

March 9, 2012

MEMORANDUM TO: R. W. Borchardt  
Executive Director for Operations

FROM: Annette L. Vietti-Cook, Secretary */RA/*

SUBJECT: 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 has approved the issuance of the proposed Orders subject to the changes and comments below.

The Order on Mitigation Strategies for Beyond-Design-Basis External Events provided in Enclosure 4 should be issued as necessary for ensuring continued adequate protection under the 10 C.F.R. § 50.109(a)(4)(ii) exception to the Backfit Rule, as revised in [Attachment 1](#).

The Order on Reliable Hardened Containment Vents (Mark I and II BWRs) provided in Enclosure 5 should be issued as necessary for ensuring continued adequate protection under the 10 C.F.R. § 50.109(a)(4)(ii) exception to the Backfit Rule, as revised in [Attachment 2](#).

The Order on Reliable Spent Fuel Pool Instrumentation in Enclosure 6 should be issued as enhanced protection under an administrative exemption to the Backfit Rule and the issue finality requirements in 10 C.F.R. § 52.63 and 10 C.F.R. Part 52 Appendix D Paragraph VIII, as revised in [Attachment 3](#).

The staff should pursue the development of implementing guidance with the urgency taken for the development of the Orders and letters. The definition of proper quality assurance pedigree assigned to the equipment enhancements is important. Reliable, commercial grade equipment could be an appropriate solution, so long as the expectations for 'reliable' are clearly outlined in the guidance documents.

If the industry submits an alternative, practical engineering approach for seismic reevaluations that could result in the quicker implementation of plant safety enhancements while enabling plants to complete the assessment within the schedule defined in the 50.54(f) request for information letter, the staff should provide an information paper to the Commission containing a determination of whether this approach is acceptable to the staff, or, if not, explaining how continuing with the staff's approach of seismic probabilistic risk assessment provides superior safety benefits on a reasonable timetable.

The staff should follow through on its commitments that the implementation of the Emergency Preparedness rule that was issued last year remains a higher priority than activities associated with Recommendation 9.3. Completing implementation activities associated with the rule we

have already promulgated has greater safety significance and also involves the coordinated actions of our partners in State and local governments. Substantial public credibility benefits accrue from continuing these activities as a priority.

As time permits and the immediate urgencies of the staff's work are addressed, the Chairman of the Steering Committee should lead an effort to consider how the work processes created to respond to the Fukushima lessons learned might best be incorporated into the agency's normal work practices.

After issuance of the requests for information, the seismic analyses required by the Requests for Information should be prioritized and proceed in a flexible manner. Plants in areas known to be more seismically active should be required to complete work on the schedule anticipated by the staff. Other plants should be permitted greater latitude for the purpose of completing higher priority assessments.

Regarding the applicability of post-Fukushima measures to fuel cycle facilities, the staff should pursue the timely completion of the ongoing inspection activities. Any proposed changes in licensing basis for any facility should be provided in a notation vote paper to the Commission as soon as practical.

The staff should continue to monitor and assess information associated with the review of the challenges and problems faced by the Fukushima Daiichi plant and its operators after the March 11, 2011 earthquake and tsunami. Should any new information arise that has bearing on any aspect of SECY-12-0025, the staff should provide this information to the full Commission as soon as possible along with any recommendation if necessary.

Attachments:

- [1. Revisions to SECY-12-0025, Enclosure 4](#)
- [2. Revisions to SECY-12-0025, Enclosure 5](#)
- [3. Revisions to SECY-12-0025, Enclosure 6](#)

cc: Chairman Jaczko  
Commissioner Svinicki  
Commissioner Apostolakis  
Commissioner Magwood  
Commissioner Ostendorff  
OGC  
CFO  
OCA  
OPA  
Office Directors, Regions, ACRS, ASLBP (via E-Mail)  
PDR

**Changes to SECY-12-0025, Enclosure 4, Order on Mitigation Strategies for Beyond-Design-Basis External Events**

1. Page 6, move the second full paragraph and make it the last paragraph of Section III revised as follows:

“Accordingly, the NRC has concluded that **these measures are necessary to ensure adequate** ~~there is a need to redefine the level of protection of public health and safety regarded as adequate~~ under the provisions of the backfit rule, 10 CFR 50.109(a)(4)(iii), and is requiring Licensee or CP holder action ~~to meet that new level of protection~~. In addition, pursuant to 10 CFR 2.202, the NRC finds that the public health, safety and interest require that this Order be made immediately effective.”

2. Page 6, last paragraph, first sentence, revise to read: “The Commission has determined that **ensuring** adequate protection...”

## Changes to SECY-12-0025, Enclosure 5, Order on Reliable Hardened Containment Vents (Mark I and II BWRs)

1. Page 2, second paragraph, third sentence, revise to read: "...Units 1 and 2, and ~~for~~ **after** some period..." **[same change should be made in other Orders to be consistent.]**
2. Page 2, third paragraph, third sentence, revise to read: "~~However,~~ **Ultimately,** without adequate..."
3. Page 3, line 1, revise to read: "challenged **in** opening the hardened wetwell..."
4. Page 3, first full paragraph, last sentence, revise to read: "...reactor buildings **precipitated** **resulted in** explosions..."
5. Page 4, second full paragraph, revise to read as follows:
 

"...However, **the importance of reliable operation of hardened vents during emergency conditions was already well established and this understanding has been reinforced by the clear lessons of Fukushima. While not required, hardened vents have been in place in U.S. plants with BWR Mark I containments for many years but a wide variance exists with regard to the reliability of the vents. Additionally, hardened vents are not required on plants with BWR Mark II containments although as discussed above, Mark II containments are only slightly larger than Mark I. NRC's assessment of new insights from the events at Fukushima Dai-ichi leads the staff to conclude that additional requirements must be imposed on Licensees to increase the capability of nuclear power plants to mitigate beyond design-basis external events. These additional requirements **Reliable hardened venting systems in BWR facilities with Mark I and Mark II containments** are needed to ensure that provide adequate protection ~~to~~ **of** public health and safety **is maintained** as set forth in Section III of this Order."**
6. Page 4, last two line, revise to read: "...operation of the vent, ~~the~~ addition of filters to hardened reliable vents **systems,**..."
7. Page 6, first full paragraph, sixth sentence, revise to read: "... may have limited **or prevented** damage to the reactor core."
8. Page 6, move the last paragraph and make it the last paragraph of Section III revised as follows:
 

"Accordingly, the NRC has concluded that **these measures are necessary to ensure adequate** ~~there is a need to redefine the level of protection of public health and safety regarded as adequate~~ under the provisions of the backfit rule, 10 CFR 50.109(a)(4)(iii), and is requiring Licensee actions ~~to meet the new level of protection.~~ In addition, pursuant to 10 C.F.R. 2.202, the NRC finds that the public health, safety and interest require that this Order be made immediately effective."

9. Page 7, first full paragraph, first sentence, revise to read: “The Commission has determined that **ensuring** adequate protection...”

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the Matter of )  
)  
ALL POWER REACTOR ) Docket Nos. (as shown in Attachment 1)  
LICENSEES AND HOLDERS ) License Nos. (as shown in Attachment 1) or  
OF CONSTRUCTION PERMITS IN ) Construction Permit Nos. (as shown in  
ACTIVE OR DEFERRED STATUS ) Attachment 1)  
)  
) EA-12-XXX

**ORDER MODIFYING LICENSES  
WITH REGARD TO RELIABLE SPENT FUEL POOL  
INSTRUMENTATION  
(EFFECTIVE IMMEDIATELY)**

I.

The Licensees and construction permit (CP) holders<sup>1</sup> identified in Attachment 1 to this Order hold licenses issued by the U.S. Nuclear Regulatory Commission (NRC or Commission) authorizing operation and/or construction of nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

II.

On March 11, 2011, a magnitude 9.0 earthquake struck off the coast of the Japanese island of Honshu. The earthquake resulted in a large tsunami, estimated to have exceeded 14 meters (45 feet) in height, that inundated the Fukushima Dai-ichi Nuclear Power Plant site.

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<sup>1</sup> CP holders, as used in this Order, includes CPs, in active or deferred status, as identified in Attachment 1 to this Order (i.e., Watts Bar, Unit 2; and Bellefonte, Units 1 and 2)

The earthquake and tsunami produced widespread devastation across northeastern Japan and significantly affected the infrastructure and industry in the northeastern coastal areas of Japan.

When the earthquake occurred, Fukushima Dai-ichi Units 1, 2, and 3 were in operation and Units 4, 5, and 6 were shut down for routine refueling and maintenance activities. The Unit 4 reactor fuel was offloaded to the Unit 4 spent fuel pool. Following the earthquake, the three operating units automatically shut down and offsite power was lost to the entire facility. The emergency diesel generators (EDGs) started at all six units providing alternating current (ac) electrical power to critical systems at each unit. The facility response to the earthquake appears to have been normal.

Approximately 40 minutes following the earthquake and shutdown of the operating units, the first large tsunami wave inundated the site, followed by additional waves. The tsunami caused extensive damage to site facilities and resulted in a complete loss of all ac electrical power at Units 1 through 5, a condition known as station blackout. In addition, all direct current electrical power was lost early in the event on Units 1 and 2 and for some period of time at the other units. Unit 6 retained the function of one air-cooled EDG. Despite their actions, the operators lost the ability to cool the fuel in the Unit 1 reactor after several hours, in the Unit 2 reactor after about 70 hours, and in the Unit 3 reactor after about 36 hours, resulting in damage to the nuclear fuel shortly after the loss of cooling capabilities.

The Unit 4 spent fuel pool contained the highest heat load of the six units with the full core present in the spent fuel pool and the refueling gates installed. However, because Unit 4 had been shut down for more than 3 months, the heat load was low relative to that present in spent fuel pools in the United States immediately following shutdown for reactor refueling. Following the earthquake and tsunami, the operators in the Units 3 and 4 control room focused their efforts on stabilizing the Unit 3 reactor. During the event, concern grew that the spent fuel was overheating, causing a high-temperature reaction of steam and zirconium fuel cladding generating hydrogen gas. This concern persisted primarily due to a lack of readily available and

reliable information on water levels in the spent fuel pools. Helicopter water drops, water cannons, and cement delivery vehicles with articulating booms were used to refill the pools, which diverted resources and attention from other efforts. Subsequent analysis determined that the water level in the Unit 4 spent fuel pool did not drop below the top of the stored fuel and no significant fuel damage occurred. The lack of information on the condition of the spent fuel pools contributed to a poor understanding of possible radiation releases and adversely impacted effective prioritization of emergency response actions by decision makers.

Following the events at the Fukushima Dai-ichi nuclear power plant, the NRC established a senior-level agency task force referred to as the Near-Term Task Force (NTTF). The NTTF was tasked with conducting a systematic and methodical review of the NRC regulations and processes and determining if the agency should make additional improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a comprehensive set of recommendations, documented in SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011. These recommendations were modified by the NRC staff following interactions with stakeholders. Documentation of the NRC staff's efforts is contained in SECY-11-0124, "Recommended Actions To Be Taken Without Delay From the Near-Term Task Force Report," dated September 9, 2011, and SECY-11-0137, "Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011.

As directed by the Commission's Staff Requirements Memorandum (SRM) for SECY-11-0093, the NRC staff reviewed the NTTF recommendations within the context of the NRC's existing regulatory framework and considered the various regulatory vehicles available to the NRC to implement the recommendations. SECY-11-0124 and SECY-11-0137 established the NRC staff's prioritization of the recommendations based upon the potential safety enhancements.



Current regulatory requirements and existing plant capabilities allow the NRC to conclude that a sequence of events such as the Fukushima Dai-ichi accident is unlikely to occur in the United States. Therefore, continued operation and continued licensing activities do not pose an imminent threat to public health and safety. However, the NRC's assessment of new insights from the events at Fukushima Dai-ichi leads the NRC staff to conclude that additional requirements must be imposed on Licensees and CP holders to increase the capability of nuclear power plants to mitigate beyond-design-basis external events. These additional requirements are needed to provide adequate protection to public health and safety. **represent a substantial increase in the protection** **The Commission has decided to administratively exempt this Order from applicable provisions of the Backfit Rule, 10 CFR 50.109, and the issue finality requirements in 10 CFR 52.63 and 10 CFR Part 52, Appendix D, Paragraph VIII.** ~~as set forth in Section III of this Order.~~

Additional details on an acceptable approach for complying with this Order will be contained in final interim staff guidance (ISG) scheduled to be issued by the NRC in August 2012. This guidance will include a template to be used for the plan that will be submitted in accordance with Section IV, Condition C.1 below.

### III.

Reasonable assurance of adequate protection of public health and safety and assurance of the common defense and security are the fundamental NRC regulatory objectives. Compliance with NRC requirements plays a critical role in giving the NRC confidence that Licensees and CP holders are maintaining an adequate level of public health and safety and common defense and security. While compliance with NRC requirements presumptively ensures adequate protection, new information may reveal that additional requirements are warranted. In such situations, the Commission may act in accordance with its statutory authority under Section 161 of the Atomic Energy Act of 1954, as amended, to require

Licensees and CP holders to take action in order to protect health and safety and common defense and security.

To protect public health and safety from the inadvertent release of radioactive materials, the NRC's defense-in-depth strategy includes multiple layers of protection: (1) prevention of accidents by virtue of the design, construction, and operation of the plant; (2) mitigation features to prevent radioactive releases should an accident occur; and (3) emergency preparedness programs that include measures such as sheltering and evacuation. The defense-in-depth strategy also provides for multiple physical barriers to contain the radioactive materials in the event of an accident. The barriers are the fuel cladding, the reactor coolant pressure boundary, and the containment. These defense-in-depth features are embodied in the existing regulatory requirements and thereby provide adequate protection of public health and safety.

In the case of spent fuel pools, compliance with existing regulations and guidance presumptively provides reasonable assurance of the safe storage of spent fuel. In particular, Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 establishes the general design criteria (GDC) for nuclear power plants. All currently operating reactors were licensed to the GDC or meet the intent of the GDC. The GDC provide the design features of the spent fuel storage and handling systems and the protection of these systems from natural phenomena and operational events. The accidents considered during licensing of U.S. nuclear power plants typically include failure of the forced cooling system and loss of spent fuel pool inventory at a specified rate within the capacity of the makeup water system. Further, spent fuel pools at U.S. nuclear power plants rely on maintenance of an adequate inventory of water under accident conditions to provide containment, as well as the cooling and shielding safety functions.

During the events in Fukushima, responders were without reliable instrumentation to determine water level in the spent fuel pool. This caused concerns that the pool may have

boiled dry, resulting in fuel damage.<sup>2</sup> Fukushima demonstrated the confusion and misapplication of resources that can result from beyond-design-basis external events when adequate instrumentation is not available.

The spent fuel pool level instrumentation at U.S. nuclear power plants is typically narrow range and, therefore, only capable of monitoring normal and slightly off-normal conditions. Although the likelihood of a catastrophic event affecting nuclear power plants and the associated spent fuel pools in the United States remains very low, beyond-design-basis external events could challenge the ability of existing instrumentation to provide emergency responders with reliable information on the condition of spent fuel pools. Reliable and available indication is essential to ensure plant personnel can effectively prioritize emergency actions.

The Commission has determined that the spent fuel pool instrumentation required by this Order represents a significant enhancement to the protection of public health and safety and is an appropriate response to the insights from the Fukushima Dai-ichi accident. While this consideration is qualitative in nature, the Commission has long taken the position that the determination as to whether proposed backfits represent a substantial safety improvement may be qualitative in nature. Staff Requirements Memorandum, SECY-93-086, "Backfit Considerations" (June 30, 1993), pp. 1-2. However the Commission does not, at this time, have sufficient information to complete a full backfit analysis of the spent fuel pool instrumentation that would be required by this Order. The NRC is analyzing the insights gained from the Fukushima Dai-ichi accident on an accelerated timeline. Additionally, the NRC has considered the Congressional intent that the agency act expeditiously on Tier 1 recommendations.

The Commission has recognized, in exceptional circumstances, that some proposed rules may not meet the requirements specified in the Backfit Rule but nevertheless should be adopted by the NRC. Hence the Commission advised the NRC staff that it would consider, on a

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<sup>2</sup> See *Institute of Nuclear Power Operations (INPO) 11-005, "Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station," Revision 0, issued November 2011, p. 36.*

case-by-case basis, whether a proposed regulatory action should be adopted as an “exception” to the Backfit Rule. This Order represents such a case. Therefore, the Commission has decided to administratively exempt this Order from the Backfit Rule and the issue finality requirements in 10 CFR 52.63 and 10 CFR Part 52, Appendix D, Paragraph VIII for several reasons.

The Fukushima Dai-ichi accident was unprecedented in terms of initiating cause and the particular failure sequence. In addition, our review of this event has highlighted the benefits that can be derived from the availability of more diverse instrumentation. Consistent with the final Aircraft Impact Assessment Rule, 10 CFR 50.150, 74 FR 28112 (June 12, 2009), the Commission’s decision to administratively exempt this Order from compliance with the Backfit Rule is a highly exceptional action limited to the insights associated with the extraordinary underlying circumstances of the Fukushima Dai-ichi accident and the NRC’s lessons learned. Furthermore, the extensive stakeholder engagement and broad endorsement for timely action support the Commission’s judgment that immediate action to commence implementation of the spent fuel monitoring requirements is warranted at this time. In addition, pursuant to 10 CFR 2.202, the NRC finds that the public health, safety, and interest require that this Order be made immediately effective.

Based upon the considerations set forth above, the Commission has determined that all power reactor licensees and CP holders must have a reliable means of remotely monitoring wide-range spent fuel pool levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis external event. These new requirements provide a greater capability, consistent with the overall defense-in-depth philosophy, and therefore greater assurance of protection of public health and safety from the challenges posed by beyond-design-basis external events to power reactors. Accordingly, the Commission concludes that all operating reactor licensees and CPs under Part 50 identified in Attachment 1 to this Order shall be modified to include the requirements identified in Attachment

2 to this Order. All combined licenses (COLs) under Part 52 identified in Attachment 1 to this Order shall be modified to include the requirements identified in Attachment 3 to this Order.

Accordingly, the NRC has concluded that there is a need to redefine the level of protection of public health and safety regarded as adequate under the provisions of the backfit rule, 10 CFR 50.109(a)(4)(iii), and is requiring actions of Licensees and CP holders to meet the new level of protection. In addition, pursuant to 10 CFR 2.202, the NRC finds that the public health, safety and interest require that this Order be made immediately effective.

The Commission has determined that adequate protection of public health and safety requires that all power reactor Licensees and CP holders have a reliable means of remotely monitoring wide range spent fuel pool levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond design basis external event. These new requirements provide a greater capability, consistent with the overall defense-in-depth philosophy, and therefore greater assurance that the challenges posed by beyond design basis external events to power reactors do not pose an undue risk to public health and safety. In order to provide reasonable assurance of adequate protection of public health and safety, all operating reactor licenses and CPs under Part 50 identified in Attachment 1 to this Order shall be modified to include the requirements identified in Attachment 2 to this Order. All combined licenses (COLs) under Part 52 identified in Attachment 1 to this Order shall be modified to include the requirements identified in Attachment 3 to this Order.

**[No changes in remainder of Order]**