Power Reactor Decommissioning
Past-Present-Future

January 13, 2015

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Decommissioned Power Reactors

- Rancho Seco – 2009
- Big Rock Point – 2007
- Hadam Neck – 2007
- Yankee Rowe – 2007
- Connecticut Yankee – 2007
- Pathfinder – 2007
- Maine Yankee – 2005
- Trojan - 2005
- Saxton - 2005
- Fort Saint Vrain - 1997
- Shoreham – 1995

Power Reactors Undergoing Decommissioning

SAFSTOR
- GE Vallecitos, 1963
- NS Savannah, 1970
- Fermi 1, 1972
- Indian Point 1, 1974
- Peach Bottom 1, 1974
- Dresden 1, 1978
- Three Mile Island, 1979
- La Crosse, 1987
- San Onofre 1, 1992
- Millstone 1, 1998
- Crystal River 3, 2013
- Kewaunee, 2013
- Vermont Yankee, 2014

Active DECON
- Humboldt Bay 3, 1976
  - Active DECON since 2009
- Zion 1 & 2, 1996/1997
  - Active DECON since 2010
- SONGS 2 & 3, 2013
Status of recent NPP being Decommissioned

- Kewaunee
  - Permanently Shutdown and defueled
- Crystal River 3
  - Permanently Shutdown and defueled
- SONGS 2 & 3
  - Permanently Shutdown and defueled
- Vermont Yankee
  - Permanently Shutdown, upcoming PSDAR Public Meeting

Exemptions Status

- Kewaunee
  - Approved on August 7, 2014
  - SRM-SECY-14-0066
- Crystal River 3
  - Approved on December 30, 2014
  - SRM-SECY-14-0118
- Vermont Yankee
  - With the Commission for approval, submitted on November 14, 2014, SECY-14-0125
- SONGS 2 & 3
  - With the Commission for approval, submitted December 17, 2014, SECY-14-0144
**Commission Direction:**
**SRM-14-0118**

- Continue to review exemption requests
- Proceed with Decommissioning Rulemaking
- Provide information about the anticipated schedule and resources for the rulemaking addressing decommissioning
- Complete the rulemaking in early 2019

**Decommissioning Rulemaking**

- A Graded approach to EP
- Lessons learned from plants that are decommissioned or are currently undergoing decommissioning
- Advisability of whether NRC should approve licensee’s PSDAR
- Appropriateness of maintaining three options for decommissioning and the timeframes for such options
- Appropriate role of the state and local governments as well as non-governmental stakeholders
Operations to Decommissioning

- Emergency Preparedness
- Security (e.g. post 9/11 requirements)
- Operator Qualifications
- Post Defueling Technical Specifications
- Rescinding Post Fukushima Orders

Current Stakeholder Concerns

- Spent Fuel Management
- High Burn-up Fuel
- Long-Term Storage/Disposal
- Post Shutdown Decommissioning Activities Report
- Role of the State in the Decommissioning Process
Reactor Decommissioning on a Global Scale

- Prescriptive requirements
- Earlier dismantlement
- Waste Management Strategies
- Guidance/Reports:
  - IAEA (GSR Part 6; WS-G-5.2; WS-G-2.1; WS-G-2.4)
  - NEA (NEA 7190; 7088; WPDD Reports)
  - WNA Reports/Positions (Decommissioning of Facilities (March 2014 Report); Safe Decommissioning of Civil Nuclear Industry Sites (Nov. 2012))

International Decommissioning

- To date, >140 reactors have been decommissioned or are undergoing decommissioning
- About one-third of those operational today are projected to be decommissioned by 2030
- Of the 100 operating reactors in the US, 72 are operating as license renewals and 28 under the original license
- Next major wave of license terminations is expected to occur between 2025-2050
International Cooperation

- Decommissioning Workshops (ROK, Taiwan)
- Research Reactor Decommissioning Demonstration Project (R2D2)
- Working Party on Decommissioning and Dismantling (NEA)
- IAEA International Expert s’ Meeting on Decommissioning and Remediation after Nuclear Accident

Future U.S. Energy Market

- Reliance on Non-Nuclear Renewable Energy Sources
- Low Natural Gas Prices
- Economics of Nuclear Power
- Premature Shutdown?
Programmatic Challenges

• Maintaining the Program While Coping with Uncertainties
• Maintaining Staff/Knowledge Management
• Ensuring Sites have Adequate Funds for Decommissioning
• Ensuring Operators Understand and Provide Adequate Decommissioning Documentation
• Ensuring Stakeholders are Appropriately Involved in the Process
• Lessons Learned
• Decommissioning Timeliness

Back-up Slides
Commercial LLW Sites in U.S.

<table>
<thead>
<tr>
<th>Facility</th>
<th>Waste Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanford, WA</td>
<td>A, B, C</td>
</tr>
<tr>
<td>Clive, UT</td>
<td>A only</td>
</tr>
<tr>
<td>Barnwell, SC</td>
<td>A, B, C</td>
</tr>
<tr>
<td>Andrews County, TX</td>
<td>A, B, C</td>
</tr>
</tbody>
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Keys to Decommissioning Project Success:

- Plan for decommissioning before facility construction and consider decommissioning throughout operations
- Have early and frequent consultations between regulators and owner/operators throughout the decommissioning process
- Ensure flexibility and transparency in regulatory implementation emphasizing safety and environmental protection
- Use realistic approaches in selecting post termination land use scenarios (e.g., based on foreseen land use) and parameters
- Involve stakeholders throughout the process
- The unexpected will happen, be ready to accept it and address the problem
### Nuclear Power Plants in Operation by Reactor Type

<table>
<thead>
<tr>
<th>Reactor type</th>
<th>Main Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressurized Water Reactor (PWR)</td>
<td>US, France, Japan, Russia, China</td>
</tr>
<tr>
<td>Boiling Water Reactor (BWR)</td>
<td>US, Japan, Sweden</td>
</tr>
<tr>
<td>Pressurized Heavy Water Reactor 'CANDU' (PHWR)</td>
<td>Canada</td>
</tr>
<tr>
<td>Gas-cooled Reactor (AGR &amp; Magnox)</td>
<td>UK</td>
</tr>
<tr>
<td>Light Water Graphite Reactor (RBMK &amp; EGP)</td>
<td>Russia</td>
</tr>
<tr>
<td>Fast Neutron Reactor (FBR)</td>
<td>Russia</td>
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