NRC Update: Fukushima Lessons Learned

Lauren Gibson, U.S. Nuclear Regulatory Commission
Agenda

- Overview of the Accident
- NRC Response
- Identifying Lessons-Learned
- Implementing Lessons-Learned
- Other Regulated Facilities
Fukushima Daiichi Site Before the Event

- Reactor #2 Operating
- Reactor #3 Operating
- Reactor #4 Shutdown
- Reactor #1 Operating
- Reactors 5 & 6 Shutdown
Tsunami

- Site designed to withstand ~6 meters (20 foot) tsunami
- Actual size estimated ~14 meters (46 feet)
After Hydrogen Explosions

UNIT 4
5

UNIT 3
March 2011

UNIT 2

UNIT 1
NRC Response

Executive, Reactor Safety, Protective Measures, Safeguards, Public Affairs, and Liaison Teams
Lessons Learned:
NRC’s Near-Term Task Force

Within weeks of the accident, NRC created a task force to review the events and provide recommendations to enhance safety at U.S. plants

- Report issued July 2011
- Concluded that a similar sequence of events in the US is unlikely and there are no imminent risks of continued operation and licensing activity
- Identified 12 Overarching Potential Safety Enhancements
Prioritization of NTTF Recommendations

- Subsequent to the NTTF Report, NRC staff prioritized the recommendations:
  - Tier 1 - To be implemented without unnecessary delay
  - Tier 2 - Could not be initiated in the near term due to resource or critical skill set limitations
  - Tier 3 - Require further staff study to determine if regulatory action is necessary

- Tools to implement recommendations include Orders, Rulemaking, and Requests for Information
Mitigation Strategies
For External Events

Requires a three-phase approach for maintaining or restoring core cooling, containment, and spent fuel cooling

<table>
<thead>
<tr>
<th>Phase</th>
<th>Licensee may use</th>
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<tbody>
<tr>
<td>Initial</td>
<td>Installed equipment</td>
</tr>
<tr>
<td>Transition</td>
<td>Portable, onsite equipment</td>
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<tr>
<td>Final</td>
<td>Resources obtained from offsite</td>
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Containment Venting System

- Applies to boiling water reactors with certain designs (Mark I/II)
- Vents help control pressure by removing heat
- May help prevent core damage
- Must continue to function if core damage/melting occurs
- Required to work when all power is lost
Spent Fuel Pool Instrumentation

Requires installation of water level instrumentation to indicate:

1 – Normal fuel pool level
2 – Below-normal level that still provides radiation shielding
3 – Very low level, near top of fuel racks, where immediate action to add make-up water should be taken
Requests for Information

NRC asked licensees to:

- Inspect or “walk down” currently installed earthquake and flooding protection features, and correct degraded conditions

- Use present-day information to reevaluate the potential effects of an earthquake or flooding event

- Enhance emergency plans to ensure sufficient staffing and communication capabilities if multiple reactors at a single site are affected by the same event
Seismic and Flooding Reevaluations

- What is the new hazard?
- How would the plant respond to the new hazard?
- Does the licensing basis need to change?
Rulemaking Activities

Station Blackout Mitigation Strategies (SBOMS)
- Will require licensees to have mitigating measures to cope with an extended loss of ac electrical power (2016)

Onsite Emergency Response Capabilities
- Will require severe accident management guidelines and smooth transition from EOPs to SAMGs to EDMGs (2016)

Filtering and Confinement Strategies
- Will consider additional measures to limit potential release of radioactive material using confinement strategies or filtration of radioactive material released during a severe accident (2017)
Other Regulated Facilities

- Do the lessons learned apply to other facilities?
- The NRC expects to complete its evaluation this summer.
Conclusion

- NRC implementing safety enhancements at U.S. plants
- Considerable progress has been made
- Substantial safety enhancements by 2016
- No imminent risk from continued operation of U.S. nuclear power plants
Public website

From [www.nrc.gov](http://www.nrc.gov), find link under “Spotlight” section called “Japan Lessons Learned”

**THANK YOU**
Tier 2 Recommendations

- Spent Fuel Pool Makeup Capability
  - Addressed under mitigation strategies*

- Emergency Preparedness
  - Addressed under mitigation strategies*
  - Multiunit dose assessment capability in place by end of 2014

- Reevaluation of Other Natural Hazards
  - Dependent on insights from seismic/flooding reevaluations and staff resources
  - Request for Information planned after the seismic and flooding hazards are resolved
Tier 3 Recommendations

2.2 Perform periodic confirmation of seismic and flooding hazards

3 Ensure enhanced capability to prevent/mitigate seismically induced fires and floods

5.2 Consider reliable hardened vents for other containment designs

6 Hydrogen control and mitigation inside containment or in other buildings

9.1/9.2 Emergency preparedness (EP) enhancements for prolonged SBO and multiunit events

9.3 Improve ERDS capability

10 Additional EP topics for prolonged SBO and multiunit events

11 EP topics for decision-making, radiation monitoring, and public education

12.1 Reactor Oversight Process modifications to reflect the recommended defense-in-depth framework

12.2 Staff training on severe accidents and resident inspector training on SAMGs
   — Revisit Emergency Planning Zone Size
   — Pre-stage potassium iodide beyond 10 miles
   — Expedited transfer of spent fuel to dry cask storage
   — Reactor and Containment Instrumentation