EPRI Project: Guidance for Transition from Operations to Decommissioning

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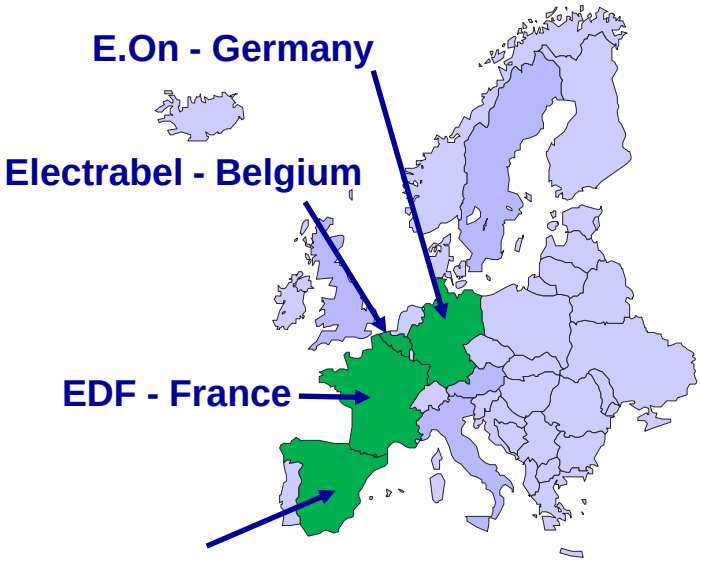
PREDEC 2016: International Symposium on Preparation for Decommissioning

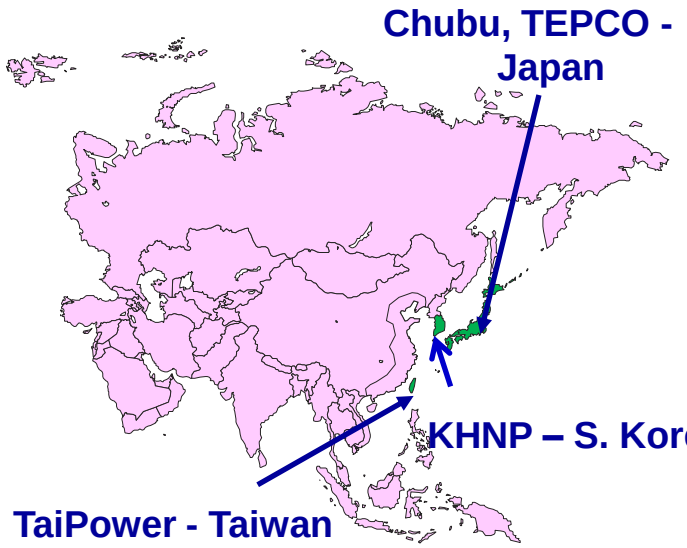
16-18 February 2016, Lyon, France

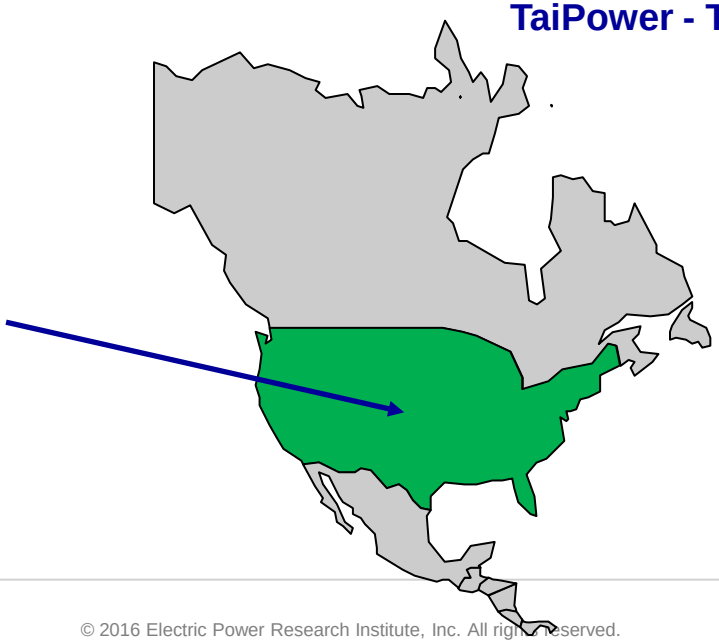
Overview

- US Transition Period Regulations
- EPRI Transition Project
- Experiences

Decommissioning Technology Program Membership

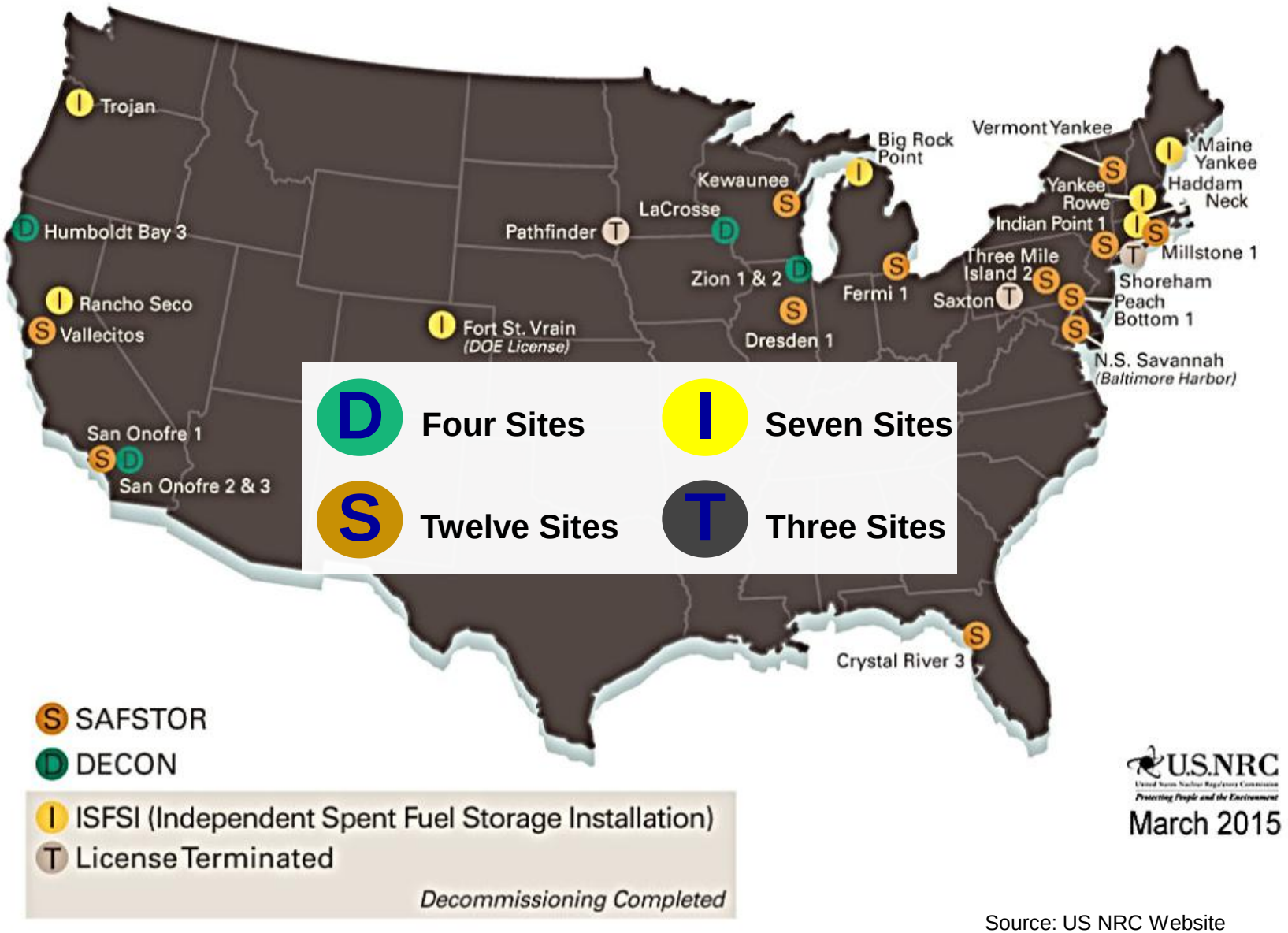






Current US Decommissioning Transition Period Regulations

Power Reactors Decommissioning Status



Source: US NRC Website

US Plants in Transition

- Unplanned Reactor Shutdowns
  - **Crystal River Unit 3** - Crystal River, Florida (February 2013)
  - **Kewaunee Power Station** - Kewaunee Wisconsin (May 2013)
  - **San Onofre Nuclear Generating Station, Units 2 & 3** - San Clemente, California (June 2013)
  - **Vermont Yankee Nuclear Power Station** - Vernon, Vermont (December 2014)
- Planned Reactor Shutdown
  - **Fitzpatrick Nuclear Station** - Oswego, New York (Announced Shutdown for 2017)
  - **Oyster Creek Nuclear Generating Station** - Forked River, New Jersey (Announced Shutdown for 2019)
  - **Pilgrim Nuclear Power Station** - Plymouth, MA (Announced Shutdown for 2019)

US Transition Regulations

- The US does not have a formal period for transitioning from operating to decommissioning, unlike some other countries
- The decommissioning process in the US is structured around several regulatory submittals, including:
  - Certification of Permanent Cessation of Operations
  - Post Shutdown Decommissioning Activities Report (PSDAR)
  - Site-Specific Decommissioning Cost Estimate
  - Revisions to Plant Licensing Design Basis Documents
    - Defueled Safety Analysis Report
- Submittals have been made by the four sites currently in transition each with multiple exemption requests for
  - Emergency Preparedness (Part 50, Appendix E)
  - Security Plan and Procedures (CFR Part 73)
  - Use of Decommissioning Trust Fund (CFR 50.82)
  - Insurance and Financial Protection (CFR 50.54 an Part 140)
- Submittal of these documents permits utilities to access their decommissioning fund and to begin certain dismantling activities

Nuclear Regulatory Commission Direction on Decommissioning Rulemaking

- **SRM SECY-14-0066,** Commission directed staff to report its views on the need for an integrated rulemaking for decommissioning.
- **SRM SECY-14-0118**, Commission directed staff to complete rulemaking in 2019.
- **SECY-15-0014,** NRC Staff Responded to both SRMs and provided high-level schedule and resource needs.

Scope of NRC Decommissioning Rulemaking

- The Commission Requested Staff to Address the Following Issues in the Rulemaking, as Discussed in SECY-00-0145:
  - Graded Approach to Emergency Preparedness;
    - Fuel in pool
    - Fuel in Dry Storage
  - Lessons Learned;
  - NRC Approval of Post-Shutdown Decommissioning Activity Report;
  - Maintaining Three Existing Decommissioning Options (i.e., SAFSTOR, DECON, ENTOMB) and Associated Timeframes;
  - Role of State and Local Governments and Non-Governmental Stakeholders;
  - Other Issues Deemed Relevant by Staff.

NRC Milestones Associated with Decommissioning Rulemaking

- Major Milestones
  - Advance Notice of Proposed Rulemaking: Request for Comment (published November 2015)
  - Regulatory Basis
  - Proposed Rule/Draft Regulatory Guidance
  - Final Rule/Final Regulatory Guidance (2019)
- Public Participation

EPRI Transition Project

Background

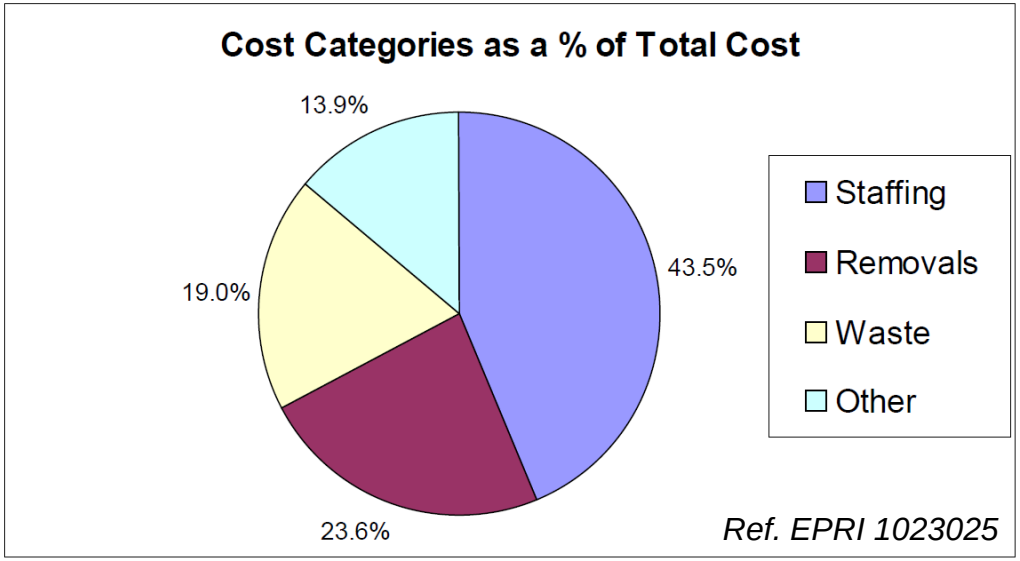
- A wide range of key activities are necessary after permanent shutdown of a nuclear power plant before active dismantlement of the plant can begin
  - For example, defueling, management of operational wastes, fulfilling regulatory requirements, staffing plan, changes to plant technical specifications, full-system chemical decontamination, etc.
- In some cases these activities are prescribed by regulation and in others they may be more practically driven or even optional
- Planning for transition should optimally take place prior to final shutdown and execution of some transition period activities, such as filing required regulatory submittals, may be performed prior to plant shutdown
- In the EPRI project, guidance is being developed for transitioning from operational to decommissioning status

Goals of Project / Project Overview

- Compile country-specific transition period regulations
  - Countries will be selected to provide a wide range of regulations (i.e., structured vs. unstructured transition)
- Compile industry transition period operating experience
  - Identify activities that can be performed / planned for before shutdown
  - Identify long-lead activities that should be prioritized
  - Identify cost-saving activities that should be performed early after shutdown
- Provide guidance for the development of a plan to transition from operational to decommissioning status

Motivation for Project

- The cost of decommissioning is highly influenced by overall staffing costs, which is related to the overall length of decommissioning



- It is anticipated that the guidance developed in this work will help shorten the length of the transition period, and thus shorten the overall length and decrease the cost for decommissioning

US Transition Period Experience

Selected Plants

Reactor	Type	Commercial Operation	Shutdown	Years Operational	Status [a]	Fuel Onsite
GE VBWR	BWR	Oct-57	Dec-63	6.1	SAFSTOR	No
Pathfinder	Superheat BWR	Jul-66	Sep-67	1.1	License Terminated	No
Saxton	PWR	Mar-67	May-72	5.2	License Terminated	No
Fermi 1	Fast Breeder	Aug-66	Sep-72	6.1	SAFSTOR	No
Indian Point 1	PWR	Oct-62	Oct-74	12.1	SAFSTOR	Yes
Peach Bottom 1	HTGR	Jun-67	Oct-74	7.4	SAFSTOR	No
Humboldt Bay 3	BWR	Aug-63	Jul-76	12.9	DECON	Yes
Dresden 1	BWR	Jul-60	Oct-78	18.3	SAFSTOR	Yes
Three Mile Island 2	PWR	Dec-78	Mar-79	0.2	SAFSTOR [b]	No
LaCrosse	BWR	Nov-69	Apr-87	17.5	DECON	Yes
Millstone 1	BWR	Mar-71	Jul-88	17.4	SAFSTOR	Yes
Rancho Seco	PWR	Apr-75	Jun-89	14.2	ISFSI Only [c]	Yes
Shoreham	BWR	Aug-86	Jun-89	2.9	License Terminated	No
Fort St. Vrain	HTGR	Jul-79	Aug-89	10.1	ISFSI Only	Yes
Yankee Rowe	PWR	Jul-61	Oct-91	30.3	ISFSI Only	Yes
Trojan	PWR	May-76	Nov-92	16.5	ISFSI Only	Yes
San Onofre 1	PWR	Jan-68	Nov-92	24.9	DECON	Yes
Zion 2	PWR	Sep-74	Sep-96	22.0	DECON	Yes
Maine Yankee	PWR	Dec-72	Dec-96	24.0	ISFSI Only	Yes
Connecticut Yankee	PWR	Jan-68	Dec-96	29.0	ISFSI Only	Yes
Zion 1	PWR	Dec-73	Feb-97	23.2	DECON	Yes
Big Rock Point	BWR	Mar-63	Aug-97	34.4	ISFSI Only	Yes
Crystal River 3	PWR	Mar-77	Feb-13	36.0	SAFSTOR	Yes
Kewaunee	PWR	Jun-74	May-13	38.9	SAFSTOR	Yes
San Onofre 2	PWR	Aug-83	Jun-13	29.9	DECON	Yes
San Onofre 3	PWR	Apr-84	Jun-13	29.2	DECON	Yes
Vermont Yankee	BWR	Nov-72	Dec-14	29.2	SAFSTOR	Yes

Decomissioning Completed

a) ISFSI = Independent spent fuel storage installation, which is a stand-alone facility within the plant constructed for the interim storage of spent nuclear fuel. "ISFSI Only" means the plant license has been reduced to include only the ISFSI.

b) TMI 2 is in a post-defueling monitored storage (PDMS) state, where the plant is in SAFSTOR but the fuel has been removed.

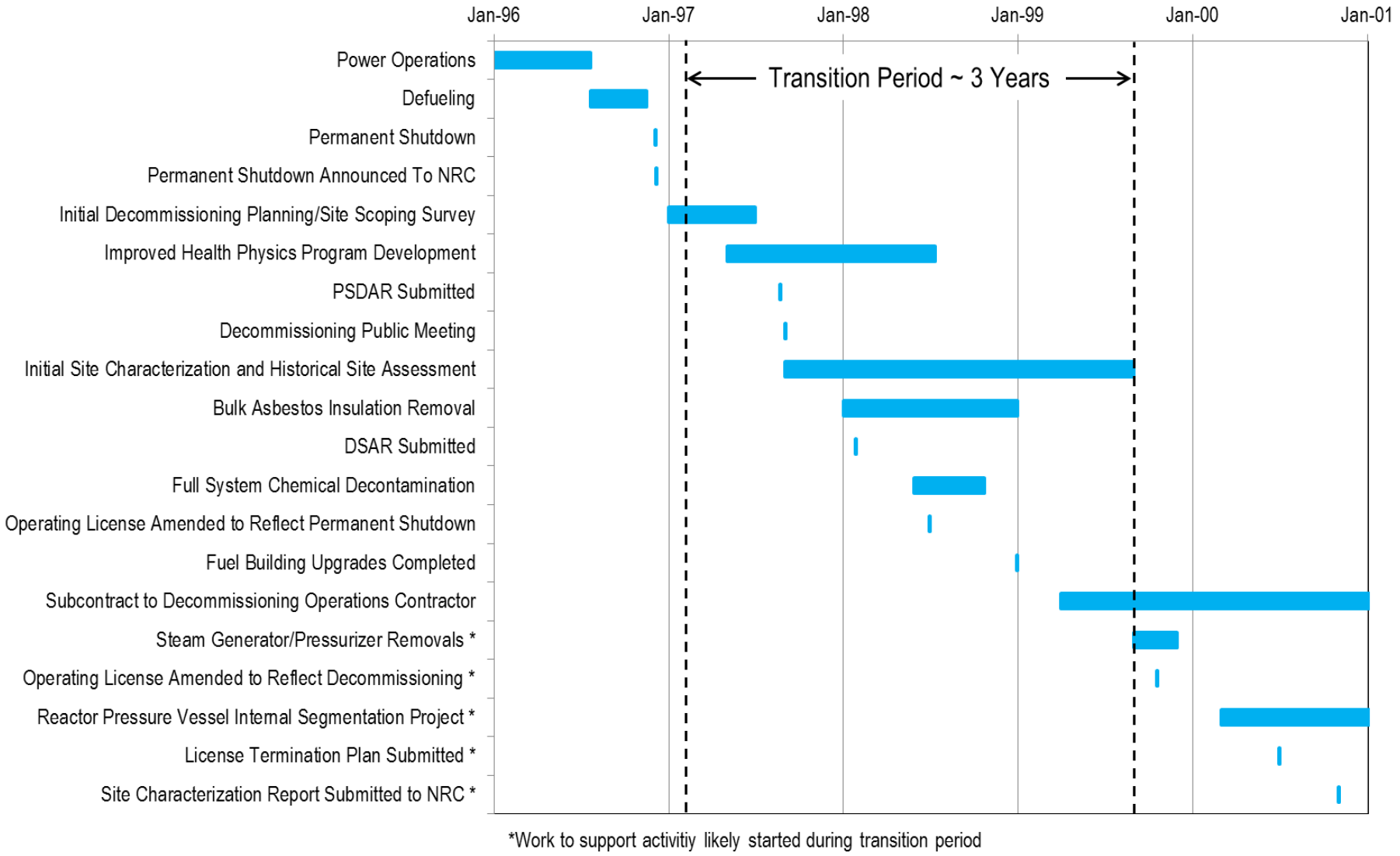
c) Some low-level waste is also stored at Rancho Seco in addition to its ISFSI.

- Recent transition period experiences from the 11 plant sites outlined in purple will be summarized
- Oyster Creek experience will also be summarized
  - Not shutdown, but transition plans have been made
- Distribution of selected experiences

Number	Description
4	PWRs that have completed decommissioning
3	PWRs that recently entered SAFSTOR
1	PWR that recently entered DECON from a period of SAFSTOR
1	PWR that recently entered DECON from operation
1	BWR that has completed decommissioning
1	BWR that has developed decommissioning plans before shutdown

US Transition Period Experience

Example – Connecticut Yankee Transition Period Timeline



*Work to support activitiy likely started during transition period

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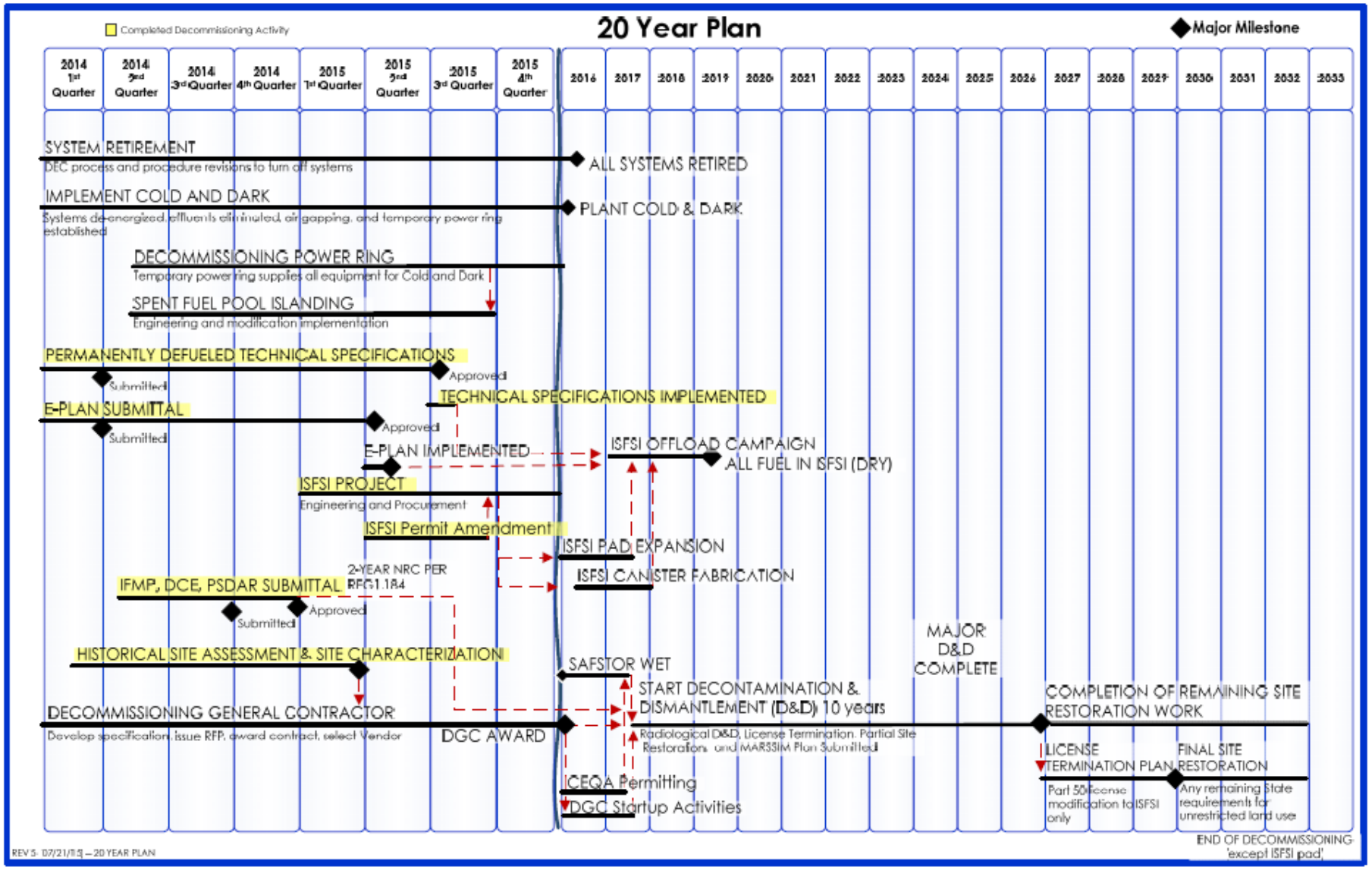
US Transition Period Experience

Example – SONGS Unit 2/3 Transition (2 years) & Decon Period



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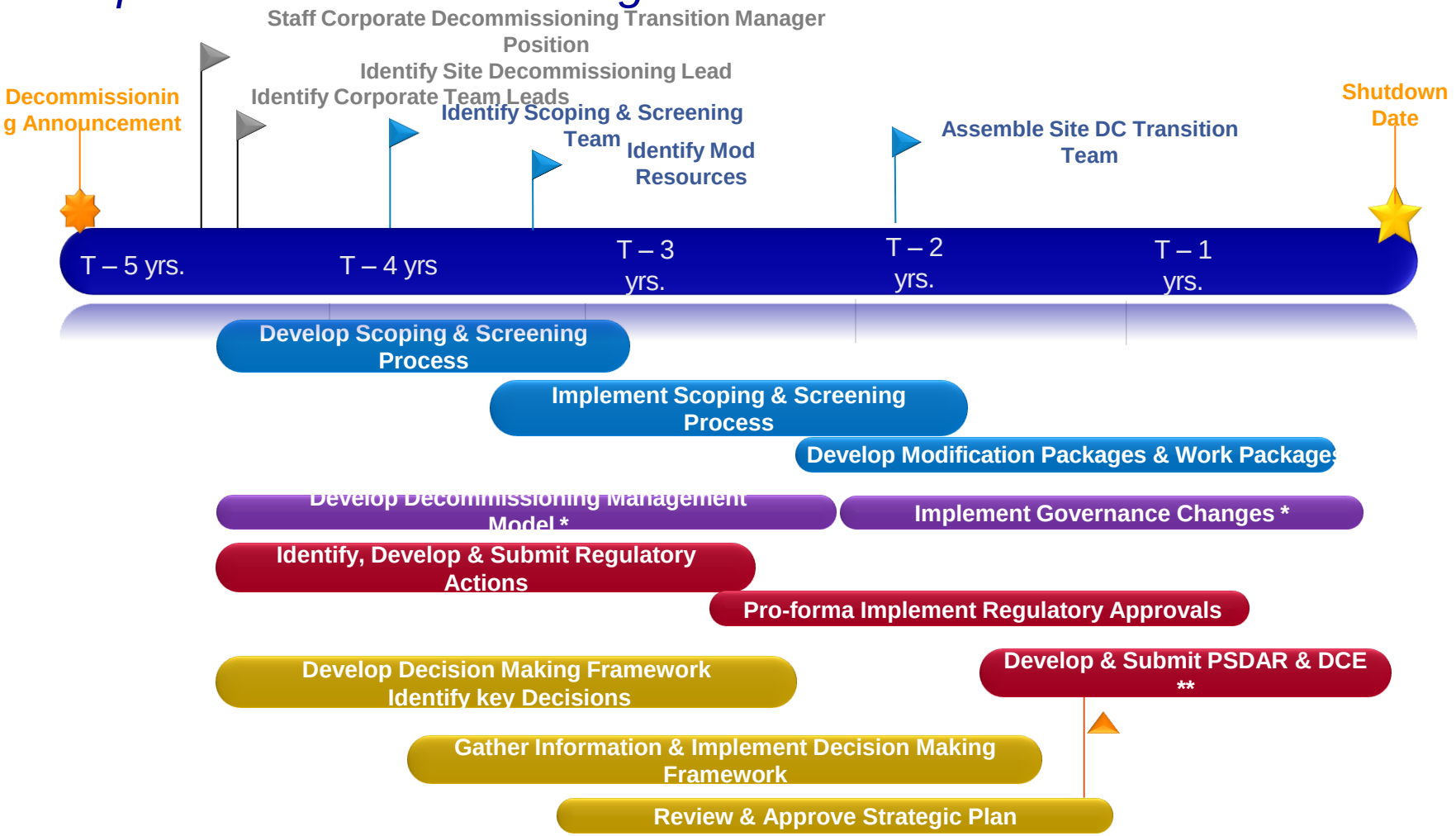
US Transition Period Experience

Example – Exelon Nuclear Mgmt. Model Transition Period Timeline



*Initial Plant Only – Management Model Addition

** PSDAR Submission Tied to Strategy Approvals; PSDAR Does Not Require NRC Approval, DCE (Decommissioning Cost Estimate) for PSDAR plan will be submitted with or shortly after PSDAR submittal. No approval required for DCE.

US Transition Period Experience

Example – List of Decommissioning Transition Activities (1/2)

- Cost Estimating
- Preparation/submittal of Regulatory Submittals
- Systems, Structures and Component (SSCs) Re-Categorization
- Revised Technical Specifications
- Cold and Dark Program (repower certain systems)
- Project Management Model
- Re-design Work Control Process
- Develop Communications Plan
  - Both internal and external
- Human Resources
  - Retention of key staff
  - Labor agreement impacts
  - Relocation of other staff
- Perform Historical Site Assessment and Initial Site Characterization
- Disposal of Operational (Legacy) Wastes

US Transition Period Experience

Example – List of Decommissioning Transition Activities (2/2)

- Fuel Building Modifications to Isolate from Other Plant Systems
- Certified Fuel Handler Program
- Transfer of Spent Fuel to Dry Casks / ISFSI
  - Design of the Dry Fuel Storage System
  - Building and System Modifications to support the Dry Fuel Storage System
  - Fabrication of Dry Fuel Storage Canisters, Storage Cells and Other Related Equipment
  - Design and Construction of the ISFSI
- Dismantling of Non-Nuclear Facilities
- Upgrade Plant /Infrastructure (e.g. rail) to Facilitate Removal of Wastes
- Full System Chemical Decontamination
- Hot Spot Reduction
- Asbestos and Flammable Materials Removal
- Preparation for Post-Transition Decommissioning Activities
  - Major Component Removal Planning
  - Reactor Vessel and Internals Segmentation Planning
  - Balance of plant dismantlement

EPRI Transition Project – Ongoing/Future Work

- Continue to compile transition period operating experience
- Summarize French, German, Spanish, and Swiss transition period regulations
- Evaluate regulations and operating experience to develop guidance for transitioning from operating to decommissioning
- Schedule for completion: Draft report Q1 2016

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