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US Industry Response to the Fukushima Accident

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Outline of Presentation

1. US Industry Response to Fukushima
2. US Regulator (NRC) Response to Fukushima
3. Global Industry Response to Fukushima
4. Institutional Changes
5. EPRI R&D Response to Fukushima

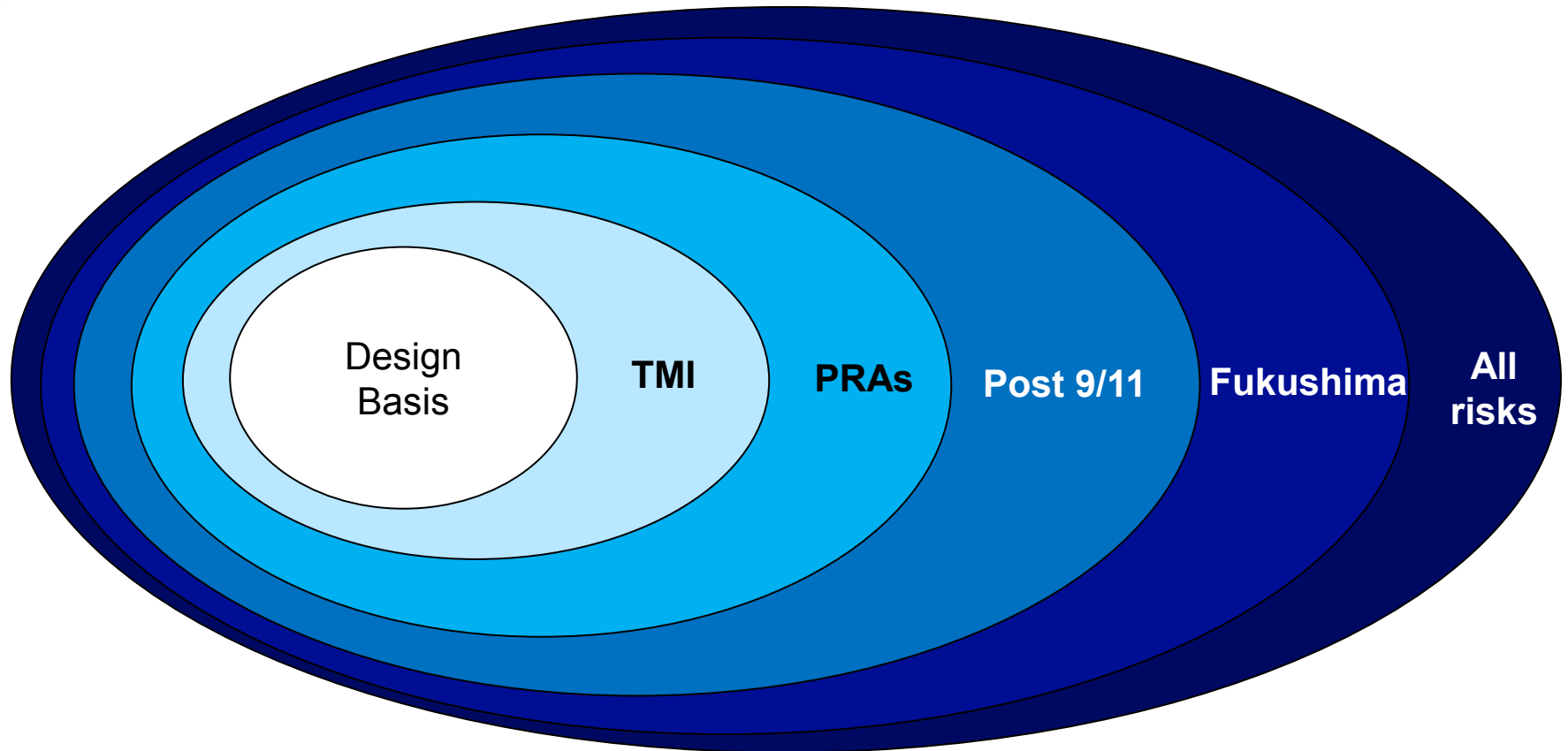


Fukushima Event – Context

- The damage to the Fukushima Daiichi Nuclear Plant was unique in nuclear power experience
 - Failed redundant and diverse means of core cooling
 - Damaged cores of three reactors
 - Hydrogen explosions damaged secondary containments
 - Spent fuel pools involved
 - Unexpected containment failure and offsite releases
- A wide-ranging set of actions and discussions are occurring, and will continue to occur, for years to come
- Results will impact all nuclear power plants



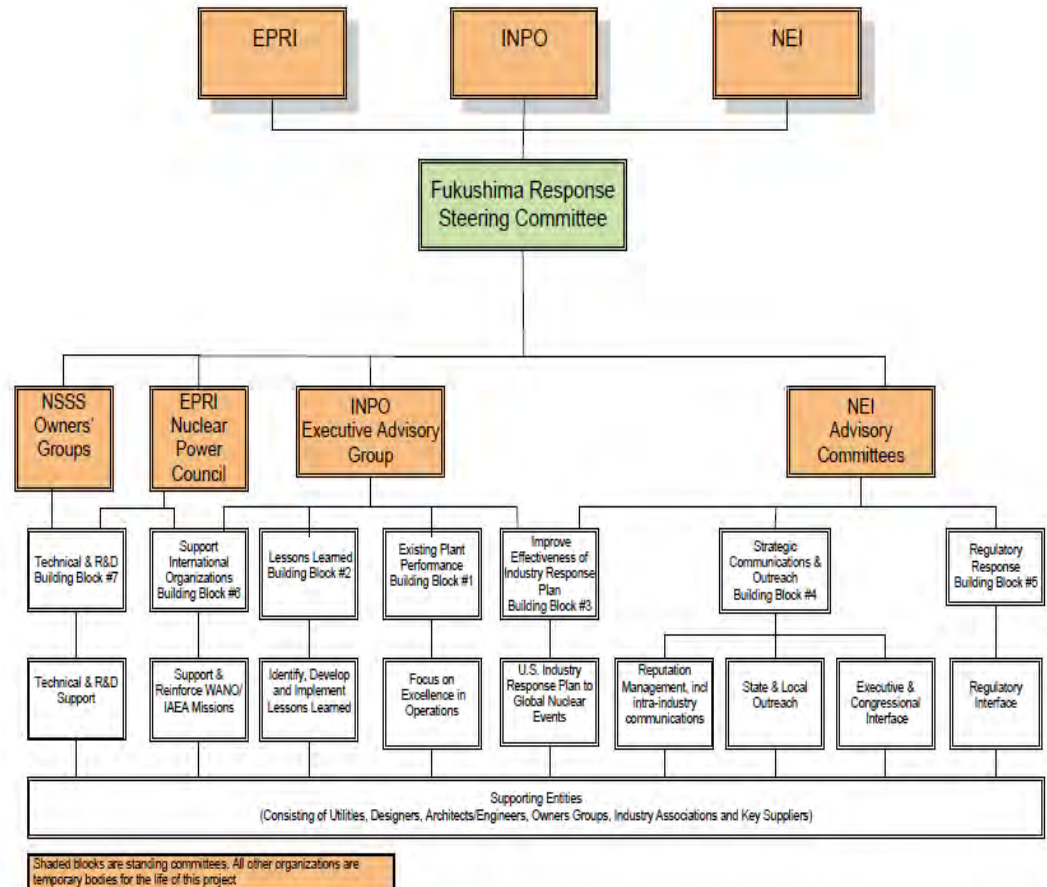
Years of Progress Reducing Risk...



Note: Risk areas not to scale.

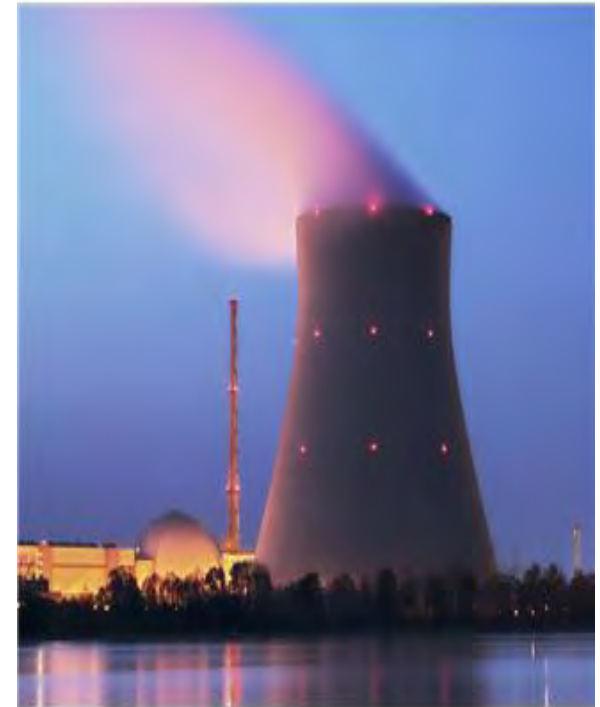
US industry Organization: “WAY FORWARD”: Seven Building Blocks

1. Maintain Focus on plant performance
2. Lessons Learned from Fukushima
3. Improve effectiveness of Industry response
4. Develop strategic communication plan
5. Regulatory Interactions
6. Coordinate with International Organizations
7. Technical support and R&D coordination



US Industry Actions (2011): Plant Safety Evaluations

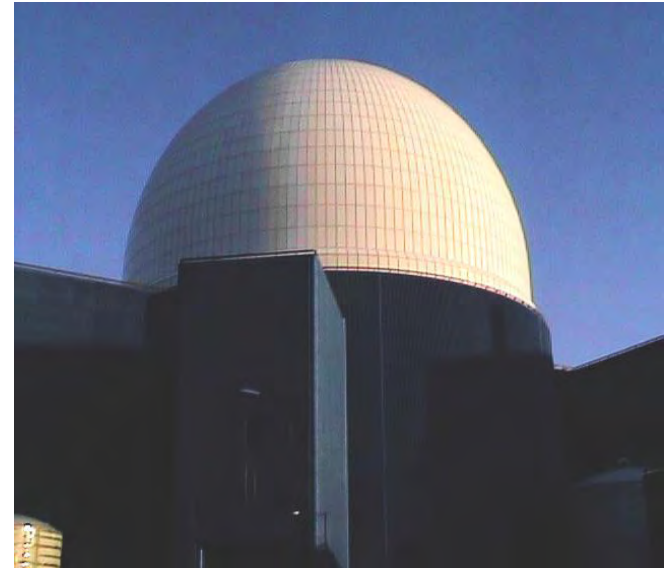
- Four INPO Event Reports (IERs):
 1. All stations verify high level of readiness against station blackout, external events and severe accidents: Issued 15 March (30 days)
 2. Focus on spent fuel pools readiness (loss of cooling and makeup) – Issued 15 April (150 days)
 3. Focus on Operators fundamentals and training, organization and practices
 4. Coping with total loss of AC power 24 hours – 1 August (150 days)



US Industry: Strategic Response Plan

Goal the United States nuclear power industry must have a plan of action that aligns our nation's resources to ensure we can combat any single accident.

- Examples of Actions identified in the SRP (not exhaustive):
 - Industry protocol for timely deployment of needed materials during an accident
 - Emergency response programs to deal with multiple unit emergencies
 - Adequate spent fuel pool cooling and makeup functions during periods of high heat load or extended station blackout conditions
 - Primary containment protective strategies to manage post-accident conditions including elevated pressure and hydrogen concentrations



NRC “NTTF - 90 Day Report”: Main Recommendations

Tier-1 Recommendations:

- start without unnecessary delay
- sufficient resources/skills exist,

Tier-2 Recommendations:

- need for further technical assessment
- dependence on Tier 1 issues
- availability of critical skill sets.
- do not require long term study

Tier- 3 Recommendations:

- require further study to support regulatory action,
- have an associated shorter term action,
- dependent on availability of critical skill sets,



- —[NRC] approach has been to say let's look at these recommendations from the task force and set the priorities. The things that will have a fairly immediate positive impact, let's get after those right away, and for the others that need some additional work or analysis, let's stage or sequence those. I think that's exactly the right approach”

James K. Asselstine
Former NRC Commissioner

International Safety Evaluation Process

- ENSREG (EU Nuclear Safety Regulators) issued a series of “stress test” requirements in May 2011
 - All EU nuclear installations are subjected to requirements
 - Process almost universally adopted
 - Main Features of Stress Tests
 - External Events (seismic, flood, winds, etc.)
 - Loss of Offsite Power and Station blackout
 - Loss of heat sink
 - Severe accident management
 - Cliff edge effects
 - Each country to report to EC in December



Planned International Conference in Atlanta (14-16 November) to share global safety evaluations results

International Institutional Changes: WANO

- The World Association of Nuclear Operators (WANO) has recently decided to:
 - Expand the scope of WANO's activities to include emergency and severe accident management preparedness
 - Develop and implement a worldwide integrated event response strategy for WANO HQ and its regional centers.
 - Conduct regular safety-related peer reviews of nuclear energy facilities and strengthening enforcement of noncompliant members
 - Improve the quality of all WANO products and services through periodic internal peer reviews



International Institutional Changes: IAEA

- The International Atomic Energy Agency (IAEA) is also planning a stronger role to promote nuclear safety



—Nuclear safety remains the responsibility of individual countries, but the IAEA will play the leading role in shaping a safer nuclear future throughout the world ...It is important for all of us—governments, nuclear regulators, plant operators and the IAEA—to maintain our sense of urgency even after the crisis at Fukushima Daiichi has faded from the international headlines”

Dr. Yukiya Amano,
Executive director of the IAEA

EPRI: Post-Fukushima Technical Evaluation

Similar to investigation after airline crash (NTSB):

- **Objective technical record**
 - Reconstruct the event
 - What happened?
 - Why did it happen?
 - Understand the physics
 - Update codes and models
 - Inform future decisions



EPRI did the same after Three Mile Island

EPRI: Post-Fukushima specific R&D Activities

- Update Industry Probabilistic Risk Analysis (PRA) Methods for Seismic and Flooding Events
- Develop technologies evaluating external hazards
- Develop technical basis for severe accident management
- Develop methods to evaluate system interactions between reactor cooling system and spent fuel pools



EPRI is coordinating these R&D activities with France, Japan, Korea, Spain, Czech Republic and others

Conclusions

- The US Industry has reacted swiftly to the Fukushima Accident
 - Providing material support and expertise to TEPCO throughout the accident (INPO, EPRI, NRC)
 - Setting up an empowered organization (Way Forward) to manage the US industry resources and involving all segments of the industry
 - Planning long-term actions to address any vulnerabilities identified from the lessons learned at Fukushima (Strategic Response Plan)
- The US industry is also strongly tied to the international community:
 - To ensure completeness of lessons learned and coordination of actions
 - To leverage international R&D and analyses of the event