Enhancing Safety after Fukushima-Daiichi

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Good afternoon. It is an honor for me to participate in this conference on the important topic of nuclear safety. I would like to thank the organizers of the meeting for the opportunity for the United States Nuclear Regulatory Commission to participate. At the outset, I would like to express my sympathies to Japan for the tragic loss of life and devastation caused by the Great East Japan Earthquake and tsunami last March and my respect and appreciation to all who responded to this tragedy.

When tragedies happen like the March 11, 2011 earthquake and the ensuing tsunami and nuclear emergency at Fukushima-Daiichi, it is important that we learn from these experiences and work together to enhance safety and security. Consequently, in my presentation this afternoon, I will summarize the actions being taken by the Nuclear Regulatory Commission in response to the emergency at Fukushima-Daiichi.

The NRC is not alone in the quest to understand what happened at Fukushima-Daiichi and to make enhancements to nuclear safety based on these lessons learned. The Government of Japan, other nations, multilateral organizations, standards organizations, the International Atomic Energy Agency, OECD's Nuclear Energy Agency, G8 and G20 groups of nations, International Commission on Radiological Protection, and other organizations are learning the lessons as new information and insights are revealed. The world nuclear community is committed to making these lessons learned lessons implemented.

As many of you know, the mission of the NRC is to regulate the use of radioactive material in the United States to protect the public health and safety, promote the common defense and security, and protect the environment. This mission established our priorities in the response to the nuclear emergency at Fukushima-Daiichi. First, we ensured protection of U.S. citizens both in the United States and abroad. Second, based on a long-standing and collaborative partnership with our counterparts in Japan, we assisted the Government of Japan in its response, along with the U.S. Department of State and other agencies of the U.S. government.

On March 23rd, the Commission directed the NRC staff to convene a task force and conduct a methodical and systematic review and recommend whether NRC should make near-term improvements to our regulatory system. The Near-Term Task Force was comprised of several of the agency's most experienced and expert staff. They concluded their review and released a report with recommendations on July 12, 2011. The Task Force made twelve overarching recommendations:

- Six for industry action to enhance safety
- Two for action to enhance NRC programs

- Four for longer-term study by the NRC

Based on the Commission's initial review of the report, the NRC staff reviewed the Near Term Task Force report and recommended how to proceed, taking safety, priorities, and resources into account in early September and October. The NRC divided the recommendations into three tiers, with Tier 1 being the highest priority and most pressing. The Commission approved proceeding without delay with the highest priority recommendations in October after some consultation with external stakeholders. In December, after additional consultation, the Commission approved proceeding with the next highest priority recommendations. At about the same time, the Japanese authorities announced that cold shutdown of Fukushima-Daiichi units 1, 2, and 3 had been achieved. Following Commission approval of new requirements on March 9, 2012, the NRC recently issued orders to require specific enhancements and requests for information.

Of greatest significance is the Task Force's conclusion that a similar sequence of events is unlikely to occur in the U.S. and that existing mitigation measures could reduce both the likelihood of core damage and radiological release. On this basis, the Task Force concluded that there is no imminent risk from continued operation of nuclear power plants in the United States and from continued licensing of both existing and new nuclear power plants. Since last March, we have continued to renew licenses for existing nuclear power plants and in February 2012 issued new licenses for Vogtle Units 3 and 4, the first new licenses issued for nuclear power plants in the United States since 1978. In light of the expectation that over a hundred reactors will continue to operate for decades to come, the Task Force concluded that enhancements to safety <u>are</u> warranted. This conclusion has been embraced by the NRC staff and the Commission, and fuels our focused and dedicated efforts today to achieve the enhancements as quickly and effectively as practicable.

So what are these enhancements? The first three enhancements that we are pursuing aggressively are re-evaluating external hazards, including seismic and flooding hazards, performing walkdowns of the nuclear power plants to ensure the effectiveness of design and mitigating measures, and modifying our existing requirements to enhance the ability of the plants to mitigate a prolonged Station Blackout event, where sites lose offsite and onsite AC power sources.

The next three Tier 1 enhancements are requiring operators to provide mitigating strategies for beyond design basis events, provide reliable hardened vents in Boiling Water Reactors with Mark I and II containments in case containment venting is required during a severe accident, and provide spent fuel pool instrumentation with reliable indications of the level of water in the pool and other conditions.

The last two Tier 1 enhancements are to strengthen and integrate onsite emergency response capabilities and to require site staffing for emergency responses involving multi-unit events and prolonged Station Blackout events.

On February 17, 2012, the NRC staff recommended that the Commission require these near term enhancements through orders and proceed with requests for information and rulemakings. As I mentioned previously, the orders and requests for information have just been issued following Commission approval on March 9th. The requests for information were issued in accordance with NRC requirements in 50.54(f); operators are required to provide information on the adequacy of the design basis, whether the plant configuration is in compliance with the design basis, and other matters. The staff is also planning to issue an Advanced Notice of

Proposed Rulemaking on the Station Blackout rule changes in the near future. We are also seeking additional input from stakeholders as we develop guidance on how the operators should respond to the orders and requests for information.

As compressed as we thought our schedule was when we developed it last fall, the United States Congress directed that we accelerate the schedule in our annual appropriations law in late December 2011. The NRC has met its goal of issuing the Tier 1 orders and information requests by the March 11 anniversary date of the earthquake and tsunami. Our overall goal is to complete the enhancements within 5 years. We recognize that this is an ambitious schedule. As we proceed, we will be particularly focused on enhancing safety and in avoiding unintended consequences that could be detrimental to safety and security.

Operators licensed by the NRC are required to provide responses to orders and the requests for information. NRC will review the responses and establish the necessary framework for regulatory oversight, including using the Reactor Oversight Process for inspections and codifying the orders through rulemaking. The information obtained in response to the requests will be used for determining appropriate actions, such as ordering additional enhancements or modifying the regulations.

In addition to the Tier 1 recommendations, the NRC staff also identified a number of Tier 2 and 3 recommendations. Tier 2 recommendations are those high priority actions that cannot be initiated in the near term due to resource and skill set limitations on the NRC staff. This includes actions that need further technical refinement and alignment or are dependent upon the Tier 1 actions. These actions do not require long-term study and will be initiated when sufficient technical information and resources become available. These actions include requiring operators to provide sufficient spent fuel pool make-up capability with safety-related AC electrical power, technical specifications for ensuring at least one train of onsite emergency power is operable for spent fuel pool makeup and instrumentation regardless of the operational mode of the reactor, and installation of a seismically qualified means to spray water into the spent fuel pools, including an easily accessible connection to supply the water.

The second set of Tier 2 actions include enhancements to emergency preparedness measures, including the capability for multi-unit dose assessment, training and exercises for multiple units and prolonged Station Blackout events, practice in the identification and acquisition of offsite resources, and assurance that emergency preparedness equipment and facilities are sufficient for responding to multiple unit and prolonged Station Blackout events.

Tier 3 recommendations require further staff assessment to support a regulatory action, have an associated shorter-term action that first needs to be completed, are dependent on critical skill sets not currently available, or are dependent on resolution of Near-Term Task Force Recommendation 1. Recommendation 1 was that the Commission establish a logical, systematic, and coherent regulatory framework for adequate protection that appropriately balances defense in depth and risk considerations. The Commission placed a higher priority on the shorter-term, important to safety enhancements. Once the staff has completed its evaluation of the impacts of Tier 1 and 2 recommendations, the staff will assess more thoroughly the Tier 3 recommendations, which include all of the long-term evaluation recommendations from the Near-Term Task Force.

The staff also identified additional issues beyond those listed in the Task Force report, which we believe should be considered as part of the longer-term review. Issues are identified, assessed, and screened for safety significance by the NRC staff and then considered by a

committee of senior NRC managers. What are these issues? Filtration of containment vents, enhanced seismic monitoring instruments, reconsideration of the adequacy of the existing sizes of Emergency Planning Zones, and whether potassium iodide (KI) should be pre-staged beyond current planning zones. The emergency also raised questions about the potential benefit of offloading spent fuel from the pools into dry casks sooner to reduce risks. We are also planning to examine the risk significance of the loss of an ultimate heat sink at U.S. plants. This is being considered within the scope of the seismic and hazards evaluation as well as the evaluations on other external hazards.

In the NRC's review of the lessons learned from the nuclear emergency at Fukushima-Daiichi, we did not identify any specific safety-security interface issues or any enhancements necessary to maintain the balance between safety, security, and safeguards. Nevertheless, as we progress, we remain mindful of how the safety enhancements can impact the safety-security interface. The owners and operators of the nuclear power plants have the primary responsibility for implementing any new requirements and we will require that such implementation not adversely impact the safety-security interface. Once the ongoing analyses of Fukushima-Daiichi and the associated lessons learned have been completed, we may collectively learn that the failure of certain structures, systems, and components, significantly contributed to the core damage. These insights should be used to enhance mutually safety and security.

As I hope my presentation has made clear, the NRC has already taken a number of actions to ensure nuclear safety, in light of the Fukushima nuclear emergency. Based on all that we have reviewed to date, we continue to have confidence in the safe operation of nuclear power plants, including spent fuel pools and dry storage facilities, and other nuclear facilities in the United States. Consequently, we are continuing with license renewal and new reactor licensing, as well as licensing of other new nuclear fuel cycle facilities. We recognize, however, that our work is far from done. We will continue to move forward with the post-Fukushima enhancements on an aggressive schedule. As we receive more information about the causes and consequences of the Fukushima-Daiichi emergency, we will evaluate that information and take the appropriate actions working in the open and engaging a full array of stakeholders.

On behalf of the NRC, thank you for your attention and best wishes for a successful conference. I would be pleased to respond to any questions or to listen to your comments.

[Backup 1]

List of Tier 2 recommendations:

- Re-evaluation of other external hazards
- Spent fuel pool makeup capability
- Additional emergency preparedness topics

[Backup 2]

List of Tier 3 recommendations:

- Ten-year periodic update of seismic and flooding hazards
- Preventing or mitigating seismically induced fires and floods

- Reliable hardened vents for containment designs other than Mark 1 and 2 containments
- Hydrogen control and mitigation inside containment or in other buildings
- Additional Emergency Preparedness (EP) enhancements for prolonged SBO and multi-unit events
- Enhanced Emergency Response Data System (ERDS) capabilities
- Enhanced EP decision-making, radiation monitoring, and public education
- Training on severe accidents and Severe Accident Management Guidelines

[Backup 3]

Additional Tier 3 recommendations:

- Whether to expand the size of emergency planning zones?
- Whether to distribute potassium iodide beyond the 10 mile Plume Pathway EPZ?
- Whether to expedite unloading older fuel from spent fuel pools into dry casks?