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Decommissioning Pilgrim



**What is Decommissioning, and What Should be Done to
Protect our Communities?**

Overview

What is likely to happen at Pilgrim?

- Spent Fuel
- Site Restoration
- Decommissioning Timeline
- Economics

What is Decommissioning?

Most People assume decommissioning Pilgrim will include:

- Removing all radioactivity
- Dismantling and removing the reactor
- Demolishing and removing all existing buildings/structures
- Safely storing spent fuel and other wastes until they are eventually moved off-site
- Removing any contaminated soil
- Restoring the site to its original condition

It Won't!

NRC's Definition of Decommissioning

- The NRC's definition of decommissioning is much narrower:
“The safe removal of a facility from service and reduction of residual radioactivity to a level that permits termination of the NRC license.”
- The NRC's definition does not include:
 - The removal or storage of spent fuel
 - Demolition of decontaminated structures
 - Site restoration activities after residual radioactivity has been removed
- NRC Rules restrict use of the Decommissioning Trust Fund to reducing “radiological radioactivity.”

Two important questions:

- 1) How low must the radioactivity be reduced, and how is it verified?
- 2) Who pays for any shortfall?

NRC's Three Decommissioning Options

1. **Decontamination (DECON)**

Structures and components contaminated with radioactivity are either cleaned, or removed and shipped to a licensed radioactive dump site

2. **Safe Storage (SAFSTOR)**

The facility is placed in nuclear limbo for up to 60 years for later decontamination

3. **Entombment (ENTOMB)**

The facility is basically covered over in cement and left forever.

- Entombment has never been used.

**WHAT SHOULD BE DONE TO
PROTECT OUR COMMUNITIES?**

TO PROTECT OUR COMMUNITIES

Spent Fuel - Spent nuclear fuel assemblies should be moved out of the pool and into hardened dry casks as soon as possible.

Finances - The Licensee (i.e. Entergy) pays for decommissioning in full, not the Commonwealth's taxpayers.

Decommissioning Trust Fund – Restrict its use to decommissioning; not taxes and operating expenses.

Timing - Decommissioning should occur ASAP following closure. Do not defer dismantlement & cleanup for decades.

TO PROTECT OUR COMMUNITIES (Continued)

Site Restoration: Site returned to “greenfield” for unrestricted use - radioactivity and chemical contamination cleaned up.

Prohibit rubbleization: Above-grade structures, including the concrete containment building, are demolished into rubble and buried in the structure's foundation below ground. The site surface is then covered, regraded, and landscaped. This saves the expense of moving the building pieces to a different site.

NEPA: Restore the **National Environmental Policy Act (NEPA)** compliance. Decommissioning is a major federal action and requires significant oversight, EPA participation, and public/state formal hearing rights.

Public Meetings: Currently, public participation is limited, with no cross-examination or discovery.

TO PROTECT OUR COMMUNITIES (Continued)

Public Safety:

- Retain current offsite emergency planning, funded by licensee, until spent fuel pool is emptied (at least 5 years)
- Continue licensee-funded offsite emergency planning, on a reduced level, until fuel leaves the site
- MDPH continue and expand offsite radiological monitoring and onsite tritium monitoring. Entergy continue to provide funding.
- Workers:
- Retain Skilled workforce for decommissioning.
- Provide job training.

TO PROTECT OUR COMMUNITIES (Continued)

NRC Oversight: Reinstate NRC inspections and oversight during decommissioning

- Currently the NRC has little to no meaningful oversight during decommissioning. There are **no resident inspectors** and **no regular inspections**.
- Lack of NRC oversight means licensee compliance with regulations is impossible to verify and enforce on a timely basis. Lack of regular reporting leaves the public in the dark.

NO MATTER WHO OWNS PILGRIM . . .

Two issues must be addressed:

1. Spent Fuel
2. Site Restoration

1. Pilgrim's Spent Nuclear Fuel

- **All of the nuclear fuel** used for the past 45 years remains on-site.
- **Most of the spent (i.e., used) fuel** is now stored in a spent fuel pool located in the upper floor of the reactor.
- **Some of the spent fuel** has been moved to dry casks on a concrete pad outside of, but near to, the reactor building.
- **Some fuel** will remain in the reactor until shut-down.
- **Eventually**, all of the spent fuel will be moved into dry casks.
- **But the dry casks of spent fuel will remain on site for decades, perhaps indefinitely.**

What's the Problem with Pilgrim's Spent Fuel Pool?

- ▶ **Location:** Pilgrim's pool is located in the upper floor of the reactor. It is outside primary containment with a thin and vulnerable roof overhead.
- ▶ **Crowded:** Pilgrim's pool was designed to hold 880 used fuel assemblies; it now holds 2,990 (September 2017). When Pilgrim shuts-down, 580 additional fuel assemblies, now in the reactor, will be moved into the pool. Pool is licensed for a maximum capacity of 3,859 assemblies.
- ▶ **Boraflex panels** were added between Pilgrim's pool assemblies to protect against overheating. – Entergy says about 900 are degrading (April 2017)
- ▶ **Risk of Fire:** If pool loses water simply to the top of the assemblies, a pool fire can occur, releasing radiation.

CONSEQUENCES OF A SPENT FUEL POOL FIRE

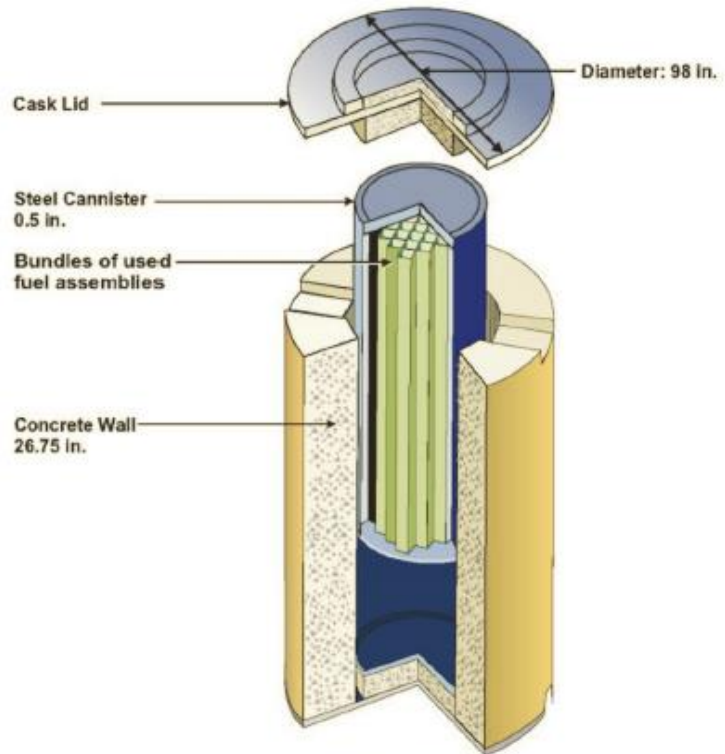
- 2016 Study: Major Spent Fuel Pool fire could contaminate over 38,000 square miles of land - almost four times the area of Massachusetts - and force millions to evacuate.
- 2006 Pilgrim Study: \$488 Billion dollars, 24,000 cancers, land uninhabitable for hundreds of miles downwind
- These risks will be reduced by transferring all the spent fuel from the pool to dry casks as soon as possible after shutdown.

Economics Will Drive Entergy's Decision When to Empty the Pool

- **Before shutdown**, Entergy has to pay for moving fuel from the pool into casks storage **out of its pocket**.
- **Post-shutdown**, NRC allows use of the ***Decommissioning Trust Fund*** to pay to move fuel from the spent fuel pool into dry casks.
- Once power generation has ceased and all of the spent fuel is put in dry casks, Entergy can dramatically reduce its work force (to as low as 15) and its spent fuel storage costs.
- The fuel that is now in Pilgrim's reactor and spent fuel pool probably will be moved into dry casks within 5 or so years after Pilgrim shuts down.

DRY CASK STORAGE

Dual Purpose Storage Cask*



(Holtec International
HI-STORM 100)

Overall Length: 197 to 225 in.
Loaded Weight: 360,000 lbs.
Typical Payload: 24 PWR Bundles

* Storage and Transportation



Dry Casks

DRY CASK STORAGE SAFETY ISSUES

Dry cask storage is far safer than pool storage, but there are problems... potential leakage

According to the Nuclear Regulatory Commission (NRC):

- The thin (0.5") stainless steel canisters may crack within 30 years.
- Currently, no technology exists to inspect, repair or replace cracked canisters.
- With limited monitoring, we will only know after a canister leaks radiation.

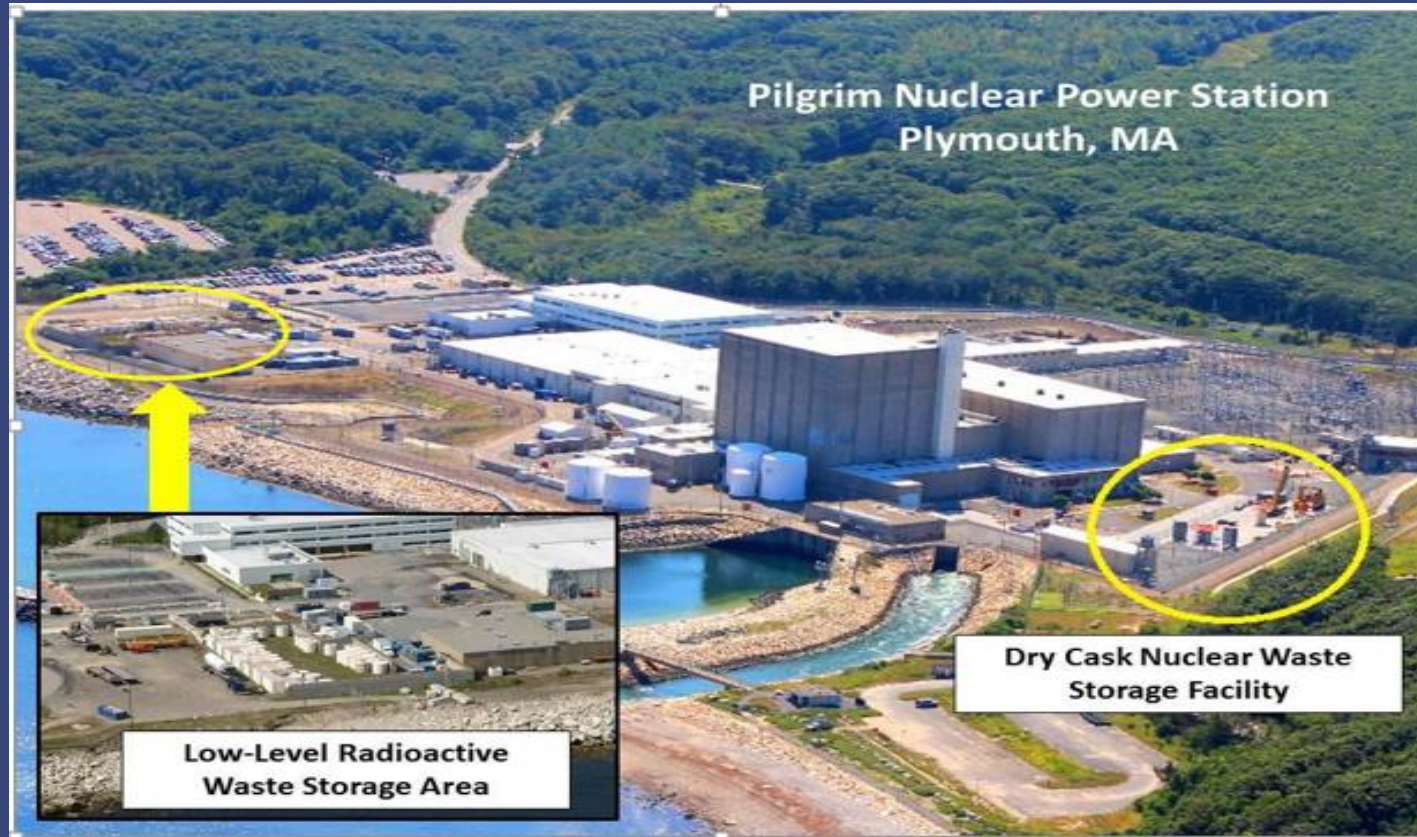
Each dry cask contains 1/2 as much Cesium-137 as the total released at Chernobyl

Pilgrim's Dry Cask & LLRW Storage Plan

Vulnerable to: **Sea-Level Rise, Coastal Storm Damage, Flooding, Surge, Salt Water Degradation**

Dry cask pad 150' from shore, 4' above FEMA Flood Level

Low Level Radioactive Waste Casks 30' from coastal bank

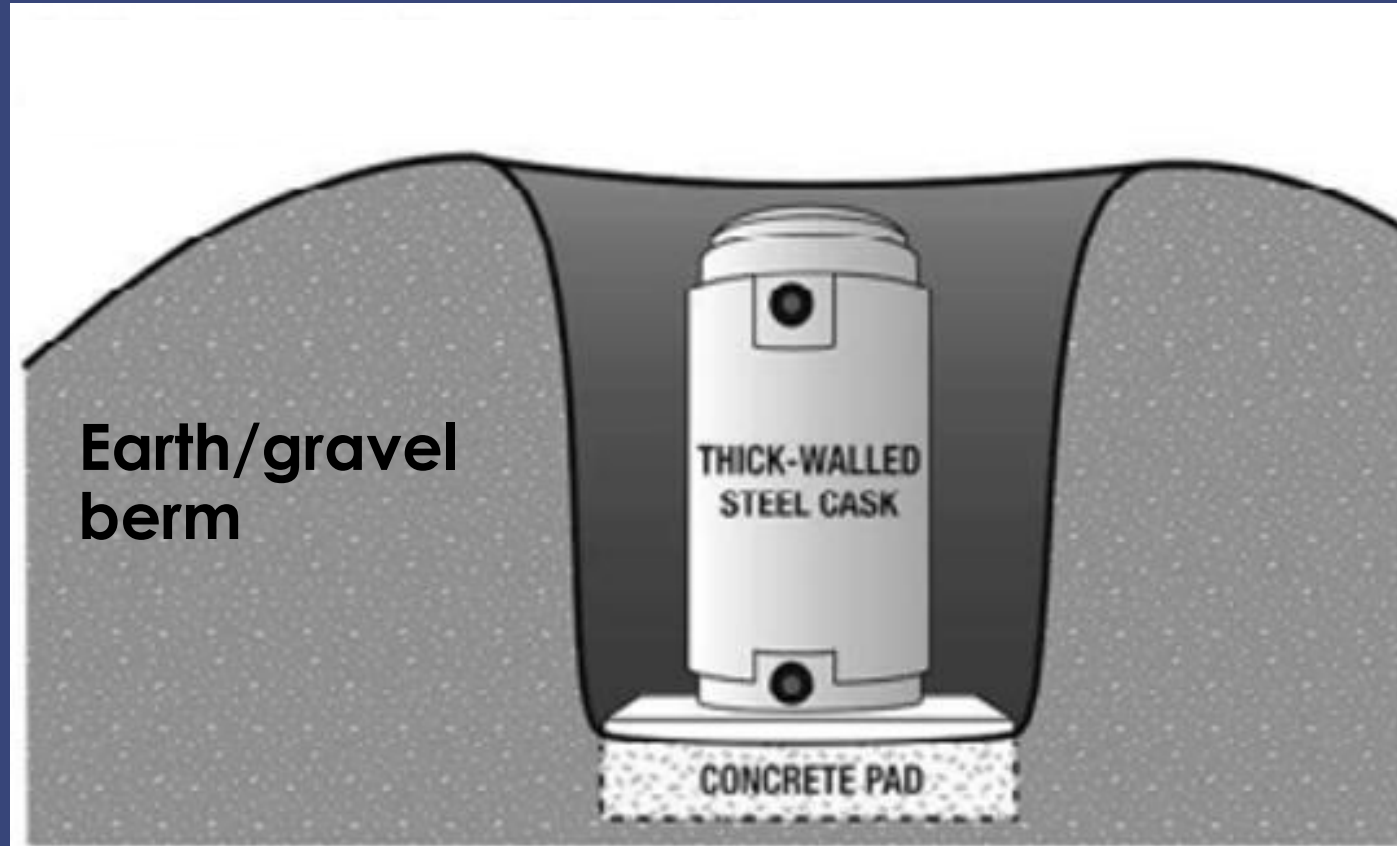


Security - Pilgrim's Plan “Candlepin Bowling for Terrorists”



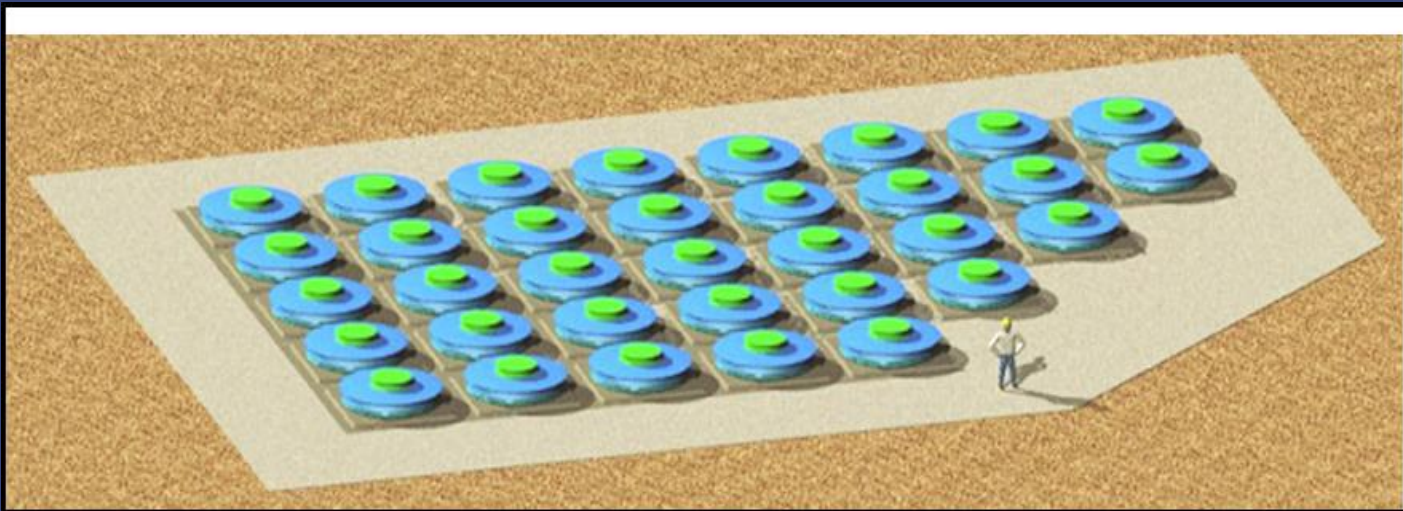
Improved Dry Cask Storage Security

Earth/gravel berms should surround each cask and hide it from ground level view.



Three Alternate Security Solutions

- Casks in Reinforced Concrete Building
- Submerged Casks, Holtec-Hi-Storm U (more secure, but unable to inspect)
- Blast Shield



Spent Fuel After Shutdown

- **Pilgrim's spent fuel will likely remain on-site for many years.**
- **Offsite Storage Options are not available. They are neither approved nor developed.**
 - **Permanent Repository- Yucca Mountain**
 - **Proposed Interim Sites- West Texas & New Mexico**

Until there are Viable Offsite Solutions:

NRC's Nuclear Waste Rule Allows:

- Spent fuel to stay in either the pool or in dry casks for 60 years
- During subsequent 300 years, spent fuel assemblies may be kept in dry casks onsite – changing pad and casks every 100 years. *Who will pay?*

2. Site Restoration (part 1) (No Matter Who Owns Pilgrim)

Key Issues:

- How clean is clean – Who decides?
- Are all structures removed?
- How long will it take?

Site Restoration (part 2)

How Clean is Clean?



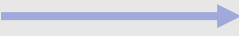
NRC's Radiation Cleanup Standard

- Release site to unrestricted use: **25 millirem** per year total effective dose equivalent to an average member of the critical group - limit includes the dose from drinking groundwater
- Release site to restricted use: **100 or 500 millirem** for restricted use.
- Massachusetts may, but has not set a more conservative standard that applies to decommissioning reactor sites

Unanswered Questions

- How is dose determined? How far down into the soil do they test?
- Is Entergy required to return Pilgrim's site to "greenfield" for unrestricted use?

Cleanup Standards and Health Effects

Lifetime Exposure (millirem/year)	Lifetime Risk of <u>Fatal</u> Cancer
0.03 	About 1.5 in 1,000,000
1 	About 5.7 in 100,000
5 	About 2.9 in 10,000 (about 1 in 3,450)
Current MA limit for <u>Unrestricted Use</u> for its licensees. Does not Apply to Pilgrim, an NRC licensee	About 5.7 in 10,000 (about 1 in 1,750)
NRC Limit for <u>Unrestricted Use</u>	About 14 in 10,000 (about 1 in 715)
NRC & MA Limits for <u>Restricted Use</u>	About 5.7 in 1,000 (about 1 in 175)
NRC & MA Limits for <u>Restricted Use</u>	About 29 in 1,000 (about 1 in 35)
Total Cancer Incidence resulting from whole body exposure is 1.5 times the mortality risk.	Reproductive disorders occur at lower levels of radiation exposure than cancer.
Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation; Nuclear and Radiation Studies Board, Division on Earth and Life Studies, National Research Council of the National Academies. <i>Health Risks From Exposure to Low Levels of Ionizing</i>	<i>Radiation: BEIR VII Phase 2.</i> Washington, DC: The National Academies Press; 2006

Site Restoration (Continued)

Not all structures onsite are removed

What is removed?

- Major radioactive components, such as the reactor vessel, steam generators, or other components that are comparably radioactive are removed
- Structures removed to 3 feet below grade (reactor building foundation is 25.5' below mean sea level)

Site Restoration (Continued)

Rubblization:

- Removal all equipment from buildings
- Surfaces decontaminated to required level
- Above-grade structures demolished into rubble - buried in the structure's foundation left below ground
- Could result in material ranging from gravel-size to large concrete blocks, or a mixture of both.
- Site surface then covered, regraded and, landscaped for unrestricted use.

Problems with Rubblization

- Contaminated rubble likely to leach into soil impacting groundwater both onsite and offsite.
- Water intrusion into the rubble is likely at Pilgrim due to flooding and proximity to the water table.
- Potential excavation of contaminated building rubble and soil for use in future construction, resulting in radiation exposure.
- Provides a less stable surface than soil/sand due to inevitable space between rubble.
- Constitutes, in reality, a low level radioactive waste facility at Pilgrim, without NRC requirements to provide protections equivalent to off-site disposal facilities for low-level radioactive waste; runs counter to existing national policy of encouraging states to manage disposal on a regional basis.

Problems with Rubblization (Continued)

- Temptation to mix clean and contaminated concrete to bring the radioactive intensity down to clearance levels - while not reducing the overall radiation content of the disposed concrete.
- Difficulty in verifying amount of radioactivity present, as major radioactive dose contributors may be completely shielded from field instrument detection by a thin layer of concrete.

The Economics of Decommissioning

- Entergy's Pilgrim Decommissioning Trust Fund (DTF) now is short at least **\$348 million** (if work started today), and probably contains **billions less than will be needed when work starts.**
- **Decommissioning could stretch out over 60 years!**
- **NRC hopes DTF investments will grow more than increased decommissioning costs, but...**
 - NRC estimates DTF will grow **3.5% to 5%** annually
 - NRC estimates decommissioning costs will increase **5% to 9%** annually

The Economics of Decommissioning (cont)

Other reasons for a Decommissioning Trust Fund shortfall:

- DTF only covers removing radioactivity - a fraction of the job.
- As is happening in Vermont, Entergy will raid DTF in order to cover their other costs:

Spent Fuel Management, Property Taxes, Emergency Planning,
Insurance, Legal & Lobbying Fees

The Economics of Decommissioning (cont)

What is 'SAFSTOR'?

- Allows Entergy to delay completion of decommissioning for 60 years.
- Delays economically productive use of site.
- Property values nearby remain depressed.
- Contamination onsite is not identified and cleaned up, providing opportunity for contamination to spread – both on and offsite.
- Offsite emergency planning will be eliminated after operations cease, placing unfunded burden on state and local communities.
- Contributions to the state for environmental monitoring also likely will be eliminated, placing unfunded burden on Mass. Taxpayers.
- Workers with specific knowledge of spills and other specific problems will have retired or been let go, likely reducing effectiveness of cleanup.

Possible Consequence of SAFSTOR

Entergy told Vermont Legislators it has no responsibilities past the 60 year Safstor period for Vermont Yankee, even if the job remains unfinished.

Alternative Decommissioning Scenario

Entergy might sell the decommissioning job to Northstar, as it wants to do in Vermont. What would that mean?

Who is Northstar?

- World's largest turnkey decommissioning and facility services contractor
- Abatement and demolition contractor
- Extensive nuclear experience
- Partners with other engineering, environmental, spent nuclear fuel support, waste management transportation & disposal firms. (Areva, WCS, Burns McDonnell)

If Northstar Takes Over Pilgrim Decommissioning

- With Approval of NRC and Massachusetts, Entergy would place all spent fuel into dry casks, presumably within 5 years of Pilgrim's shutdown.
- NorthStar would:
 - Initiate onsite work
 - Decommission and restore nearly the entire Pilgrim site within about 10 years
 - Provide financial commitments to assure completion of decommissioning
 - Obtain NRC approval for partial release of the site (except the Independent Spent Fuel Storage Installation and switchyard areas) to allow productive use of the area

This sounds good, BUT several questions are raised . . .

NorthStar's Financial Commitments

- If the funds that Northstar commits are inadequate to complete cleanup, how does NorthStar intend to deal with financial short falls?
- Will NorthStar pay to guard the spent fuel-about \$ 5 million a year- if DOE does not reimburse NorthStar for those costs? Who will pay to replace casks? Is NorthStar, DOE or Holtec responsible? Is Holtec a limited liability company? What guarantee did Holtec provide when it provided the casks?
- If the Pilgrim DTF appears to be adequate, why should we believe NorthStar can do the job?
- Are NorthStar and its partners limited liability corporations?

Northstar Ownership Worries: Quick, Cheap, and Dirty?

- Will the sale to NorthStar and its decommissioning plan create incentives to cut corners?
- Some citizen groups fear the cleanup will be cheap and dirty.
- Will there be enough money?
- What guarantees and liabilities does Holtec, the cask manufacturer, have?

Nuclear Decommissioning Citizens Advisory Panel (NDCAP)

- Established by Legislature -section 14, Chapter 188, Acts of 2016
- Members include:(6) state officials; (8) members appointed by state officials; (2) Entergy officials; (1) representative from the Utility Workers Union America Local 369 who either works or worked at Pilgrim; (1) representative from the Old Colony Planning Council; and (3) appointees from the Town of Plymouth.
- The Panel is advisory.
- Its duties include: hold at minimum 4 public meetings a year (increased to 10 by the Panel); issue an annual report; serve as a conduit for public information; encourage community involvement; receive reports on decommissioning and the decommissioning trust fund.
- At this time, it is unfunded.

Thank you for your interest!

Questions & Discussion

Pilgrim Watch: www.pilgrimwatch.org

Pilgrim Legislative Advisory Coalition: www.plac-ma.org
