

# **An Overview of Power Reactor Decommissioning in the United States**

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May 26, 2016

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# Overview

- Decommissioning Regulatory Framework
- Power Reactor Decommissioning Process
- Transition
- Power Reactor Decommissioning Program Status
- Areas of High Public Interest
- Rulemaking
- Observations from NRC Decommissioning Experience
- Summary

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# NRC Decommissioning Program Regulatory Framework

- Statutory authority
- Comprehensive regulations:
  - Environmental review
  - Financial assurance
  - Site characterization
  - Site remediation/Radiological clean-up
  - Final site surveys
- Guidance
- Public Involvement
- Oversight

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# Reactor Decommissioning Alternatives

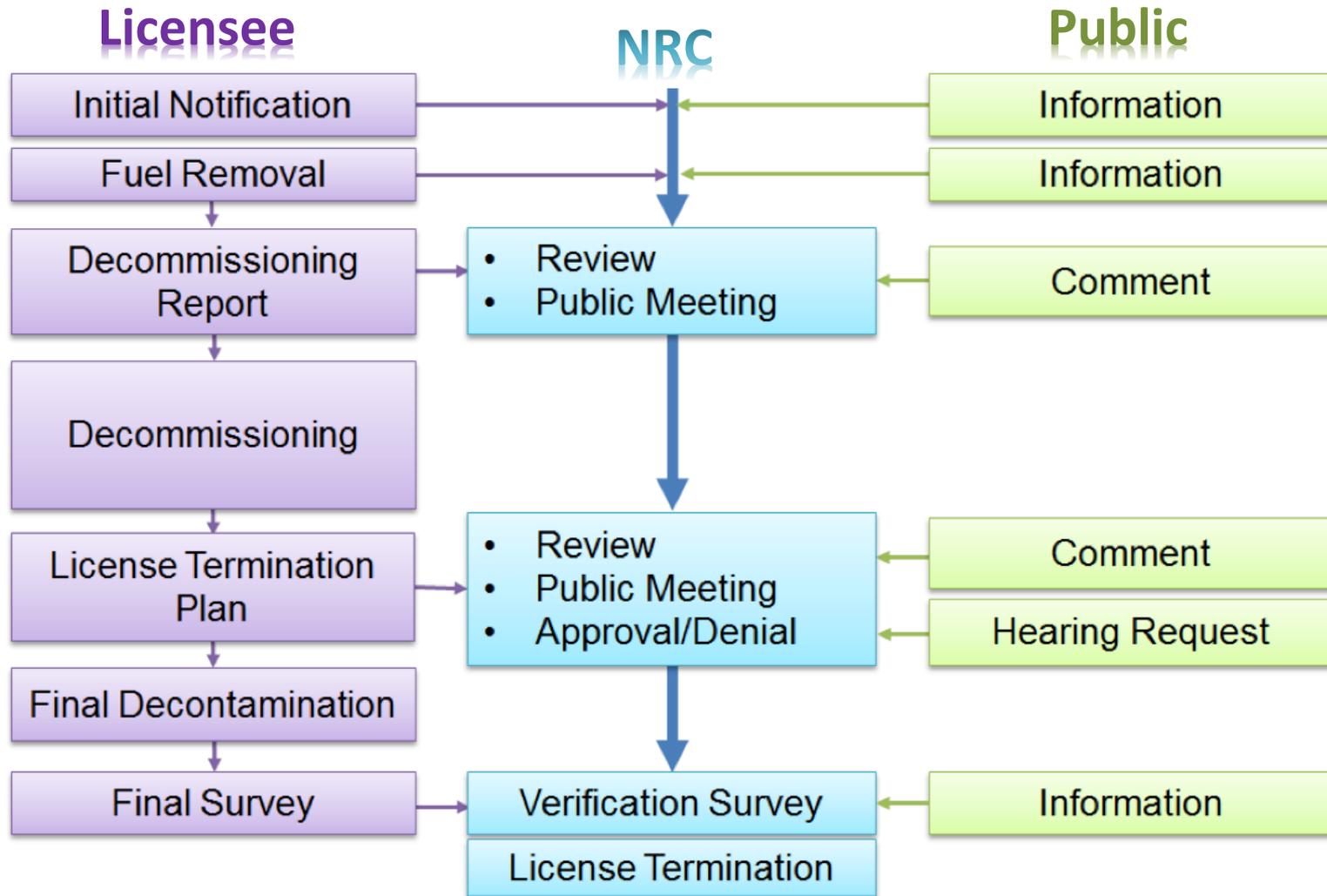
- DECON - prompt removal of radioactivity from equipment, structures, and site
- SAFSTOR - stabilize radioactively contaminated structures followed by dismantlement and decontamination in future
- ENTOMB - encase radioactive structures, systems, and components in a structurally long-lived substance (e.g., concrete)
- Decommissioning must be completed within 60 years of the plant ceasing operations.

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# Decommissioning Financial Assurance

- Costs for decommissioning range from \$280-\$612 million
- Cost factors include:
  - Timing and sequence
  - Type of reactor
  - Location of reactor
  - Waste disposal costs
  - Spent fuel storage costs
- Licensees report funding status at least once every 2 years then annually within 5 years of the planned shutdown and once the plant ceases operation
- Licensees demonstrate financial assurance via:
  - Prepayment
  - Surety, insurance, or parent company guarantee method
  - External sinking fund

# Power Reactor Decommissioning Process



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# Transitioning to Decommissioning

- **License amendments**
  - Permanently defueled technical specifications
  - Revised emergency plan and emergency action level scheme
- **Exemptions from Title 10 Code of Federal Regulations**
  - Emergency preparedness (Part 50, Appendix E)
  - Security plan and procedures (Part 73)
  - Insurance and financial protection (§ 50.54 and Part 140)
- **NRC internal transfer of oversight**

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# Reactor Decommissioning Program Status

- 10 power reactors have terminated their licenses and have been released for unrestricted use
- 19 power reactors in decommissioning
  - 5 power reactors in active DECON or active dismantling:
    - Zion 1 & 2, Humboldt Bay 3, and San Onofre 2 & 3
  - 14 power reactors in SAFSTOR or deferred dismantlement
- 3 power reactors have announced they will permanently cease operations by 2019
  - FitzPatrick<sup>1</sup>, Pilgrim and Oyster Creek
- Four additional units have announced that they are likely to shutdown in the near term: Quad Cities (2 units), Clinton, Ft. Calhoun

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<sup>1</sup> In February 2016, Entergy announced FitzPatrick will cease operations on Jan 27, 2017.

# Maine Yankee Decommissioning



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# Decommissioning Issues of High Public Interest

- Decommissioning funding & adequacy
- Reactor decommissioning strategies
- Economic losses to the local community
- Independent Spent Fuel Storage Installations (ISFSI)
- High-level waste storage and transport
- Community involvement - advisory groups
- Future use of the site

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# Commission Direction on Decommissioning Rulemaking

- **Commission directed staff to consider the following issues and complete rulemaking in 2019:**
  - Graded approach to emergency preparedness
  - Lessons learned from previous and current decommissioning
  - NRC approval of Post-Shutdown Decommissioning Activity Report
  - The appropriateness of maintaining the three existing options for decommissioning and the timeframes associated with those options (DECON, SAFSTOR, ENTOMB)
  - Role of State and local governments and non-governmental stakeholders
  - Other issues deemed relevant by staff

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# Observations from NRC Decommissioning Experience

- Early and frequent consultations between NRC, licensee, and governmental bodies and the public are important
- Detailed licensee project planning contributes to effective and safe decommissioning
- Lessons learned from actual decommissioning cases continue to inform NRC processes
  - Implement Guidance Updates
  - Maintain Communications
  - Encourage Community Involvement
  - Decommissioning Rulemaking

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## Summary & Conclusion

- NRC's decommissioning program has met our safety and security objectives
- NRC's power reactor decommissioning program is expanding as more shutdowns are anticipated
- Several regulatory issues related to transitioning from operations to decommissioning are being addressed through rulemaking