to prompt initiation of appropriate actions to maintain safe storage conditions for spent fuel in a severe emergency. The use of temperature indication is not justified for beyond-design-basis external events, since temperature does not provide vital information to emergency responders. In a severe emergency involving extensive damage to safety systems and loss of power, increasing temperature in the SFP is expected and does not indicate a need for immediate action. When level drops below normal, however, personnel can then obtain information, allowing a quick determination of the rate of water level change, and take appropriate action or further defer SFP actions to focus on the higher priority actions related to core cooling and maintenance of containment integrity.

ACRS recommendation:

The ISG should be modified to specify the capability to display pool levels and temperatures as a function of time.

Staff response:

As stated in the order, the goal of the SFP instrumentation order is to establish a reliable means of remotely monitoring wide-range SFP levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis external event. While the capability to display pool levels and temperatures against time may be a desired function, it does not provide vital action-based information to emergency responders for the low-frequency, high consequence scenarios described by the Fukushima Orders. The performance criteria for the instrumentation specified in the order provide for the capability to determine rate of change of level indication in a time frame adequate for emergency responders to take appropriate actions. While the instrument criteria do not provide for on-demand rate of change, plant personnel have the capability to determine the rate of change by obtaining level measurements over a set time period. This specified capability is adequate to inform emergency responders, while allowing the flexibility for individual licensees to deploy instrumentation with enhanced effectiveness where consistent with site-specific constraints.

The staff appreciates the comments and recommendations ACRS provided and looks forward to continuing to work with the Committee in the future.

Sincerely,

/RA/

R. W. Borchardt
Executive Director
for Operations

cc: Chairman Macfarlane
Commissioner Svinicki
Commissioner Apostolakis
Commissioner Magwood
Commissioner Ostendorff
SECY

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