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*Protecting People and the Environment*

# Briefing on the Status of Lessons Learned from the Fukushima Dai-ichi Accident

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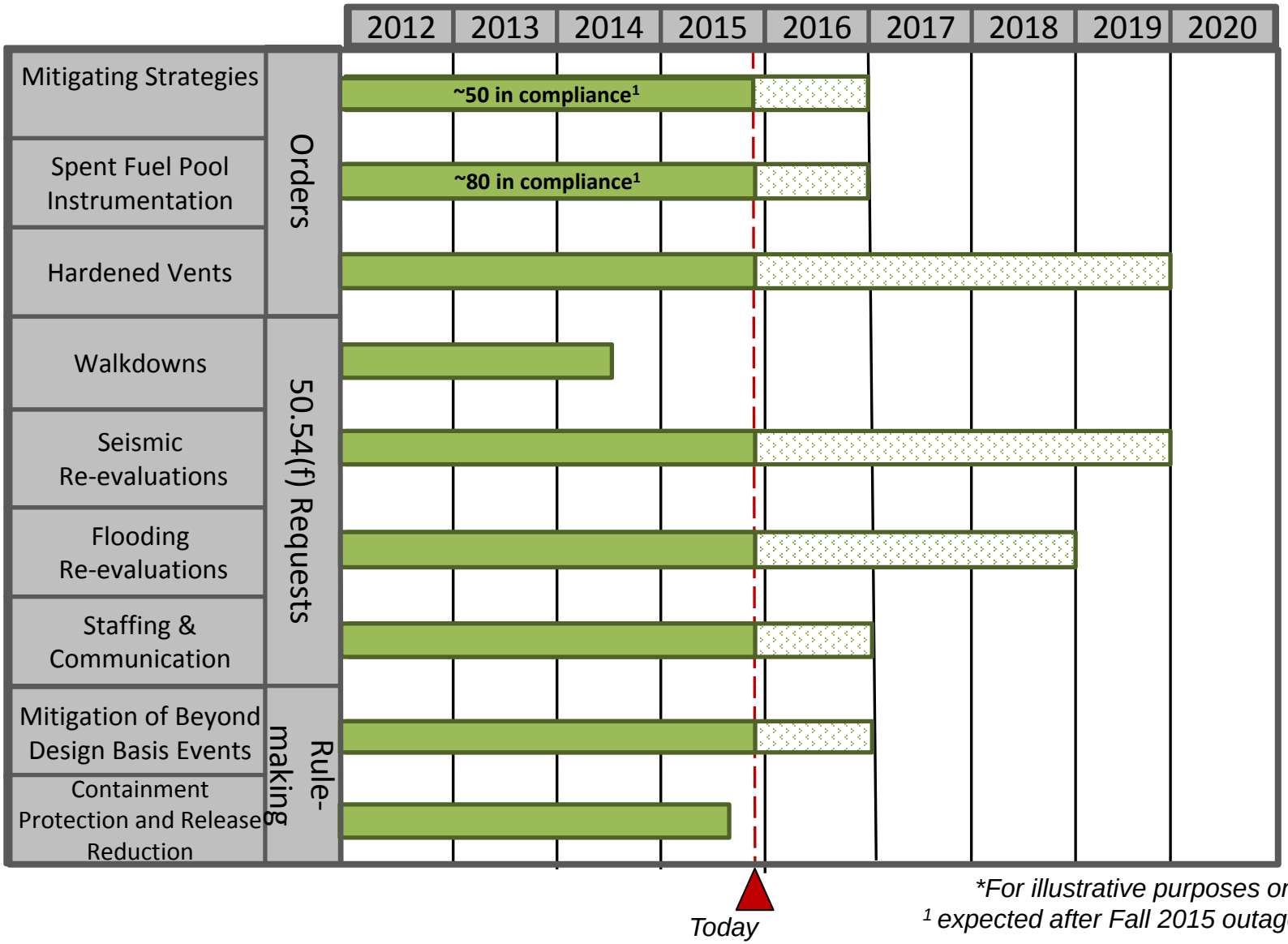
**Executive Director for Operations**
**November 17, 2015**

# Speakers

- **William Dean, Director, Office of Nuclear Reactor Regulation**
  - **Overall Progress**
  - **Seismic and Flooding Reevaluations**
- **Jack Davis, Director, Japan Lessons-Learned Division**
  - **Resolution of Tier 2 and 3 Recommendations**
- **Michael Johnson, Deputy Executive Director for Reactor and Preparedness Programs**
  - **International Activities**

# Tier 1 Implementation On or Ahead of Schedule




*For illustrative purposes only

[1] expected after Fall 2015 outages

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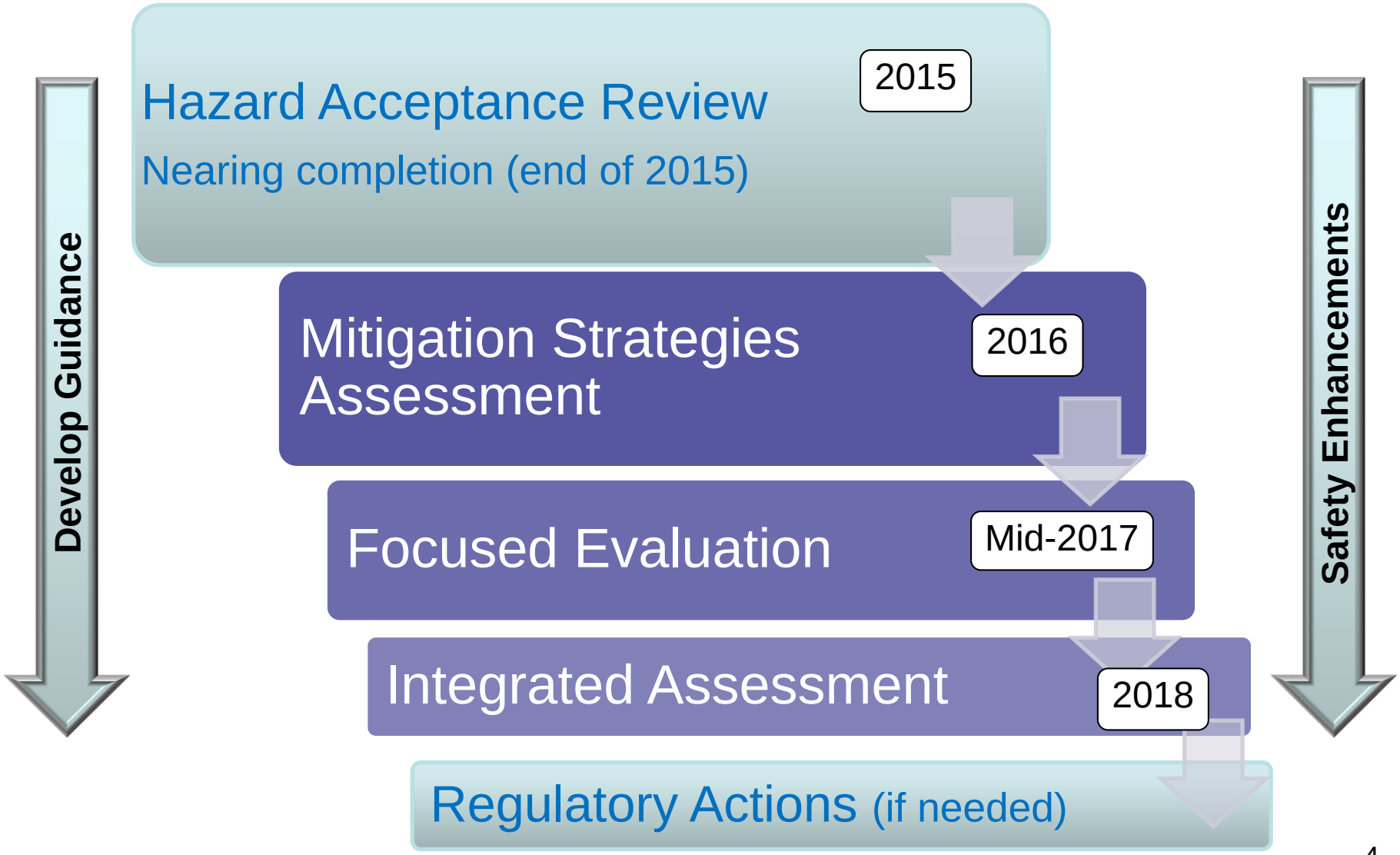
# Flooding Hazard Reevaluation Closure Plan



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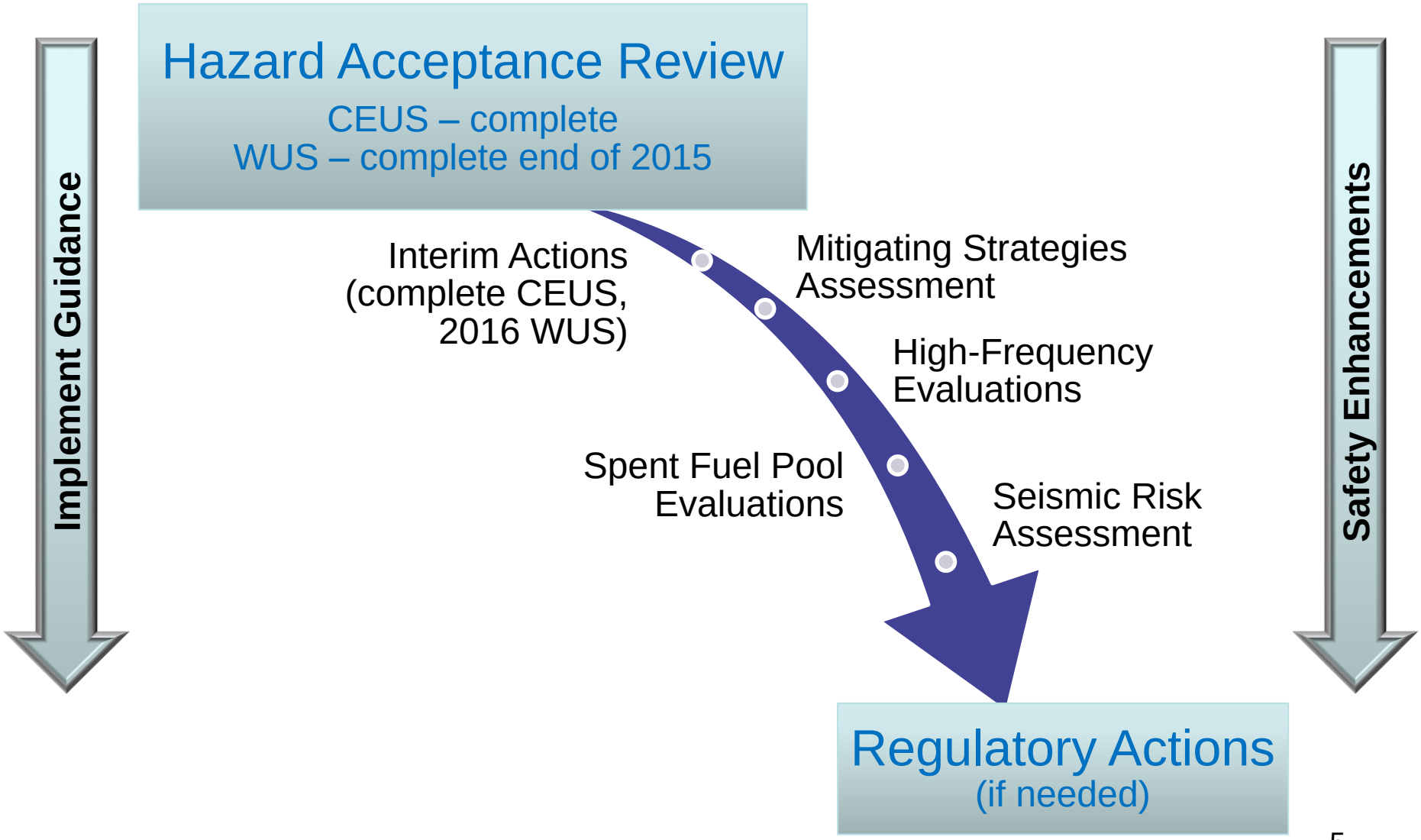
# Seismic Hazard Reevaluation Closure Plan



# Tier 2 and 3 Resolution Paths Determined

- Assessments with a focus on identifying and assessing regulatory gaps
- Evaluations consider:
  - Existing requirements
  - Tier 1 safety enhancements
  - Insights from completed Tier 2&3 work
  - Insights from previously completed analyses
- Engagement with stakeholders
- Importance of maintaining an appropriate level of technical rigor

# Summary of Proposed Resolution Approach for Tier 2 and 3 Recommendations

*Resolved*

| | |
|---|---|
| - | Expedited transfer of spent fuel to dry cask storage |
| 3 | Enhanced capability to prevent/mitigate seismically-induced fires & floods |
| - | Revisit emergency planning zone size & pre-stage potassium iodide beyond 10 miles |
| 9.3 | ERDS capability throughout accident (partial) |
| 10 | Additional EP topics for prolonged SBO and multiunit events (partial) |
| 11 | EP topics for decision-making, radiation monitoring, and public education (partial) |
| 12.1 | Reactor Oversight Process modifications to reflect DID framework |
| 12.2 | Staff training on severe accidents and resident inspector training on SAMGs |
| 7.2 – 7.5 | Spent fuel pool makeup capability |
| 9.1/9.2 | EP enhancements for prolonged SBO and multiunit events |
| 9.3 | Emergency preparedness (partial) |
| 9.4 | Improve ERDS capability |
| 10 | Additional EP topics for prolonged SBO and multiunit events (partial) |
| 11 | EP topics for decision-making, radiation monitoring, and public education (partial) |
| 5.2 | Reliable hardened vents for other containment designs |
| 6 | Hydrogen control and mitigation inside containment or in other buildings |
| - | Reactor and containment instrumentation |
| - | Reevaluation of “other” external hazards |
| 2.2 | Periodic confirmation of seismic and flooding hazards |
| 11 | EP topics for decision-making, radiation monitoring, and public education (partial) |

Completed | Subsumed in Tier 1 | Ready to Close | Further Interaction | Further Assessment

# Ready to Close – Seismically-Induced Fires and Floods

3: Evaluate potential enhancements to prevent or mitigate seismically-induced fires and floods

Tier 1 → Initiate development of a PRA methodology
Tier 3 → Determine if regulatory action is needed

## Evaluation

- Existing robust NRC requirements.
- Safety enhancements associated with Tier 1 activities mitigate risk.
- Draft feasibility study for the PRA methodology is currently under review.

## Recommendation

Close

. . . Additional safety enhancements not necessary

# Ready to Close – Basis of EPZ Size and Pre-Staging KI Beyond 10 Miles

Additional Recommendation: Reevaluate the basis of EPZ size and pre-staging KI beyond 10 miles

Tier 3 → Dependent on long-term studies

## Evaluation

- 2014 denial of rulemaking petition to expand EPZ size.
- Insights from international studies at Fukushima.
- New data from the site supports existing regulations and policies.

## Recommendation

Close

. . . Information continues to support existing regulations and policies

# Ready to Close – Various Emergency Preparedness Activities

Rec. 9.3 (Partial): Maintain ERDS throughout accident

Rec. 10.3: ERDS enhancements

Rec. 11.2: Evaluate recovery and reentry insights from Fukushima

Rec. 11.4: Training in the local community on radiation, radiation safety, and the use of KI

## Evaluation

- NRC's oversight role in emergencies
- ERDS design considerations
- Some licensees voluntarily transmit ERDS continuously
- FEMA is leading the ongoing efforts for 11.2 and 11.4

## Recommendation

Close

. . . Cost/benefit considerations; progress to date

# Ready to Close – ROP Modifications to Reflect Defense-in-Depth Framework

12.1: Expand ROP self-assessment and biennial ROP realignment to include defense-in-depth considerations

Tier 3 → Dependent on Recommendation 1

## Evaluation

- Rec. 1 now closed to RMRF initiative.
- ROP self-assessment and realignment processes being enhanced.
- General ROP enhancements underway.
- Existing agency processes in place.

## Recommendation

Close

. . . Follow normal agency processes for future ROP enhancements

# Ready to Close – Staff Training on Severe Accidents and SAMGs

12.2: Enhance training to include lessons learned and training on SAMGs for resident inspectors

Tier 3 → Dependent on Recommendation 8 (now subsumed in MBDBE proposed rulemaking)

## Evaluation

- Severe accident training enhanced to include the accident and lessons learned.
- SAMG training is being developed.
- Qualification programs being updated.

## Recommendation

Close

. . . Enhancements to training and qualification programs are underway

# Tier 3 Emergency Preparedness Activities Addressed by the Mitigation of Beyond-Design-Basis Events Rulemaking

**Rec. 9.1: Initiate rulemaking to require EP enhancements for multiunit events**

**Rec. 9.2: Initiate rulemaking to require EP enhancements for prolonged station blackout**

**Rec. 9.3 (Partial): Order licensees to perform various EP enhancements until rulemaking is complete**

**Rec. 10.1: Analysis of protective equipment Requirements**

**Rec. 10.2: Command and control structures**

**Rec. 11.1: Enhanced resources to get equipment onsite**

# Additional Stakeholder Interaction – Instrumentation Enhancements

ACRS: Assess need to enhance reactor and containment instrumentation to survive beyond design basis events

Tier 3 → Further staff study; dependent on higher priority recommendations

## Evaluation

- Tier 1 enhancements and existing requirements.
- Insights from MBDBE rulemaking analyses.
- Ongoing work to develop consensus standard.

## Recommendation

No need for regulatory action identified, but staff plans additional interaction before finalizing assessment

# Additional Stakeholder Interaction – Vents for Other Containment Designs

5.2: Reevaluate the need for hardened vents for other containment designs. . . [take] appropriate regulatory action . . .

Tier 3 → Dependent on insights from Tier 1 activities (Order EA-13-109 and related rulemaking)

## Evaluation

- Significant information from previous studies.
- EA-13-109 in progress.
- Mitigating strategies enhance safety.
- Commission disapproved CPRR rulemaking.

## Recommendation

No need for regulatory action identified, but staff plans additional interaction before finalizing assessment

# Additional Stakeholder Interaction – Hydrogen Control and Mitigation

6: Identify insights about hydrogen control and mitigation inside containment or in other buildings as additional information is revealed through further study. . .

Tier 3 → Dependent on insights from Tier 1 activities and further evaluation

## Evaluation

- 10 CFR 50.44.
- Significant information from previous studies.
- EA-13-109 in progress.
- Mitigating strategies enhance safety.
- NRC participated in international studies.

## Recommendation

No need for regulatory action identified, but staff plans additional interaction before finalizing assessment

# Further Assessment Needed – Evaluation of Other Natural Hazards

ACRS and Consolidated Appropriations Act for 2012: The [NRC] shall require reactor licensees to reevaluate the seismic, tsunami, flooding, and other external hazards at their sites . . .

Tier 2 → Lack of critical skill set for both NRC and industry

## Evaluation

- External natural hazards addressed by mitigation strategies.
- Enhanced efficiency through screening process.
- Process focuses on hazards of primary concern.

## Recommendation

Further assessment/ interaction needed

. . . Including previous assessments, protection under current regulations, and stakeholder input

# Further Assessment Needed – Periodic Reconfirmation of Natural Hazards

2.2: . . . rulemaking to require licensees to reevaluate the seismic hazards and flooding hazards every 10 years and address any new and significant information. If necessary, update the design basis. . .

Tier 3 → To be based on insights from Tier 1 reevaluations (also Tier 2 other external hazards)

**Evaluation**

- Existing processes ensure safety maintained.
- Rulemaking not necessary.
- Internal processes could be enhanced to make them more proactive and systematic.

**Recommendation**

Further assessment/ interaction needed

. . . To obtain input from stakeholders and complete process enhancements

# Further Assessment Needed – Radiation Monitoring During an Accident

Rec. 11.3: Efficacy of real-time radiation monitoring in EPZ and onsite

Tier 3 → Required further staff study

## Evaluation

- Consider history with real-time radiation monitoring.
- Benefit from interaction with Federal, State, local stakeholders.

## Recommendation

Further assessment/ interaction needed

. . . To gather stakeholder input, evaluate, and document assessment results

# International Collaboration

- Continued engagement and cooperation with international counterparts
  - Participate in meetings and missions
  - Review and assess reports
- NRC regulatory actions are similar to those taken by international partners
- Focus areas include:
  - Protection from external hazards
  - Mitigation of beyond-design-basis events
  - Strengthening emergency preparedness

# Consistency with IAEA Lessons Learned

| | IAEA Themes* | NTTF |
|---|---|---|
| ✓ Ensuring Protection from External Events | Vulnerability of plants to external events | 2, additional issues |
| ✓ Enhancing Mitigation of Beyond-Design-Basis Events | Application of the defense-in-depth concept<br>Assessment of the failure to fulfil fundamental safety functions<br>Assessment of beyond-design-basis accidents and accident management | 1, 4.2, 5, 6, 7, 8, 12 |
| ✓ Strengthening Emergency Preparedness for Multi-Unit Events | Assessment of human and organizational factors<br>Emergency preparedness – Response in Japan<br>Protecting emergency workers<br>Protecting the public<br>Transition from the emergency phase to the recovery phase and analysis of the response<br>Onsite stabilization and preparations for decommissioning | 4, 9, 10, 11 |
| ✓ Regulatory Philosophy | Assessment of regulatory effectiveness<br>Response within the international framework for emergency preparedness and response | Pre-existing NRC/U.S. processes |
| ✓ Radiological Consequences | Off-site remediation of areas affected by the accident<br>Radioactivity in the environment<br>Radiological consequences for non-human biota<br>Management of contaminated material and radioactive waste | Pre-existing NRC/U.S. processes |

*IAEA, “The Fukushima Daiichi Accident,” August 2015

# Conclusions

- **Continued focus on the safety and security of operating plants**
- **Steady progress towards completion of Fukushima initiatives**
- **Sound recommendations for resolving Tier 2 and 3 items**
- **Demonstrable improvement in safety as the lessons are implemented**

# Acronyms

| | | | |
|---|---|---|---|
| ACRS | Advisory Committee on Reactor Safeguards | IAEA | International Atomic Energy Agency |
| CEUS | Central and Eastern United States | KI | Potassium Iodide |
| CPRR | Containment Protection and Release Reduction | MBDBE | Mitigation of Beyond-Design-Basis Events |
| DID | Defense in Depth | PRA | Probabilistic Risk Assessment |
| EA | Enforcement Action | ROP | Reactor Oversight Process |
| EP | Emergency Preparedness | SAMGs | Severe Accident Management Guidelines |
| EPZ | Emergency Planning Zone | SBO | Station Blackout |
| ERDS | Emergency Response Data System | WUS | Western United States |
| FEMA | Federal Emergency Management Agency | | |