



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

June 19, 2012

Mr. R. W. Borchardt  
Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**SUBJECT: NRC STAFF'S DRAFT PLANS AND STATUS SUMMARIES FOR TIER 3 JAPAN  
LESSONS LEARNED RECOMMENDATIONS**

Dear Mr. Borchardt:

During the 595<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards (ACRS), June 6-8, 2012, we reviewed the staff's draft program plans for disposition of the Tier 3 Japan Lessons Learned Recommendations. We also reviewed the staff's seismic walkdown guidance and guidelines for performing verification walkdowns of plant flood protection features addressing Near-Term Task Force (NTTF) Recommendation 2.3 and responding to NRC's 10 CFR 50.54(f) letter. Our Fukushima Subcommittee also reviewed these matters on May 22-23, 2012. During these reviews, we had the benefit of discussions with representatives of the NRC staff, the Nuclear Energy Institute, and members of the public. We also had the benefit of the documents referenced.

## **CONCLUSIONS**

The staff's proposed plans for addressing the Tier 3 recommendations have been developed appropriately at this stage. Our observations on the implementation plans for each category shown in Table 1 are provided below.

## **BACKGROUND**

On February 17, 2012, the staff issued SECY-12-0025 providing, for Commission consideration, the proposed orders in response to lessons learned from the Fukushima event. Also included in this notation vote paper were the staff's review and disposition of our recommendations (from the October 13 and November 8, 2011 letters) and the six additional recommendations identified in SECY-11-0137. Based on SECY-12-0025, the 14 recommendations in Table 1 were assigned to Tier 3 meaning that, in the staff's view, they (1) require further study to support a regulatory action, (2) have an associated shorter-term action that needs to be completed to inform the longer-term action, (3) are dependent on the availability of critical skill sets, or (4) are dependent on the resolution of NTTF Recommendation 1.

Table 1. SECY-12-0025 Tier 3 Recommendations

Recommendations	Description
NTTF 2.2	- Ten-year confirmation of seismic and flooding hazards (dependent on Recommendation 2.1)
NTTF 3	- Potential enhancements to the capability to prevent or mitigate seismically induced fires and floods
ACRS 1(g)	- NTTF Recommendation 8 to be expanded to include fire response procedures
ACRS 2(d)	- Integration of onsite emergency response capabilities to be expanded to include fire response procedures
NTTF 5.2	- Reliable hardened vents for containment designs other than Mark 1 and Mark II
Additional	- Filtration of containment vents
NTTF 6	- Hydrogen control and mitigation inside containment or in other buildings
ACRS 1(e)	- Additional hydrogen control and mitigation measures in reactor buildings with Mark I and Mark II containments
ACRS 2(b)	- Combustible gas control in reactor buildings with Mark I and Mark II containments
ACRS 2(c)	- Vulnerabilities introduced by shared ventilation systems or shared stacks in multi-unit sites
NTTF 9.1 and 9.2	- Emergency preparedness (EP) enhancements for prolonged SBO and multi-unit events (dependent on availability of critical skill sets)
NTTF 9.3	- Emergency Response Data System (ERDS) capability (related to long-term evaluation Recommendation 10)
NTTF 10	- Additional EP topics for prolonged SBO and multi-unit events
NTTF 11	- EP topics for decision-making, radiation monitoring, and public education
NTTF 12.1	- Reactor Oversight Process (ROP) modifications to reflect the recommended defense-in-depth framework (dependent on Recommendation 1)
NTTF 12.2	- Staff training on severe accidents and resident inspector training on severe accident management guidelines (SAMGs) (dependent on Recommendation 8)
Additional	- Emergency planning zone size
Additional	- Prestaging of potassium iodide beyond 10 miles
Additional	- Transfer of spent fuel to dry cask storage
ACRS 2(e)	- Reactor and containment instrumentation withstanding beyond-design-basis conditions

All ACRS recommendations in the above table were identified in our October 13, 2011 letter to the Commission.

The staff is providing 6-month status reports to the Commission on the developments supporting the Fukushima efforts. The proposed plans for addressing Tier 3 recommendations are a key part of these reports.

## **DISCUSSION**

We reviewed the flow logic of the evaluation process for disposition of all Tier 3 recommendations, along with the possible alternative outcomes from that review. This process design is logical and straightforward, and should provide a clear direction and record of how each recommendation was evaluated, what disposition conclusions were developed, and how these conclusions are supported.

### NTTF 2.2: Ten-Year Confirmation of Seismic and Flooding Hazards

In the near term the staff focus is on the initial pre-rulemaking activity to define appropriate approaches to reevaluate seismic and external flooding hazards on a periodic basis. We agree that a plant's capabilities to maintain adequate safety margins against challenging events should be reexamined periodically to account for advances in the state of knowledge about the hazards, mitigation capabilities, analytical methods, and improved characterization of the associated uncertainties. However, it is not evident why the scope of these examined hazards should be limited to only earthquakes and external floods. The regulatory framework and process to implement this recommendation should facilitate a broader and more flexible determination of the most appropriate scope of the evaluations for each plant as information about its most relevant hazards evolves.

The staff has identified an appropriate structure to evaluate current approaches to periodic reassessment and to identify the important regulatory issues requiring resolution. A robust stakeholder interaction process is planned. The definition of what constitutes "new and significant information requiring a regulatory response by the licensee" has been cited as a critical feature in this process. While the NTTF used that phrase to characterize the intent of these periodic assessments, other criteria for reexamination and prioritization of specific technical issues may accomplish the same objective. We commend the staff's plan to evaluate approaches used in selected international periodic safety review programs, including the associated criteria that are used to determine the technical scope of each reevaluation and the approaches to modify regulatory practices where required.

### NTTF 3: Potential Enhancements to Prevent or Mitigate Seismically Induced Fires and Floods; ACRS 1(g) and 2(d)

This program plan is designed to rely upon industry consensus (ASME/ANS Joint Committee on Nuclear Risk Management) and the results from Tier 1 seismic and flooding hazard and vulnerability evaluations. Enhancements considered and developed here should also be fed back in an integrated fashion to the other external event evaluation tasks.

NTTF 5.2: Reliable Hardened Vents for Containment Designs other than Mark I and Mark II

The staff presented a review of the information assembled from investigations of venting systems, as well as filtration systems, in foreign reactor facilities. Little information was available on the effectiveness of these systems in reducing risk. Following the Reliable Hardened Vent Order issued March 12, 2012, for Mark I and Mark II containment designs, the staff is currently focusing their attention on the implementation of this order. We agree that other containment designs are less susceptible to overpressurization and the focus on the Mark I and II containments is appropriate. Additional consideration of installation of hardened vents for other containment designs requires further evaluations. It may be helpful to review the work that was done on this subject in the late 1980s. We look forward to providing comments and recommendations as the staff completes these evaluations.

NTTF 6: Hydrogen Control and Mitigation inside Containment and in other Buildings; and ACRS 1(e), 2(b) and 2(c)

The events at Fukushima Daiichi provide an impetus for the re-assessment of hydrogen control inside containment and other buildings. The first significant regulatory action for severe accident mitigation was the hydrogen rule (10 CFR 50.44, Combustible Gas Control for Nuclear Power Reactors) issued soon after the TMI-2 accident. When this rule was promulgated, it was thought that inerting the containment atmosphere in BWRs with Mark I and Mark II containments was sufficient to eliminate any concerns regarding combustible gas control during a degraded core accident for these plant designs. Fukushima has shown that further hydrogen control measures need to be considered.

We agree that the staff should gather more information on how the hydrogen was released into the reactor buildings before recommending specific combustible gas control measures in BWRs with Mark I and Mark II containments. The staff currently appears to consider that improved venting capability will eliminate the need for further hydrogen control measures, but they have not presented analyses and arguments to justify this position. We continue to believe that if venting can not be shown to be effective, consideration of additional combustible gas control measures should be given higher priority.

We have suggested as a defense-in-depth measure that for BWR plants with Mark I and Mark II containments, combustible gas control measures be implemented in the reactor buildings. We encourage the staff to consider what measures are most appropriate (e.g., igniters, passive hydrogen recombiners, or hydrogen getters), and the strategy for their spatial arrangement. Additionally, work focused on identifying and minimizing potential hydrogen leakage paths in aging BWRs (e.g., degradation of drywell head seals, and lines venting into the suppression pools) would be highly beneficial.

NTTF 9.1, 9.2, 9.3, 10, and 11: Emergency Planning Topics; Additional: EPZ size, and Potassium Iodide

These program topics fall into a category of “event response” and include a broad scope of evaluations which will be influenced by and should be focused on several Tier 3 recommendations, as well as those in Tiers 1 and 2. This includes consideration of an Advanced Notice of Proposed Rulemaking, which should either sharpen the technical basis for rulemaking or screen activities for longer term evaluation or elimination.

Command and control decision-making that is required in the course of managing a severe nuclear accident requires involvement by licensee management and government and institutional decision-makers, beyond those presently assigned to the licensee’s Emergency Response Organizations (ERO). The institutional and political impact of these decisions requires the decision-makers to be competent with unique knowledge relative to a nuclear accident. Their training and required competencies are different from those required by ERO members. Qualification of decision-makers should be an important objective of Tier 3 Recommendation 11.2.

The staff should continue to encourage and support the Interagency Working Group in programs to reconstruct the offsite radionuclide release and deposition from Fukushima Daiichi. The work could incorporate sensitivity studies to examine both the actual case study for this event, as well as reasonable variations due to alternate weather scenarios or siting conditions as examples. Such studies could be used in part to inform the effects of changes in emergency planning zone size, or protective action guidelines including sheltering and evacuation. As an example, distribution of potassium iodide should consider its benefits and its risks such as the effects from interactions with over 40 commonly used drugs.

NTTF 12.1: Potential Modifications to the Reactor Oversight Process

This evaluation is taking place in concert with Recommendation 1. The schedule for this work is proceeding through 2013. We anticipate further discussions with the staff during this period when results and recommendations that feed into this work have progressed.

NTTF 12.2: Staff Training

The staff described their plans for augmenting the current staff training program, including staff in the Regions and site resident inspectors, to incorporate additional severe accident related training. We agree with these plans and offer the following observations:

- The training curricula should recognize the differences in site-specific aspects of emergency operating procedures, severe accident management guidelines, extensive damage mitigation guidelines, and emergency action levels.
- The staff described current work to develop desktop severe accident simulation using MELCOR software. Although plant simulators are not designed specifically to model severe accident sequences or conditions, simulator training using selected accident sequences should be considered for augmenting classroom training for on-site NRC staff.

ACRS 2(e): Reactor and Containment Instrumentation Capability in Beyond Design Basis Accident Conditions

As part of this work scope, the staff is examining near-term Tier 1 activities to assure that reactor and containment instrumentation requirements and considerations are incorporated.

Activities proposed by the staff to implement this recommendation include applying a systematic approach to identify which sensors are critical for operators to assess the plant state during the severe accidents and the conditions that the sensors must withstand. We encourage the staff to use information about severe accidents from the State-of-the-Art Reactor Consequence Analysis (SOARCA) project and existing Level 3 probabilistic risk assessments (PRAs) to provide insights related to these conditions.

Additional: Transfer of Spent Fuel to Dry Cask Storage

There are a variety of tasks preceding this investigation, including the Spent Fuel Pool Scoping Study and Tier 2 recommendations related to provision of safety-related makeup capability and seismically qualified spray capability for the spent fuel pools. Other ongoing spent fuel storage option evaluations will affect this work. For example, the new Extended Fuel Storage program will introduce new considerations, such as canister thermal loading, that could impose additional constraints to dry storage of recently discharged spent fuel.

Tier 1 NTF Recommendation 2.3: Walkdown Guidance to Identify Vulnerability to Seismic and Flooding Events

In addition to the Tier 3 program implementation plan, the staff also presented the final guidance for seismic and flooding walkdowns to be conducted under Tier 1 Recommendation 2.3. The staff and the Fukushima Steering Committee fully considered the issues that were discussed in our May 22, 2012 Fukushima Subcommittee meeting, and we concur with the endorsed guidance issued May 31, 2012.

**SUMMARY**

The staff's proposed plans for addressing Tier 3 recommendations have been developed appropriately at this stage.

We look forward to working with the staff on all important matters related to the Fukushima efforts.

Sincerely,

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J. Sam Armijo  
Chairman

**REFERENCES:**

1. NRR Memorandum; Subject: Draft Program Plans and Status Summaries for Tier 3 Japan Lessons Learned Recommendations, dated May 24, 2012 (ML12145A131)
2. Notation Vote 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," February 17, 2012 (ML12039A103)
3. ACRS letter, "Initial ACRS Review of: (1) the NRC Near-Term Task Force Report on Fukushima and (2) Staff's Recommended Actions to be Taken Without Delay," dated October 13, 2011 (ML11284A136)
4. ACRS letter, "ACRS Review of Staff's Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned (SECY-11-0137)," dated November 8, 2011 (ML11311A264)
5. Notation Vote SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," October 3, 2011 (ML11272A111)
6. Order EA-12-050, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents," dated March 9, 2012 (ML12054A696)
7. NRR Letter, "Endorsement of Electric Power Research Institute (EPRI) Draft Report 1025286, 'Seismic Walkdown Guidance,'" dated May 31, 2012 (ML12145A529)
8. NRR Letter, "Endorsement of Nuclear Energy Institute (NEI) 12-07, 'Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features,'" dated May 31, 2012 (ML12144A142)

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1. NRR Memorandum; Subject: Draft Program Plans and Status Summaries for Tier 3 Japan Lessons Learned Recommendations, dated May 24, 2012 (ML12145A131)
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Letter to R.W. Borchardt, Executive Director for Operations from J. Sam Armijo, ACRS  
Chairman dated June 12, 2012

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