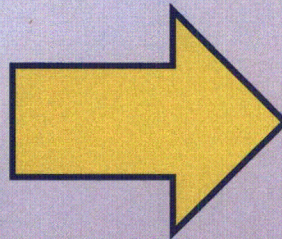
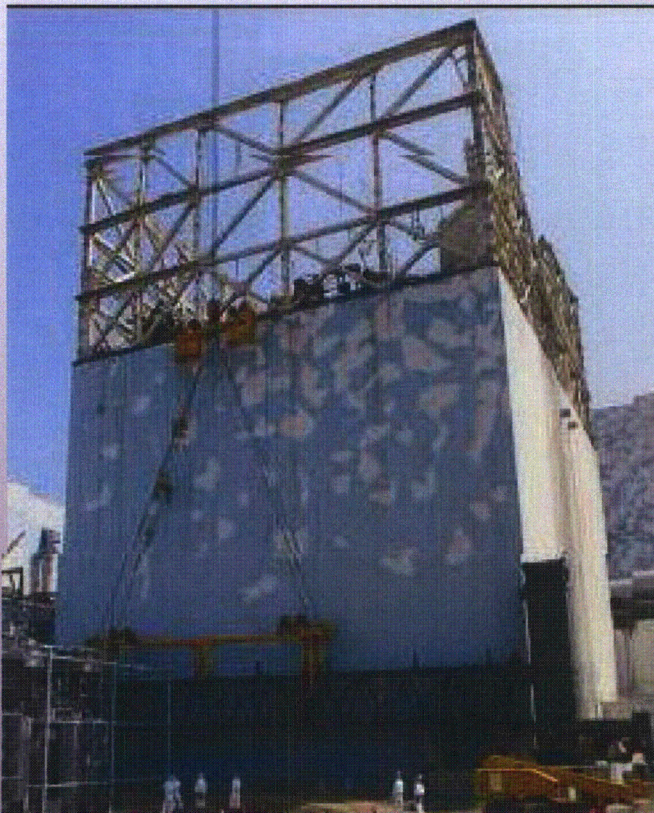


SITE STATUS AS OF MARCH 2012

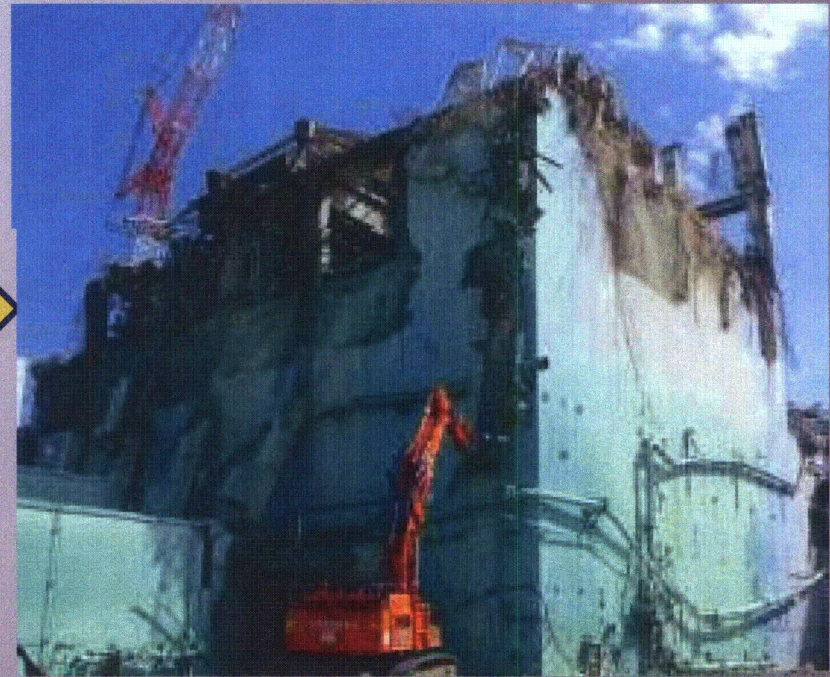
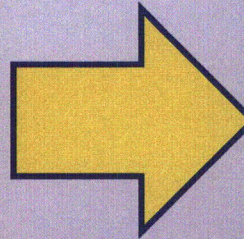
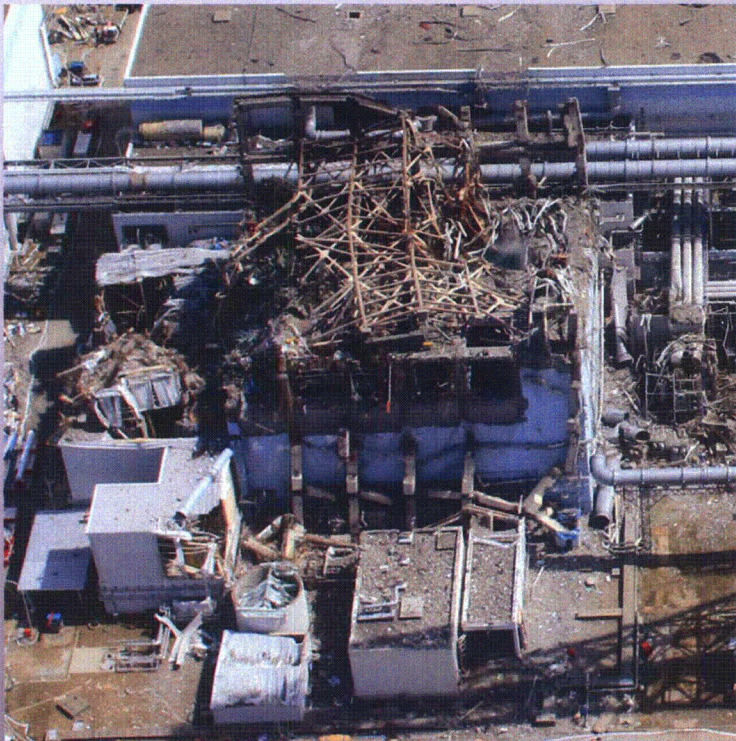
UNIT 1



Installation of Reactor Building Cover (on Oct. 28, 2011)
Installed to minimize release of radioactive materials.

SITE STATUS AS OF MARCH 2012

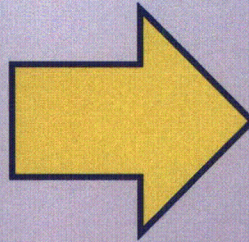
UNIT 3



Rubble is being removed from the upper part of the Unit 3 reactor building before installation of the covers.

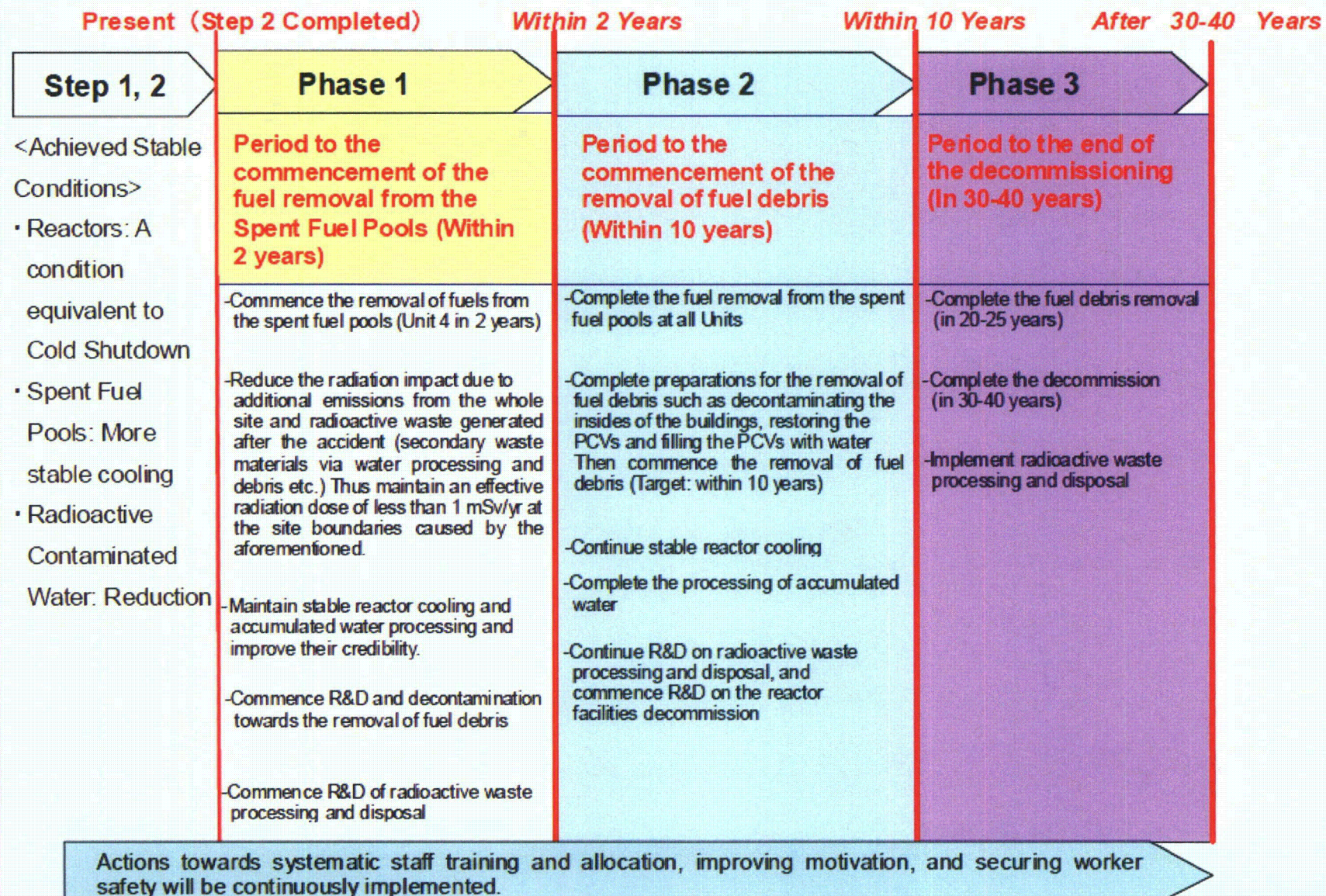
SITE STATUS AS OF MARCH 2012

UNIT 4



Rubble is being removed from the upper part of the Unit 4 reactor building before installation of the covers.

Mid-to-Long-Term Roadmap towards the Decommissioning of Fukushima Nuclear Power Units 1-4



NRC JAPAN LESSONS LEARNED INITIAL NRC ACTIONS

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NEW REACTORS
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001

March 18, 2011

NRC INFORMATION NOTICE 2011-05 TOHOKU-TAIHEIYU-OKI EARTHQUAKE
EFFECTS ON JAPANESE NUCLEAR POWER
PLANTS

ADDRESSEES

All holders of or applicants for operating licenses for nuclear power reactors under the provision of Title 10 of the Code of Federal Regulations (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

All holders of or applicants for a standard design certification, standard design approval, manufacturing license, limited work authorization, early site permits or combined license issued under 10 CFR Part 52, "Licenses, Certifications and Approvals for Nuclear Power Plants."

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of effects of the Tohoku-Taiheiyu-Okai Earthquake on nuclear power plants in Japan. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

The following summary of events is provided based on the best information available at this time. The situation in Japan regarding recovery efforts for the Fukushima Daiichi Nuclear Power Station continues to evolve on an hourly basis.

On March 11, 2011, the Tohoku-Taiheiyu-Okai Earthquake occurred near the east coast of Honshu, Japan. This magnitude 9.0 earthquake and the subsequent tsunami caused significant damage to at least four of the six units of the Fukushima Daiichi nuclear power station as the result of a sustained loss of both the offsite and on-site power systems. Efforts to restore power to emergency equipment have been hampered or impeded by damage to the surrounding areas due to the tsunami and earthquake.

ML10760432

IN 2011-05
Inform U.S.
Licensees of event
details

NRC INSPECTION MANUAL TEMPORARY INSTRUCTION 2515/183

FOLLOWUP TO THE FUKUSHIMA DAIICHI NUCLEAR STATION
FUEL DAMAGE EVENT

CORNERSTONE: INITIATING EVENTS AND MITIGATING SYSTEMS

APPLICABILITY: This Temporary Instruction (TI) applies to all holders of operating licenses for nuclear power reactors, except plants which have permanently ceased operations.

2515/183-01 OBJECTIVES

The objective of this TI is to independently assess the adequacy of actions taken by licensees in response to the Fukushima Daiichi nuclear station fuel damage event. The inspection results from this TI will be used to evaluate the industry's readiness for a similar event and to aid in determining whether additional regulatory actions by the U.S. Nuclear Regulatory Commission are warranted. Therefore, the intent of this TI is to be a high-level look at the industry's preparedness for events that may exceed the design basis for a plant. If necessary, a more specific followup inspection will be performed at a later date.

2515/183-02 BACKGROUND

On March 11, 2011, the Tohoku-Taiheiyu-Okai Earthquake occurred near the east coast of Honshu, Japan. This magnitude 9.0 earthquake and the subsequent tsunami caused significant damage to at least four of the six units of the Fukushima Daiichi nuclear power station as the result of a sustained loss of both the offsite and on-site power systems. Efforts to restore power to emergency equipment have been hampered or impeded by damage to the surrounding areas due to the tsunami and earthquake. The following background information is current as of March 16, 2011.

Units 1 through 3, which had been operating at the time of the earthquake, scrambled automatically, injecting their reaction absorbing control rods to ensure immediate shutdown of the fission process. Following the loss of electric power to normal and emergency core cooling systems and the subsequent failure of back-up decay heat removal systems, water injection into the cores of all three reactors was compromised, and reactor water levels could not be maintained. Tokyo Electric Power Company (TEPCO), the operator of the plant, resorted to injecting sea water and boric acid into the reactor vessels of these three units, in an effort to cool the fuel and ensure the reactors remained shutdown. However, the fuel in the reactor cores became partially uncovered. Hydrogen gas built up in Units 1 and 3 as a result of exposed, overheated fuel reacting with water. Following gas venting from the primary containment to relieve

Issue Date: 03/23/11

1

2515/183

TI 2515/183
U.S. Licensee
Inspections to assess
similar vulnerabilities

NRC INSPECTION MANUAL TEMPORARY INSTRUCTION 2515/184

AVAILABILITY AND READINESS INSPECTION OF
SEVERE ACCIDENT MANAGEMENT GUIDELINES (SAMGs)

CORNERSTONE: MITIGATING SYSTEMS

APPLICABILITY: This Temporary Instruction (TI) applies to all holders of operating licenses for nuclear power reactors, except plants which have permanently ceased operations.

2515/184-01 OBJECTIVES

The objectives of this TI are to

- Determine that the severe accident management guidelines (SAMGs) are available and how they are being maintained
- Determine the nature and extent of licensee implementation of SAMG training and exercises.

2515/184-02 BACKGROUND

On March 30, 2011, the Executive Director for Operations chartered a task force to conduct a near-term evaluation of the need for agency actions following the events in Japan. During the task force's deliberations, the importance of severe accident management guidelines (SAMGs) has been highlighted. The SAMGs were implemented as a voluntary industry initiative in the 1990s and are not part of the agency's routine Reactor Oversight Program. In order to evaluate the current status of SAMGs and determine the need for any further recommendations, the task force is requesting the enclosed information regarding SAMGs at operating power reactors be gathered, assessed, and summarized.

2515/184-03 INSPECTION REQUIREMENTS AND GUIDANCE

03.01 Assess the availability and readiness of the licensee's ability to access and implement the SAMGs at their facility. Answer the following questions by filling out the attached datasheet.

- When were the SAMGs last updated? Are controlled copies of the SAMG located in the technical support center (TSC) (Y/N), emergency operations facility (EOF) (Y/N), control room (Y/N)? For licensees that use one common EOF for multiple reactor sites, one review of the EOF will serve for all applicable sites.

Issue Date: 04/29/11

1

2515/184

TI 2515/184
U.S. Licensee
Inspections to assess
adequacy of SAMG's

OMB Control No.: 3150-0012

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001

May 11, 2011

NRC BULLETIN 2011-01 MITIGATING STRATEGIES

ADDRESSEES

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operation and have certified that fuel has been removed from the reactor vessel.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this bulletin to achieve the following objectives:

- To require that addressees provide a comprehensive verification of their compliance with the regulatory requirements of Title 10 of the Code of Federal Regulations (10 CFR) Section 50.54(h)(2).
- To notify addressees about the NRC staff's need for information associated with licensee mitigating strategies under 10 CFR 50.54(h)(2) in light of the recent events at Japan's Fukushima Daiichi facility in order to determine if 1) additional assessment of program implementation is needed, 2) the current inspection program should be enhanced, or 3) further regulatory action is warranted; and
- To require that addressees provide a written response to the NRC in accordance with 10 CFR 50.54(h).

BACKGROUND

Following the terrorist events of September 11, 2001, the readiness of NRC-regulated facilities to manage challenges to core cooling, containment and spent fuel pool cooling (SFP) following large explosions or fires was enhanced through a series of orders and imposition of license conditions. These requirements were formalized in the rulemaking of March 27, 2009, resulting in 10 CFR 50.54(h)(2).

The NRC conducted a comprehensive inspection of the implementation of the mitigating strategies developed by licensees in 2009. Subsequently the NRC incorporated this inspectable area into the baseline reactor oversight process on a sample basis as part of the biennial file protection inspection.

ML111250380

BL 2011-01
Request U.S. Licensee
mitigative strategies
information for similar
events

05/14/2012

49

NRC JAPAN LESSONS LEARNED TASK FORCE RECOMMENDATIONS

- On 11 March, 2011 data gathering began
- On 13 July, 2011 the Commission was presented the written report, SECY-11-0093, "Near Term Report and Recommendations for Agency Actions following the Events in Japan," dated July 12, 2011 (ADAMS Accession No. ML11186A950)
- On 19 July, 2011 the Task Force presented the recommendations verbally to the Commission
- On 3 October, 2011 the NRC Staff proposes a prioritization plan for implementing the Task Force recommendations , SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned" dated October 3, 2011 (ADAMS Accession No. ML11272A111)
- On 15 December, 2011 the Commission approved the prioritization plan for the Task Force Recommendations

NRC JAPAN LESSONS LEARNED TASK FORCE RECOMMENDATIONS

PRIORITIZATION PLAN

- **TIER 1**
Those recommendations that should be implemented without unnecessary delay and for which sufficient resources are available
- **TIER 2**
Those recommendations that cannot be initiated in the near term due to factors that include the need for further technical assessment and alignment, dependence on Tier 1 issues, or availability of critical skill sets.
- **TIER 3**
Those recommendations that require further staff study to support a regulatory action, have an associated shorter-term action that needs to be completed to inform the longer-term action, or are dependent on the availability of critical skill sets.

NRC JAPAN LESSONS LEARNED TASK FORCE RECOMMENDATIONS

INITIAL TIER 1 RECOMMENDATIONS (implement without delay)

- Licensees re-evaluate the seismic and flood hazards against current NRC requirements and upgrade as necessary. (2.1)
- Licensees perform seismic and flood protection walkdowns to identify and address vulnerabilities. (2.3)
- Rulemaking to 10 CFR 50.62 (SBO) for a minimum coping time of 8 hours with on-site resources and 72 hours using off-site resources. (4.1)
- Licensee orders to upgrade the storage and protection of equipment covered under 10CFR50.54(hh)(2). (4.2)

NRC JAPAN LESSONS LEARNED TASK FORCE RECOMMENDATIONS

INITIAL TIER 1 RECOMMENDATIONS (implement without delay)

- Order licensees to include reliable hardened vents for Mark I and Mark II Containments capable of easy operation during prolonged SBO events. (5.1)
- Order licensees to install sufficient control room safety related Spent Fuel Pool Instrumentation (7.1) (without delay)
- Orders and rulemaking to require SAMG's and EDMG's as a license condition and more realistic hands on staff training to all involved decision makers. (8)
- Order licensees to upgrade the Emergency Plan staffing and strategies for multi-unit and extended SBO events. (9.3)

NRC JAPAN LESSONS LEARNED

TIER I IMPLEMENTATION

TIER 1 RECOMMENDATIONS (implemented without delay)

- The staff has expanded upon the recommendations of NRC's Near Term Task Force and continues to make additions and modifications, as appropriate
- The staff initiated SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons-Learned from Japan's March 11, 2011, Great Tōhoku Earthquake and Tsunami" (ADAMS Accession No. ML12039A103) dated February 17, 2012
- The Tier 1 Orders and 50.54(f) letter were issued March 13, 2012.
- Currently developing implementation guidance for the orders and requests for information

NRC JAPAN LESSONS LEARNED TIER I IMPLEMENTATION CURRENTLY UNDER ORDER

TIER 1 ORDERS TO LICENSEES

- Develop strategies and procure additional equipment to address beyond-design-basis natural phenomena and multiunit events (derived from Recommendation 4.2)
- Include a reliable hardened vents in Mark I and Mark II containments (derived from Recommendation 5.1)
- Enhance spent fuel pool instrumentation for beyond design basis accidents (derived from Recommendation 7.1)

NRC JAPAN LESSONS LEARNED

TIER I IMPLEMENTATION

TIER 1 REQUESTS FOR INFORMATION

- Provide information on the adequacy of facility design bases with respect to seismic and flooding hazards (derived from Recommendation 2.1)
- Provide information on whether facility configurations, as confirmed by seismic and flooding walkdowns, are in compliance with current facility design bases (derived from Recommendation 2.3)
- Provide information on current communications system power supplies and their availability during a prolonged SBO event (derived from Recommendation 9.3)
- Provide information on the required staffing necessary to respond to a multiunit, prolonged SBO event (derived from Recommendation 9.3)

NRC JAPAN LESSONS LEARNED

TIER I IMPLEMENTATION

TIER 1 RULEMAKING ACTIVITIES

- Station Blackout (SBO) Rulemaking (derived from Recommendation 4.1)
 - Modify the SBO rule to require enhanced capability to mitigate a prolonged SBO
 - Advanced Notice of Proposed Rulemaking to be issued soon
 - The Commission directed that SBO rulemaking be completed within 24-30 months
- Emergency Procedures Integration Rulemaking (derived from Recommendation 8)
 - Create a new rule requiring the integration of the emergency procedures
 - Advanced Notice of Proposed Rulemaking under development
 - The rulemaking is expected to be completed in 2016

NRC JAPAN LESSONS LEARNED

TIER 2 RECOMMENDATIONS

TIER 2 RECOMMENDATIONS (future implementation)

- Further Spent Fuel Pool Enhancements:
 - Order licensee to provide safety related AC power for SFP makeup. (7.2)
 - Order licensees to revise Technical Specifications for SFP makeup and instrumentation operability during all modes of operation. (7.3)
 - Order licensee to install a seismically qualified SFP portable pump spray system from outside grade level. (7.4)
 - Rulemaking to require all 4 above recommendations. (7.5)

NRC JAPAN LESSONS LEARNED

TIER 2 RECOMMENDATIONS

TIER 2 RECOMMENDATIONS (future implementation)

- Emergency preparedness regulatory actions (Recommendation 9.3b)
 - Require licensees to have guidance for multiunit dose assessment capability
 - Require licensees to hold training and exercises for multi unit and prolonged SBO scenarios
 - Require that licensees practice the identification and acquisition of offsite resources
 - Require that licensees ensure that EP equipment and facilities are sufficient for dealing with multiunit and prolonged SBO scenarios
- Other (Related to Recommendation 2.1)
 - Request that licensees perform an other external hazards evaluation

NRC JAPAN LESSONS LEARNED TIER 3 RECOMMENDATIONS

TIER 3 RECOMMENDATIONS (Approval and prioritization expected in ~September, 2012)

- Rulemaking to confirm the seismic and flooding hazards analysis and upgrade facilities as necessary every 10 years (2.2)
- NRC evaluation to determine potential enhancements to the capability to prevent or mitigate seismically induced fires and floods. (3)
- Re-evaluate the need for and issue appropriate Regulatory Action to require reliable hardened vents for other containment designs. (5.2)

NRC JAPAN LESSONS LEARNED TIER 3 RECOMMENDATIONS

TIER 3 RECOMMENDATIONS (Approval and prioritization expected in ~September, 2012)

- NRC review and identify Fukushima insights about hydrogen control and mitigation inside containment or other buildings as they become available. (6)
- Rulemaking for require Emergency Preparedness upgrades to address multi-unit and extended SBO events (9.1 and 9.2)
- Upgrade/enhance ERDS to maintain capability throughout the events. (9.3)

NRC JAPAN LESSONS LEARNED TIER 3 RECOMMENDATIONS

TIER 3 RECOMMENDATIONS (Approval and prioritization expected in ~September, 2012)

- Additional EP Topics for Prolonged SBO and Multi-Unit Events (10)
 - Protective equipment requirements for emergency responders
 - Command and control structure and qualification requirements for decisionmakers
 - ERDS transmission methods independent of hardwire infrastructure
 - ERDS continuous transmission evaluation
 - Evaluate completeness of current ERDS data set with respect to assessment needs.

NRC JAPAN LESSONS LEARNED TIER 3 RECOMMENDATIONS

TIER 3 RECOMMENDATIONS (Approval and prioritization expected in ~September, 2012)

- EP Topics for Decision Making, Radiation Monitoring, and Public Education (11)
 - Enhancing on-site and off-site emergency response resources and availability with a degraded off-site infrastructure.
 - Evaluate and address further lessons learned from the Fukushima event.
 - Study the possibility of real time radiation monitoring within the EPZ including protected power supplies.
 - Public radiation safety and use of KI training coordinated with other Federal agencies.

NRC JAPAN LESSONS LEARNED TIER 3 RECOMMENDATIONS

TIER 3 RECOMMENDATIONS (Approval and prioritization expected in ~September, 2012)

- Strengthen the Reactor Oversight Process (ROP) with more focus on the defense-in-depth requirements. (12.1)
- Enhance NRC staff training on Severe Accidents and provide Resident Inspector training on SAMG's. (12.2)

REFERENCES

- USNRC Emergency Operations Center Status Update; 5 May, 2011: 1200 EDT
- USNRC R-104B Technical Training Manual; BWR Technology
- USNRC R-350B Technical Training Manual; ABWR Technology
- Overview of Events at Fukushima Nuclear Power Plant Sites Following Earthquake and Tsunami on March 11, 2011; N.G. Trikouros, 6 April, 2011
- Tohoku Pacific Earthquake and the Seismic Damage to the NPP's; Nuclear and Industrial Safety Agency Japan, 21 March, 2011
- The Great East Japan Earthquake and Current Status of Nuclear Power Stations; Tokyo Electric Power Company, 18 April, 2011
- Earthquake and Tsunami in Japan on March 11, 2011 and Consequences for Fukushima and other Nuclear Power Plants: VGB Power Tech, 15 April, 2011
- INPO 11-005; Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station
- NRC Report by Fukushima Daiichi Near Term Task Force; Recommendations for Enhancing Reactor Safety in the 21st Century
- SECY-11-0137; Prioritization of Recommended Actions to be Taken in response to Fukushima Lessons Learned
- SRM-SECY-12-0035; Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami
- 3/13/12 Orders and 50.54(f) Letter (ML12054A696, ML12054A736 , ML12054A682, & ML12056A046
- Causes and Countermeasures: The Accident at TEPCO's Fukushima Nuclear Power Stations, Masaya Yasui, Deputy Director General, Nuclear Safety Regulation Reform Ministry of Economy, Trade and Industry (METI) March, 2012