NCSL Energy Supply Task Force

Japan and U.S. Nuclear Update

May 6, 2011
Today’s Briefing

- Fukushima Accident
- Review of 2010 operating performance
- Policy outlook
Fukushima Daiichi Nuclear Power Plant Before the Accident

At the time of the earthquake
Reactors 1, 2 and 3 operating

Reactors 4, 5 and 6 shutdown for maintenance, inspection, refueling
Boiling Water Reactor Design & Fukushima Daiichi Status

Boiling Water Reactor Design
At Fukushima Daiichi

Secondary Containment
Steel Containment Vessel
Primary Containment
Spent Fuel Pool
Reactor Vessel
Suppression Pool (Torus)
U.S. Nuclear Power Plants
Prepared for Extreme Events

- Maximum credible earthquakes and floods
- Loss of off-site power and on-site power
- Hydrogen generation as a result of fuel damage during loss-of-coolant accidents
- Post 9/11: aircraft impact, loss of large areas of the plant
- Industry preparation, training, etc. exceed NRC requirements
- U.S. industry has long history of continuous learning
U.S. Government Response

- Multi-agency task force (Nuclear Regulatory Commission, Department of Energy, Department of Defense) supporting Japan recovery efforts
- President Obama directed the NRC to perform a comprehensive review of U.S. reactors
- NRC established agency task force to develop lessons learned from Fukushima Daiichi accident to provide short-term and long-term analysis of the events
Short-Term Industry Actions to Ensure Safety

- Verify each plant's capability to manage major challenges, such as aircraft impacts, loss of large areas of plant due to natural events, fires or explosions
- Verify each plant's capability to manage loss of off-site power
- Verify capability to mitigate flooding and the impact of floods on systems inside and outside the plant
- Perform walk-downs and inspection of important equipment needed to respond to extreme events
Review of 2010
Operating Performance
Safe Operation Is Our Top Priority

- NRC, industry safety indicators remain at or near record-high levels
- Nuclear plants are the most secure industrial facilities
- BP Commission recommends oil industry emulate nuclear industry’s model for achieving operational excellence

“The basic, successful principles upon which the INPO model is premised can serve as the touchstones for the oil and gas industry in establishing its own [safety organization].”

—National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling
U.S. Nuclear Plant Reliability Remains High

Generation

807.0 billion kWh in 2010

Average Capacity Factor

91.2% in 2010

Refueling Outage Duration
(Industry Average in Days)

Sources: Energy Information Administration, 1990-98 EUCG, 1999-2010 Ventyx Velocity Suite / Nuclear Regulatory Commission
Investments in Extended Operations

License Renewals

- 63 Approved
- 19 Under NRC Review
- 16 Intend to Renew
- 6 Unannounced

Cumulative Power Uprates

- 1977-2015
- Approved - 5,810 MW
- Under Review and Expected - 3,422 MW by 2015

Total Capital Spending

- Billions of Dollars
- Sources: Nuclear Regulatory Commission, Electric Utility Cost Group
The Next Nuclear Plant: Watts Bar Unit 2

- Project remains on schedule and under budget
- Fuel load April 2012
- Full power operations October 2012
- Engineering 90% complete
- Construction 64% complete
- 3,500 people working on-site
Global Leadership in Development of Uranium Enrichment Capacity and Technology

- AREVA Centrifuge Enrichment
- USEC Centrifuge Enrichment
- GE-Hitachi Laser Enrichment
- Urenco-USA Centrifuge Enrichment
Policy Outlook
A Changed Political Environment, But...

- Continued Administration support
  - Loan guarantee program
  - Three new commissioners for Nuclear Regulatory Commission
  - Negotiated key 123 nuclear trade agreements with U.A.E., Russia, Australia

- Continued bipartisan support in Congress

* Includes 2 Independents
President’s Challenge: 80% Clean Electricity by 2035

“So those of us who are concerned about climate change, we’ve got to recognize that nuclear power, if it’s safe, can make a significant contribution to the climate change question.”

President Barack Obama
March 30, 2011
Nuclear Industry Policy Agenda

- Stability at the NRC: renomination of two commissioners this year
- Appropriate response to Fukushima accident
- Ensure loan guarantee program is workable financing platform
- Alignment of U.S. government agencies to support exports of nuclear goods and services
- Constructive congressional oversight
Small Reactor Concepts

- Come in a range of physical sizes
- Cover a wide variety of reactor types
  - Water, gas, and liquid metal cooled
  - Both fast and slow neutron spectrums
- Suitable for a variety of applications
Promise of Small Reactors

- Expand nuclear benefits to areas and applications underserved by large plants
- Job creation by reestablishing domestic manufacturing for global deployment
- Growing political support from those traditionally opposed to nuclear energy
DOE’s FY 2012 SMR Budget:
SMR Licensing Technical Support

- Competitive process
- Minimum 50% cost share
  - “within the merit review process, higher industry cost-share (i.e., greater than 50%) will be a rating criterion in evaluating program solicitations”
- Two reactor technology vendors: design, engineering, testing, analysis and NRC design certification
- Two utilities or consortia to develop Combined Operating License applications
  - “10 CFR 50 licensing framework may be considered, if appropriate”
- Five-year program cost: $452 million
Blue Ribbon Commission

- Established by Energy Secy Chu in Jan 2010 to make recommendations on nuclear waste management
- Independent, credible, and unbiased, with technical, organizational, and policy expertise
- Expect recommendations for durable long-term federal policies and programs for managing commercial used fuel and defense nuclear waste, beginning with central storage.
- Draft recommendations expect mid-2011; finalized by 2012
Blue Ribbon Panel – Industry Vision

- Needed to produce roadmap for a plausible, durable long-term federal program to meet legal and contractual obligation to remove used fuel from reactor sites
  - Important for new nuclear
- Lay out a well defined path with firm milestones for recycling decisions
- Must address disposal in responsible time frame
Integrated Used Nuclear Fuel Management

- Interim Storage
  - At-reactor sites
  - Central locations
- Recycling (and enhanced fuels use)
  - Research and development
  - Deployment at the right time
- Disposal
- Federal corporation to manage fuel cycle back-end
Used Fuel Principles

- Durable policy to manage used fuel responsibly.
- A plan for ultimate disposal.
- An ideal technical solution is not required to begin implementation of a new policy direction.
  - Evolutionary (and even revolutionary) advances in technology can be accommodated over time
- Non-proliferation goals must be met.
- The successes and failures of the past (especially in facility siting) must be heeded.
- An organization better able to carry out the program is needed.
Centralized Interim Storage

- Near-term consolidation of used fuel (Interim Storage)
  - Volunteer sites
  - Private sector initiative with DOE as a customer
  - NRC Licensed

- Benefits of central interim storage
  - Earliest way to move fuel from sites
  - Demonstrate ability to manage used fuel
  - Cost effective
  - Increased security
  - Clean up decommissioned sites
Nuclear Industry Policy Agenda

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Path Forward for Used Nuclear Fuel Management

- Develop a centralized interim storage
- Complete the Yucca Mountain licensing process
- Technology development to close the fuel cycle
- Create a federal corporation for managing used fuel
- Used fuel is not an impediment to operation or licensing of nuclear power plants

Lee Hamilton, right, and Brent Scowcroft, center, co-chairs, Blue Ribbon Commission on America's Nuclear Future Agenda, talk with former New Mexico Sen. Pete Domenici.
$400 Billion Global Nuclear Energy Market

Worldwide Development
- 65 reactors under construction
- 156 reactors on order or planned

Planned
- 50

Under Construction
- China: 27
- Russia: 14
- India: 18

Sources: International Atomic Energy Agency, World Nuclear Association
The Nuclear Energy Dividend

- Capital invested in operating plants and new plants will provide 60+ year assets with high yields in future years
- Nuclear plants are a hedge against fuel and environmental costs in well-balanced generation portfolios
- The industry will continue a disciplined approach to plant operations and new construction
“Our nuclear power plants have undergone exhaustive study, and have been declared safe for any number of extreme contingencies.”

President Barack Obama
March 17, 2011

“All the plants in the United States are designed to deal with a wide range of natural disasters, whether it’s earthquakes, tornados, tsunamis, other seismic events. We require all of them to deal with those.”

NRC Chairman Gregory Jaczko
March 17, 2011