

Vermont Yankee License Termination Issues

Vermont Department of
Health, October 8, 2013

Decommissioning Is...

- Permanently removing a nuclear facility from service and reducing radioactive material on the licensed site to levels that permit termination of the NRC reactor license.
- This is for radiological decommissioning of Vermont Yankee's nuclear power reactor 10 CFR 50 license.
- Radiological decommissioning funding is separate from spent fuel management funding.
- Regulations published on July 29, 1996 in *Federal Register* (61 FR 39278).

Decommissioning Is...

- VY holds a separate 10 CFR 72 NRC license for the independent spent fuel storage installation.
 - The current ISFSI cannot hold all the spent fuel from plant operations.
 - A new, much larger, ISFSI will have to be licensed by the NRC, certified by the PSB and built.
- The Public Service and Health Departments are provided monthly reports of the environmental and radiological conditions of the current ISFSI. This should be incorporated for the final ISFSI.
- All content herein is about the radiological decommissioning.

Three phases of Decommissioning

- Initial activities:
 - Cessation of operations, and
 - Preparations for DECON or SAFSTOR.
- Major decommissioning activities:
 - Storage up to 60 years after cessation of operations, or
 - Dismantling and disposal of radioactive components.
- License termination

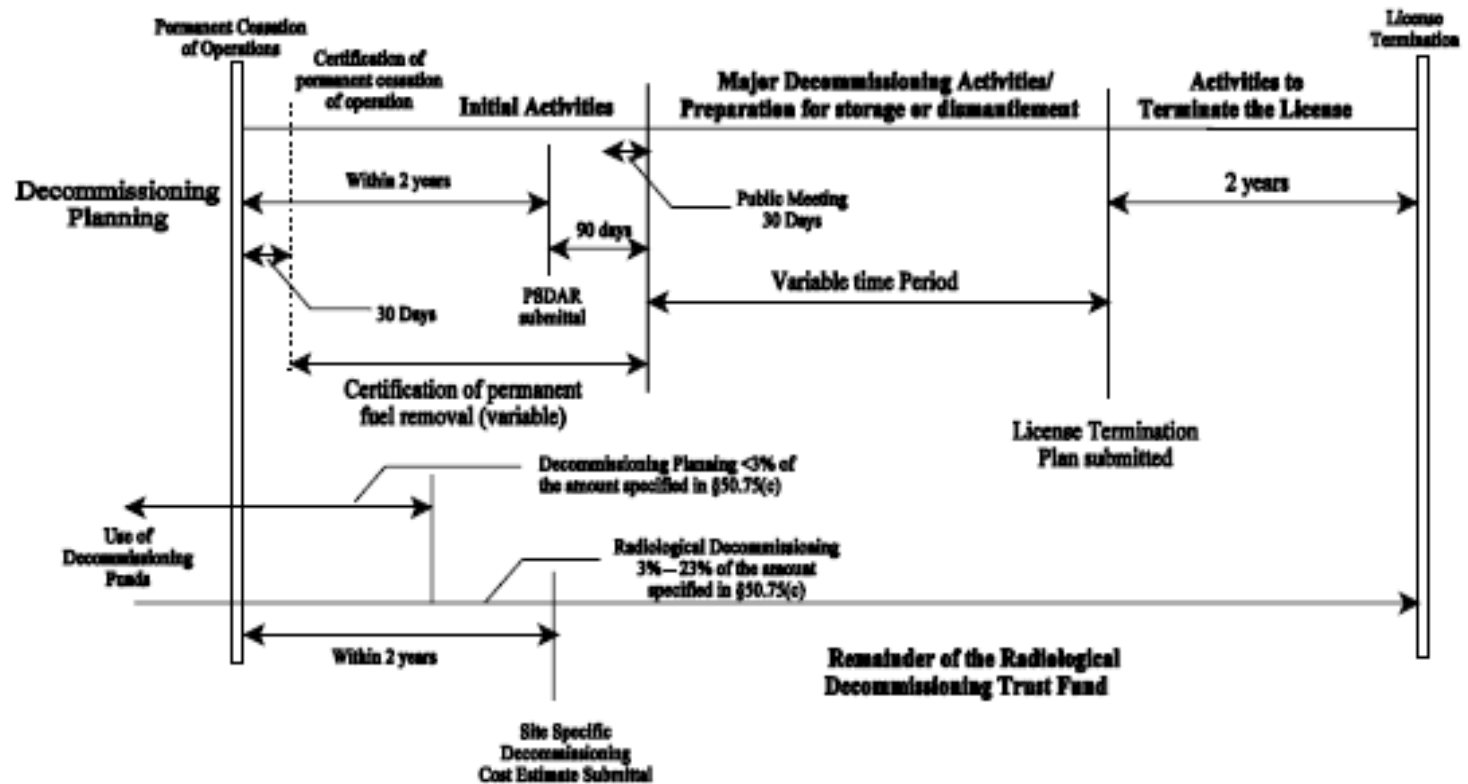
DECON

- Spent fuel is removed from the reactor and placed in the spent fuel pool in the reactor building.
- Certification of defueling is made with the NRC.
- Spent fuel is moved from the spent fuel pool in the reactor building and placed into dry casks and placed within the ISFSI.
- Equipment, structures and portions of the facility and site that contain radioactive contaminants are removed or decontaminated to a level that permits termination of the license.

SAFSTOR

- After cessation of operations, the reactor is defueled. Reactor fuel is moved to the spent fuel pool. Defueling certification with NRC.
- Spent fuel is removed from the spent fuel pool in the reactor building. Placed into dry casks and placed in the ISFSI.
- Reactor coolant and other fluids are drained from plant systems.
- Facility is placed in a safe and stable condition and maintained in that state until subsequently decontaminated and dismantled.
- The ultimate disposition of a site released for unrestricted use after license termination is not a matter for the NRC.

DECOMMISSIONING TIMELINE



From US NRC Regulatory Guide 1.184, Decommissioning of Nuclear Power Reactors

Initial Activities

- Written certification of decision to permanently cease operations provided to NRC within 30 days of public announcement.
- Defueling certification
 - No operations of the reactor or movement of fuel into the reactor vessel allowed afterward.
 - There is a fee reduction for the licensee.
 - There are exemptions from certain regulatory requirements (covered below).
- Post-shutdown decommissioning activities report (PSDAR) provided to NRC and States.

Initial Activities - PSDAR

- Required within two years of cessation of operations.
- Description of licensee's planned decommissioning activities.
- Schedule for significant milestones.
- Estimate of expected costs.
- Environmental impact assessment:
 - Determination that impacts of decommissioning have been considered in previous environmental assessment reports, or
 - Provision of a supplement to the environmental reports specifically addressing unassessed impacts.

Site Specific Cost Estimate

- Required five years prior to end of operations or, if prematurely shutdown, within two years of cessation of operations.
- For VY, it would be the latter, and this coincides with the PSDAR submittal time limit.
- Includes assessment of major factors that could affect costs.
- Up to 23 percent of funds may be spent from trust fund before site-specific decommissioning cost estimate.
 - 3 percent for decommissioning planning.
 - 20 percent after the PSDAR 90 day comment period.
- Remaining 77% for major decommissioning activities after submittal of site specific decommissioning cost estimate.

Initial Activities – PSDAR Review and Public Comment

- Until receipt of the PSDAR and certification of defueling, only minor activities in support of decommissioning like draining liquids from systems and removing filter media may occur.
- After receipt of PSDAR, there is a 90 day period for NRC and state review and public comment.
- A public meeting chaired by a public official is held near the facility.
- Major activities may commence after 90 days unless NRC requires supplements to the PSDAR. NRC does not approve PSDAR.

Regulatory Requirements That May Be Eliminated

- After certification of permanent cessation of operations and permanent removal of fuel, these requirements may be eliminated without notifying the NRC:
 - Combustible Gas Control,
 - Emergency core cooling system acceptance criteria,
 - Environmental qualification of electrical equipment,
 - Containment leakage testing,
 - Fracture prevention measures,
 - Fracture toughness requirements, and
 - Anticipated transient without scram requirements.

Major Activities of Decommissioning Include:

- Permanent removal of major radioactive components like the reactor vessel and internals, large bore reactor coolant piping and other large components radioactive to an equivalent degree;
- Permanent modification to the containment; and
- Dismantling of components containing “Greater Than Class C Waste” for disposal.

Greater Than Class C Waste

- This is the most hazardous low level radioactive waste*.
- Classes A, B and C are handled fairly routinely now.
 - Public Safety and Health Departments are notified of shipments.
 - Greater than Class C waste shipments likely would require special state surveillance.
- Availability and maintenance of Greater than Class C radioactive waste disposal accommodations is important.
 - Texas Low Level Radioactive Waste Disposal Compact available currently.
 - Capacity for Greater than Class C Waste should be verified and maintained.

*Note: Spent fuel is high level radioactive waste.

License Termination

- Application for termination requires a License Termination Plan (LTP) that must be submitted no more than two years before the expected termination date.
- Key elements of the LTP:
 - A site characterization,
 - Remaining dismantlement activities,
 - Plans for site remediation,
 - Plans for the final site survey,
 - Description of the end-use of the site, including for the ISFSI,
 - Updated cost estimates, and
 - Supplements to the environmental report
- After fulfillment of the LTP, the reactor's 10 CFR 50 license is terminated and the site is released for unrestricted use.
- The NRC maintains oversight of the ISFSI under its 10 CFR 72 license.

Final Site Survey and Dose Limits

- A final site survey must demonstrate that the radiological conditions of the site will not result in a total effective dose to an average member of the public greater than 25 millirem each year.
 - This is the NRC limit. It is for all media including drinking groundwater.
 - Health Department regulations are specific to five media:
 - 5 millirem per year from gaseous effluents,
 - 5 millirem per year from liquid effluents,
 - 5 millirem per year from radioiodine,
 - 5 millirem per year from particulates, and
 - 5 millirem per year from direct gamma radiation.
 - Gaseous effluents and radioiodine are unexpected after DECON.
- 100 and 500 millirem per year limits are available if the site is not released for unrestricted use.

Conditions Until License Termination

- Changes to the operational technical specifications must be submitted to the NRC for decision on a case-by-case basis.
- Annual radioactive effluent and environmental monitoring reports must be submitted to the NRC until the license is terminated. Health currently gets copies.
- Remaining structures, systems and components must be maintained according to operational regulations until free for unrestricted use and the license is terminated.
- The PSDAR may be revised, e.g., for cost increases > 20% of the previous estimates and for unexpected environmental impacts, with notice to NRC and states.

Conditions Until License Termination

- Final Safety Analysis Report must be updated at least every 24 months for:
 - Decommissioning activities and conditions, and
 - Removal of design basis accidents that are no longer possible.
- Fire protection program assessed regularly.
 - Designed not for safe shutdown, but to address fires that could cause release or spread of radioactive materials.
 - May be changed without NRC review.
 - The Health Department is assessing risks from spent fuel pool fires for emergency planning.

New England Case Studies:

Millstone 1

- Connecticut BWR facility ceased operations in 1988.
- With Units 2 and 3, still running, licensee elected for SAFSTOR.
 - Licensee defueled the reactor and the fuel remains in the spent fuel pool.
 - Systems were drained and capped.
 - Site “went dark” with periodic maintenance from other unit staff.
 - Millstone 1 emergency planning Included in that for units 2 and 3.
 - No change to plant environmental surveillance as site footprint remains as when operating.
- Remains limited to NRC 25 millirem per year dose to public from radiological effluents.

Connecticut Yankee

- Ceased operations in December 1996.
- Prompt DECON, leaving only an ISFSI on its 600 acre site.
- Despite the opportunity to site a gas cogeneration plant, owner elected to keep all of its property for the ISFSI license to prevent future challenges of emergency planning for ISFSI.
- The State of Connecticut accepted the NRC limits of 25 millirem per year established in decommissioning regulations of 1996.
- Environmental surveillance remains, though at reduced levels as compared to reactor operations period.
- Emergency planning is ISFSI-based only.
- NRC estimates costs at \$344.4 million radiological decommissioning and \$82.3 million for spent fuel storage (1997\$).

Maine Yankee

- Shutdown December 1996.
- Permanently ceased operations in August 1997.
- Completed DECON in eight years to terminate license in December 2005. Ten years the norm.
- Has so far sold about 600 of its 900 acre site for other uses. Remaining acreage for ISFSI.
- Maine enacted a law requiring 10 millirem per year dose to public from sites released for unrestricted use. Owner of Maine Yankee agreed to comply.

Maine Yankee

Environmental Surveillance

- Perimeter dosimeters:
 - Shrank from Emergency Planning Zone distances (10 mile radius or more) to major transportation routes near plant after DECON;
 - Now just around ISFSI.
- Ocean media sampling ceased in 2005.
- Groundwater and air sampling ceased in 2010.
- Removal of buildings stimulated release of radioactivity into groundwater during DECON.
 - Tritium up to 1 million picocuries per liter in groundwater (EPA limit in drinking water is 20,000 pCi/L).
 - Low, but detectable, concentrations of cesium-137 and other fission and activation product contaminants.

Maine Yankee DECON

- Site characterization 1998 and 1999 with limited personnel on site.
- DECON started in 2000 with major influx of contractors who:
 - Decontaminated and/or dismantled major components,
 - Shipped wastes for disposal, and
 - Conducted final site survey.
- Significant oversight by State of Maine for environmental and radiological impacts.
- Large quantities of groundwater used.
- NRC estimates radiological decommissioning costs at \$274.9 million and spent fuel storage costs of \$53.4 million (1997\$).

Yankee Rowe

- PWR ceased operations in October 1991.
- Decommissioning plan accepted in February 1995.
- Chose to conduct DECON.
- Last contents for ISFSI transferred in June 2003.
- Site devoted to only a 16 canister ISFSI.
- A partial site release request is under review.
- NRC estimates it cost \$306.4 million (1995\$) for radiological decommissioning.

Vermont Yankee, Kewaunee, Crystal River and San Onofre May Represent a New Era.

- Other power reactors that have been decommissioned in the past that were part of multi-unit sites.
 - Emergency planning, environmental surveillance and other oversight continues on the basis of the remaining operating units.
 - Many of these sites elected SAFSTOR.
- Most sites with single reactors proceeded to DECON.

Regulations

- 10 CFR 20.1402: Radiological Criteria for Unrestricted Use.
- 10 CFR 20.1403: Criteria for License Termination Under Restricted Conditions.
- 10 CFR 20.1404: Alternate Criteria for License Termination.
- 10 CFR 20.1405: Public Notification and Participation.
- 10 CFR 20.1406: Minimization of Contamination.
- 10 CFR 50.75 Reporting and Record Keeping for Decommissioning Planning.
- 10 CFR 50.82: Termination of License.
- 10 CFR 51.53: Post-Construction Environmental Reports.
- 10 CFR 51.95: Post-Construction Environmental Impact Statements.