

# PUBLIC SUBMISSION

<b>As of:</b> 8/22/22, 4:16 PM <b>Received:</b> August 22, 2022 <b>Status:</b> Pending_Post <b>Tracking No.</b> 174-xjm9-fv0u <b>Comments Due:</b> August 30, 2022 <b>Submission Type:</b> Web
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**Docket:** NRC-2015-0070

Regulatory Improvements for Production and Utilization Facilities Transitioning to Decommissioning

**Comment On:** NRC-2015-0070-0229

Regulatory Improvements for Production and Utilization Facilities Transitioning to Decommissioning

**Document:** NRC-2015-0070-DRAFT-0299

Comment on FR Doc # 2022-03131

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## Submitter Information

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## General Comment

See attached file(s)

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## Attachments

PW Comment Decommissioning Rule Congress 08.22.22

## **BACKGROUND**

Testimony is provided by Mary Lampert-director Pilgrim Watch a public interest group focused on safety concerns regarding Pilgrim Station; co-chair Town of Duxbury's Nuclear Advisory Committee; member of the Commonwealth's Nuclear Decommissioning Advisory Panel, appointed by the Massachusetts Senate President. James Lampert, graduate MIT, Harvard Law School, 50 years legal practice, member Pilgrim Watch and Town of Duxbury Nuclear Advisory Committee.

The Proposed Rulemaking on Regulatory Improvements for Production and Utilization Facilities Transitioning to Decommissioning put forth several regulatory changes. The regulatory changes were put into context by Commissioner Baran's Comments on SECY-18-0055.<sup>1</sup> He explained that the draft so-called "improvements" continue to allow the licensee to make the key decisions with minimal role for NRC and almost no role for stakeholders. This needs to be changed. NRC, States, and stakeholders need a process to have a meaningful say.

The rule, as written, should never have been let out of NRC and put out for comment. Its real purpose is to save industry money. NRC admits it.

Most of the cost savings are attributable to the relief of exemptions and amendments that licensees would typically submit to the NRC for review and approval during decommissioning."

The proposed changes result in significant savings to licensees and the NRC, not the public. Under current regulations, licensees are required to seek exemptions from significant regulatory requirements. The rule, as proposed, would make it unnecessary for a licensee to seek, or the

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<sup>1</sup> NRC Electronic Library, Accession Number ML 21230A313

NRC to review, these exemptions. The exemptions would become regulation. The industry will save large amounts of money by, for example, eliminating offsite emergency planning costs, shifting those costs and responsibility to FEMA, the State, and local responders; reduction of liability insurance; and shifting spent fuel management costs away from licensees to the rate-payer decommissioning funds and providing that DOE monies recovered for spent fuel management costs go to the licensee not, as they should, to reimburse the decommissioning trust fund.

The “savings” to State and local governments and the public have nothing to do with public health and safety. The claim is hollow. The NRC, with or without a straight face, found that there would be “beneficial” savings because state and local governments and the public would no longer have to spend time and money in fruitless efforts to convince the NRC that exemptions or amendments to an operating license such as Pilgrim’s should not be granted. They always are granted. Under the proposed new regulations, licensees would no longer have to submit proposed exemptions and amendments to the NRC for review, there would be no NRC review, and the public would have no opportunity to tell the NRC the other side of the story.

The staff incorrectly believed in finalizing the rule and said that they had not identified any safety or security concerns in the current regulatory framework for decommissioning power reactors. But as Commissioner Baran noted in his comments on SECY-18-0055, “radiological risks remain at shutdown nuclear power plants that must be taken seriously.” Risks from spent fuel pool fires and dry casks remain, both could result in catastrophic consequences.

#### **NRC INCORRECT ASSUMPTIONS USED TO SUPPORT PROPOSED CHANGES**

NRC’s basic justification for the proposed rule is that shutdown nuclear reactors pose less radiological risk of offsite radiological release than operating reactors and the possibility of accidents are significantly fewer. However, they ignore that radiological risks remain at shutdown nuclear power plants until the spent fuel leaves the site.

- NRC Staff assumed after the reactor has been permanently shut down, and the fuel has been moved from the reactor core to the spent fuel pool, the only accident that might lead to a significant radiological release is a zirconium fire from a spent fuel pool (SFP) accident that drained the water in the pool. (NRC 2)
- NRC Staff assumed that the probability of a zirconium fire scenario decreases as a function of the time that the fuel has been out of the reactor core; and after a cooling period of 10 months for BWRs (example, Pilgrim) or 16 months for PWRs (example Seabrook), there is only “a low-likelihood possibility that a rapid drain down of the spent fuel pool (SFP) could cause a subsequent zirconium fire and release in less than 10 hours.”
- The NRC does not consider a partial draindown of water in the pool and its impact on a subsequent zirconium fire.
- NRC assumed that in the unlikely event of a fire, it would be of small consequence. Staff says that there are “no applicable design-base events at a decommissioning licensee’s facility that could result in an offsite radiological release exceeding the limits established by the U.S. Environmental Protection Agency’s (EPA’s) early phase protective action guides (PAGs) of 1 rem at the exclusion area boundary.” (NRC 30)
- The 10-hour ignition delay time allows time for mitigation to put out the fire and time for the offsite population to evacuate. There is no need for an offsite radiological emergency plan after reactor fuel has been moved into the spent fuel pool. (NRC 29, 34-35, 36).
- NRC Staff and Commissioner Baran in his Comments on SECY-18-0056 assumed that dry cask storage presents no risk. This is based, in part, on NRC’s assumption that “the spent fuel is stored in an onsite ISFSI for 16 years before the spent fuel is transmitted to either an offsite ISFSI or a permanent geologic repository. (NRC 5) But no interim or permanent storage sites exist.
- The regulation ignores risks from decommissioning activities such as decontamination, cutting and handling of large equipment and dismantling safety systems that have potential for creating new hazards

- The NRC failed to update its allowable doses to the public and workers on the latest scientific evidence of the biological effects of radiation, BEIR VII, that found impact more severe than previously recognized.

## **NRC'S ASSUMPTIONS - INCORRECT**

### **Spent Fuel Pool Risks**

**Risk during Fuel Transfer:** The NRC analysis ignores the potential of a spent fuel fire during the initial decommissioning activity in which fuel assemblies in the reactor are moved from the reactor to the spent fuel pool. Accidents during this transfer of fuel assemblies, such as dropping an assembly, can happen, and such accidents have come very close to happening in the past.<sup>2</sup>

**Causes of Spent Fuel Pool Cooling Water Loss & Fire.** The NRC's update does not recognize that there are many potential causes of "a significant draw-down of the spent fuel pool." Water could be lost from a spent-fuel pool through leakage, boiling, siphoning, pumping, displacement by objects falling into the pool, or overturning of the pool.

These modes of water loss could arise from events, alone or in combination, that include the following: Earthquake - beyond licenses design; Cask drop during transfer; Accidental fires or explosions; A severe accident at an adjacent reactor that, through the spread of radioactive material and other influences, precludes the ongoing provision of cooling and/or water makeup to the pool;<sup>3</sup> Acts of malice by persons within or outside the plant boundary. An aircraft impacting a spent fuel pool.

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<sup>2</sup>Environmental Impacts of Storing Spent Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Nuclear Waste Confidence Decision and Environmental Impact Determination, Gordon Thompson, February 6, 2009; Comments on the US Nuclear Regulatory Commission's Draft Consequence Study of a Beyond Design Basis Earthquake Affecting Spent Fuel Pool for a US Mark 1 Boiling Water Reactor, Gordon Thompson, August 1, 2013

<sup>3</sup>Environmental Impacts of Storing Spent Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Nuclear Waste Confidence Decision and Environmental Impact Determination, Gordon Thompson, February 6, 2009; Comments on the US Nuclear Regulatory Commission's Draft Consequence Study of a Beyond Design Basis Earthquake Affecting Spent Fuel Pool for a US Mark 1 Boiling Water Reactor, Gordon Thompson, August 1, 2013

Aircraft impacts are denied by NRC but cannot be dismissed. The NRC June 4, 2009, final rule *Consideration of Aircraft Impacts for New Nuclear Power Reactors*<sup>4</sup> required all new reactor designs to have considered aircraft impacts and taken measures to minimize their vulnerabilities. If existing plants were invulnerable, the NRC would not have revised its regulations to narrow the safety gap; and no-fly zones around nuclear facilities would not have been imposed following 9/11. Who needs to protect things that are invulnerable?

The Sandia air crash study is real data, but real incomplete data. The Sandia destroy an airplane test did not consider the consequences from fires. The World Trade Center towers were not toppled by the force of the impacting aircraft. Instead, the ensuing fires ultimately weakened the structures and caused both towers to collapse.

Another lab study commented on the aircraft part penetrating the containment dome demonstrating that the aircraft need not penetrate the wall to cause harm. The impact could shake the structure enough to impart more motion than experienced during design basis earthquakes. That motion could cause walls to act like knives and slice through pipes carrying makeup cooling water to the core. And the shaking could cause electrical relays to change position -- turning off pumps needed for core cooling and/or opening valves that allow makeup cooling water to be diverted for useless purposes.

**Fire:** At many nuclear plants, fire represents half of the calculated risk of core damage -- meaning it alone matches the risks from all other postulated causes combined. Fire studies assume that a fire occurs in only one fire area with the plant -- one area among dozens of areas. If the surviving equipment combined with fire brigade response is successful, meltdown is avoided. But the risk is such that success is far from guaranteed.

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<sup>4</sup> See for Aircraft impacts: NRC 10 CFR Pt 50 and 52, RIN 3150-A119/NRC 2007-0009; Accident Analysis, J.R Engel, *Probabilistic Assessment of Aircraft Risk for Nuclear Power Plants* Nuclear Safety, Vol.15, No 3, 1974; *Evaluation of Aircraft-Crash-Hazards Analysis for Nuclear Power Plants*, Kot, et al., NURG/CR-2859, ANL-CT-81-32; Union Concerned Scientists Brief Paper, *Aerial Threat to Nuclear Power Plants*, April 8, 2003; UCS Briefing Paper, *NRC's Revised Security Regulation*, February 1, 2007

**Partial draindown:** NRC considers a spent fuel pool “draindown.” But NRC Staff fails to analyze the different consequences of both a full draindown and a partial draindown. This is an important omission because total drainage of the pool is not the most severe case of water loss. In a partial draindown the presence of residual water would block air convection, e.g., by blocking air flow beneath the racks.<sup>5</sup> Previously, in filings made during a 2002 license-amendment proceeding, NRC staff assumed that a fire would be inevitable if the water fell to the top of the racks.

**Consequences Pool Fire:** Studies of the consequences of a spent fuel pool fire show huge potential consequences.

- 2016 Princeton Study: A major Spent Fuel Pool fire could contaminate as much as 100,000 square kilometers of land (38,610 square miles) and force the evacuation of millions.<sup>6</sup>
- 2013 NRC Study: A severe spent fuel pool accident would render an area larger than Massachusetts uninhabitable for decades and displace more than 4 million people.<sup>7</sup>
- 2006 Massachusetts Attorney General Study: \$488 Billion dollars, 24,000 cancers, hundreds of miles uninhabitable<sup>8</sup>

**Ignition Time.** NRC Staff claims that that it would take, a minimum of 10 hours for the fuel in a boiling water reactor aged 10 months or in a PWR for 16 months to heat to zirconium ignition

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<sup>5</sup> *Environmental Impacts of Storing Spent Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Nuclear Waste Confidence Decision and Environmental Impact Determination*, Gordon Thompson, Feb 6, 2009; <http://www.environmental-defense-institute.org/publications/Cover.Ltr.Thompson.NRC.SNF.Short.pdf>

<sup>6</sup> Frank N. von Hippel, Michael Schoepner, “Reducing the Danger from Fires in Spent Fuel Pools,” *Science & Global Security* 24, no.3 (2016): 141-173 <http://scienceandglobalsecurity.org/archive/sgs24vonhippel.pdf>; Richard Stone, “Spent fuel fire on U.S. soil could dwarf impact of Fukushima,” *Science*, May 24, 2016. (NRC variable at: <http://www.sciencemag.org/news/2016/05/spent-fuel-fire-us-soil-could-dwarf-impact-fukushima>)

<sup>7</sup> Consequence Study of a Beyond Design-Basis Earthquake Affecting the Spent Fuel Pool for A U.S. Mark I Boiling Water Reactor (October 2013) at 232 (Table 62) and 162 (table 33), Adams Accession NO ML13256A342)

<sup>8</sup> The Massachusetts Attorney General’s Request for a Hearing and Petition for Leave to Intervene With respect to Entergy Nuclear Operations Inc.’s Application for Renewal of the Pilgrim Nuclear Power Plants Operating License and Petition for Backfit Order Requiring New Design features to Protect Against Spent Fuel Pool Accidents, Docket No. 50-293, May 26, 2006 includes a Report to The Massachusetts Attorney General On The Potential Consequences Of A Spent Fuel Pool Fire At The Pilgrim Or Vermont Yankee Nuclear Plant, Jan Beyea, PhD., May 25, 2006 (NRC RC Electronic Hearing Docket, Pilgrim 50-293-LR, 2—6 pleadings, MAAGO 05/26 (ML061640065) & Beyea (ML061640329))

temperature; and that the 10- hour period “allows for the licensee to take onsite mitigation measures or, if necessary, for offsite authorities to take appropriate response actions using an all-hazards approach emergency management plan.” (NRC, 29)

NRC staff assumes that the minimum delay time for SNF ignition can be calculated by further assuming that an SNF assembly is perfectly insulated thermally. The NRC analysis provides no basis for assuming these assumptions are correct.

A 10-hour minimum delay time for BWR SNF aged 10 months is potentially plausible. But that is not the whole story. In a multi-unit site, if a SNF pool is adjacent to an operating reactor that experiences an incident, the pool could become inaccessible for much longer than 10 hours, as we saw at Fukushima. For both single unit sites, like Pilgrim, and multi-unit sites, if the reactor is shut down the pool could be inaccessible for a period exceeding 10 hours. For example, an attack scenario could cause partial drain-down and a local radiation field precluding access; and a fuel handling accident during transfer from pool to dry casks - such as a cask drop.

**Mitigation.** Contrary to NRC, 10 hours is not a guaranteed enough time to put out a spent fuel fire. An attack scenario could rapidly cause partial drain-down and result in a local radiation field that precludes access to the fire. There is no basis for assuming that a site’s Flex program to provide supplemental water will be sufficient. For example, Pilgrim Watch and the Union of Concerned Scientists showed that Pilgrim’s Flex plan to provide supplemental water had little to no probability of working, especially in severe storm conditions.<sup>9</sup>

**Evacuation.** Ten hours is not enough time for offsite authorities to take appropriate response actions using an all-hazards approach emergency management plan. NRC’s emergency preparedness recommendation, option EP-2, essentially eliminates offsite emergency preparedness at Level 2 (pool storage) and Level 3 (ISFI storage). In addition, the notification requirement to State and Local Governmental is changed from 15 minutes to 60 minutes; and

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<sup>9</sup> Presentation to NRC: Status of Fukushima Lessons, Union of Concerned Scientists, David Lochbaum, July 31, 2014, <https://www.nrc.gov/reading-rm/doc-collections/commission/slides/2014/20140731/lochbaum-20140731.pdf> ; Pilgrim Watch Comment (11.16.2014) Waterways Application, No. W14-414, Cape Cod Bay, Plymouth, Plymouth County, Ch 91 Application of Entergy Nuclear Operations, Inc. Pilgrim Nuclear Power Station; Pilgrim Watch Comment NRC, January 30, 2014

public alert and notification systems and Evacuation Time Estimates (even with a significant population change) are not required. As early as Level 2, challenging drills and exercises involving hostile action said not to be warranted, and ORO participation in radiological drills and exercises would no longer be required. Pilgrim Watch has previously shown that even with offsite emergency plans in place during operations, a timely (less than 10 hour) evacuation is not possible<sup>10</sup>; therefore, absent offsite preparedness there is no way that 10-hours would allow offsite authorities to evacuate the population.

### **Dry Cask Storage Risks**

**Causes of a Dry Cask Canister Rupture.** NRC staff and commissioners ignore the potential of a dry cask canister rupture. Casks, although safer than spent fuel pool storage, are vulnerable to attack<sup>11</sup> and may corrode – especially in marine environments and over the anticipated long period of onsite storage.

Holtec’s stainless steel canisters holding the spent fuel assemblies are thin walled, only (0.5) inches thick<sup>12</sup>, are subject to corrosion and may crack within 30 years, or less. No available current technology exists to inspect, repair, or replace cracked canisters. There are no hot cells that are needed to transfer spent fuel assemblies into new dry storage. They are not ASME N3 certified. With limited monitoring, we will only know after the fact that a cask has leaked

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<sup>10</sup> Pilgrim Watch’s 2.206 Petition To Modify, Suspend, Or Take Any Other Action To The Operating License Of Pilgrim Station Until The NRC Can Assure Emergency Preparedness Plans Are In Place To Provide Reasonable Assurance Public Health & Safety Are Protected In The Event Of A Radiological Emergency (19.30.2013); Pilgrim Watch’s September 3, 2014 Supplement To Its August 30, 2013 2.206 Petition To Modify, Suspend, Or Take Any Other Action To The Operating License Of Pilgrim Station Until The NRC Can Assure Emergency Preparedness Plans Are In Place To Provide Reasonable Assurance Public Health & Safety Are Protected In The Event Of A Radiological Emergency (09.03.2014) <https://www.nrc.gov/docs/ML1433/ML14338A180.pdf>

<sup>11</sup> Environmental Impacts of Storing Spent Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC’s Nuclear Waste Confidence Decision and Environmental Impact Determination, Gordon Thompson, Feb 6, 2009; Comments on the US Nuclear Regulatory Commission’s Draft Consequence Study of a Beyond Design Basis Earthquake Affecting Spent Fuel Pool for a US Mark 1 Boiling Water Reactor, Gordon Thompson, August 1, 2013

<sup>12</sup> The Sandia National Lab Department of Energy (DOE) December 2019 Technology Gap Analysis Report moved to Priority #1 the problem of the risks of short-term through wall cracks in thin-wall canisters. However, there appears to be no effort by the DOE, NRC, or US nuclear industry to consider thick-wall casks that meet ASME N3 and other safety standards. [\*Gap Analysis to Guide DOE R&D in Supporting Extended Storage and Transportation of Spent Nuclear Fuel: An FY2019 Assessment SAND2019-15479R, December 23, 2019\*](#)

radiation.<sup>13</sup> Casks may remain onsite indefinitely subjected at Pilgrim, Oyster Creek, San Onofre, and others to salt induced stress corrosion cracking. Last, casks are vulnerable to a terrorist attack.

We note that it does not have to be this way. The Swiss & German use both Orano and Castor thick-wall bolted lid casks that meet ASME N3 certification requirements. The Swiss System (at Zwiilag) has an on-site hot cell facility. Both the Swiss and German store and monitor the casks inside a hardened building. In addition to radiation monitoring at each cask, they both have pressure monitoring. A change in pressure might indicate a metal lid seal needs to be replaced. There are two independent bolted lids each with two metal seals. Lots of redundancy. Compared with zero redundancies with the thin-wall canisters.

**ISFSI's-Vulnerable/ Tempting Terrorist Targets:** Many ISFSIs are located in tempting terrorist targets. Pilgrim has symbolic value, located in "America's Hometown." Some sites are near key financial centers, like Indian Point. Many sites have dense population nearby, such as Indian Point, San Onofre, and Pilgrim.

For example, Pilgrim's ISFSI is a football field's distance from a public road. It is in full view. It is vulnerable to weapons, delivered either on or offsite, that are available today and to an air attack. It is not protected, as it should be, by a barrier or reinforced building to protect against a line of sight attack. Further NRC supervised mock attack tests are no longer held each year to provide valuable lessons.

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<sup>13</sup> The NRC's inspection guidance for ISFSI activities can be found in Inspection Manual Chapter 2690, "Inspection Program for Dry Storage of Spent Reactor Fuel at Independent Spent Fuel Storage Installations and for 10 CFR Part 71 Transportation Packaging" (ML092730246 ); Holtec's Inspection Plan for Pilgrim (NRC's Electronic Library, Accession number ML20049A083.) The section about the inspection frequency is on page A-3. HI-STORM 100 CoC (certificate of compliance) renewal application ADAMS package: [ML20049A081](https://sanonofresafety.files.wordpress.com/2011/11/drycaskstorageissues2014-09-23.pdf). Also see <https://sanonofresafety.files.wordpress.com/2011/11/drycaskstorageissues2014-09-23.pdf>



The on-going war in Ukraine shows that reactors and spent fuel storage installations are pre-deployed nuclear weapons waiting to be detonated.

**Shrinking Protected Area:** Once fuel is transferred to the ISFSI, the Protected Area will shrink from being the security fence around key plant buildings to the fence around the ISFSI. When the Protected Area is shrunk to just the ISFSI, most of the workers doing the dismantling activities will not be subject to background checks and drug/alcohol testing. The 9/11 terrorists took advantage of less-robust screening at the airport to carry weapons aboard and then hijack airliners. Tomorrow's terrorists might gain cover employment at a nuclear plant being decommissioned and use the equipment provided by the company at the site to damage the ISFSI casks. Picture a bulldozer toppling a vertical cask and rolling it down to the sea. No background checks mean no protection.

**Cybersecurity:** The rule calls for eliminating the requirement to defend against cyberattacks<sup>14</sup> 10 months for BWRs after the cessation of power generation. This means that digital security communication equipment and security cameras needed to protect the spent nuclear fuel are now vulnerable. The Commonwealth in its Settlement Agreement with Holtec Pilgrim and HDI - took corrective action. Paragraph 23 requires HDI, “within thirty (30) days of the Effective Date, certify to the implementation of a cybersecurity plan at Pilgrim, which shall, at the very least, include [10] cybersecurity measures.” In substance, the ten measures seem to be what should be

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<sup>14</sup> NRC Electronic Library, Adams, Accession Number ML19276C420

standard business practice, e.g., eliminating exposure of Critical Digital Assets to external networks, implementing network segmentation, using secure remote access methods, and using only strong passwords. Cyber protection should not be left up to chance that the state can reach an agreement with the licensee.

**Security-Available Means of Attack on either the pool or ISFSI:** The following table, prepared by Dr. Gordon Thompson for the Massachusetts Attorney General,<sup>15</sup> summarizes available means of attack. Dr. Gordon Thompson’s analyses have been made available to NRC for decades, but ignored.

Mode of Attack	CHARACTERISTICS	PRESENT DEFENSE
Commando-style by land	<ul style="list-style-type: none"> <li>• Could involve heavy weapons/sophisticated tactics</li> <li>• Attack requiring substantial planning and resources</li> </ul>	Alarms, fences, lightly-armed guards, with offsite backup
Commando-style by water	<ul style="list-style-type: none"> <li>• Could involve heavy weapons/sophisticated tactics</li> <li>• Could target intake canal</li> <li>• Attack may be planned to coordinate with a land attack</li> </ul>	500 yard no entry zone – marked by buoys – simply, “no trespassing” signs  Periodic Coast Guard surveillance by boat or plane
Land-vehicle bomb	<ul style="list-style-type: none"> <li>• Readily obtainable</li> <li>• Highly destructive if detonated at target</li> </ul>	Vehicle barriers at entry points to Protected Area
Anti-tank missile	<ul style="list-style-type: none"> <li>• Readily obtainable around world to those with ideological grievances</li> <li>• Highly destructive at point of impact</li> </ul>	None if missile is launched from offsite
Commercial aircraft	<ul style="list-style-type: none"> <li>• More difficult to obtain than pre-9/11</li> <li>• Can destroy larger, softer targets</li> </ul>	None
Explosive-laden smaller aircraft	<ul style="list-style-type: none"> <li>• Readily attainable</li> <li>• Can destroy smaller, harder targets</li> </ul>	None

**Drones, an added threat, recognized by President Biden April 2022:** Drones pose a number of security concerns for ISFSI security. Payload drones could deliver explosives to attackers onsite.

<sup>15</sup>The Massachusetts Attorney General’s Request for a Hearing and Petition for Leave to Intervene With respect to Entergy Nuclear Operations Inc.’s Application for Renewal of the Pilgrim Nuclear Power Plants Operating License and Petition for Backfit Order Requiring New Design features to Protect Against Spent Fuel Pool Accidents, Docket No. 50-293, May 26, 2006 includes a Report to The Massachusetts Attorney General On The Vulnerability of Pilgrim’s Spent Fuel Pool - Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants, Gordon Thompson, May 25, 2006

But, the main concern is that drones could enhance tactical advantage. For example, drones could distract the security guard force during a ground attack, slowing their response or causing them to be mispositioned to the advantage of the attackers; and drones could target the security cameras, motion sensors, etc. to mask ground attackers. The timelines for security force personnel to deploy and prevent attackers from successfully sabotaging key equipment are short. Anything that prevents timely and proper response by the guard force could be a problem.

**Impact of Shaped Charge:** Dr. Gordon Thompson also analyzed the impact of a shaped charge as one potential instrument of attack.<sup>16]</sup> The analysis shows that the cylindrical wall of the canister is about 1/2 inch (1.3 cm) thick, and could be readily penetrated by available weapons. The spent fuel assemblies inside the canister are composed of long, narrow tubes made of flammable zirconium alloy, inside which uranium oxide fuel pellets are stacked. The walls of the tubes (the fuel cladding) are about 0.023 inch (0.6 mm) thick.

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<sup>16</sup> Gordon R. Thompson, *Environmental Impacts of Storing Spent Nuclear Fuel and High- Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Waste Confidence Decision and Environmental Impact Determination* (Cambridge, Massachusetts: Institute for Resource and Security Studies, 6 February 2009). Tables also in Declaration of 1 August 2013 by Gordon R. Thompson: Comments on the US Nuclear Regulatory Commission's Draft Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a US Mark I Boiling Water Reactor.



# Impact of Shaped Charge

Canister - 0.5" thick/ Concrete outer wall - 26.8"



## Performance of US Army Shaped Charges, M3 and M2A3

Target Material	Indicator	Type of Shaped Charge	
		M3	M2A3
Reinforced concrete	Maximum wall thickness that can be perforated	60 in.	36 in.
	Depth of penetration in thick walls	60 in.	30 in.
	Diameter of hole	• 5 in. at entrance • 2 in. minimum	• 3.5 in. at entrance • 2 in. minimum
	Depth of hole with second charge placed over first hole	84 in.	45 in.
Armor plate	Perforation	At least 20 in.	12 in.
	Average diameter of hole	2.5 in.	1.5 in.

**Notes:** (a) Data are from: Army, 1967, pp 13-15 and page 100. (b) The M2A3 charge has a mass of 12 lb., a maximum diameter of 7 in, and a total length of 15 in including the standoff ring. (c) The M3 charge has a mass of 30 lb., a maximum diameter of 9 in, a charge length of 15.5 in, and a standoff pedestal 15 in long<sup>17</sup>

One scenario for an atmospheric release from a dry cask would involve mechanically creating a comparatively small hole in the canister. This could be the result, for example, of the air blast produced by a nearby explosion, or by the impact of an aircraft or missile. If the force was sufficient to puncture the canister, it would also shake the spent fuel assemblies and damage their cladding. A hole with an equivalent diameter of 2.3 mm, radioactive gases and particles released would result in an inhalation dose (CEDE) of 6.3 rem to a person 900 m downwind from the release. Most of that dose would be attributable to release of two-millionths (1.9E-06) of the MPC's inventory of radioisotopes in the "fines" category.

<sup>17</sup> Ibid.

Another scenario for an atmospheric release would involve the creation of one or more holes in a canister, with a size and position that allows ingress and egress of air. In addition, the scenario would involve the ignition of incendiary material inside the canister, causing ignition and sustained burning of the zirconium alloy cladding of the spent fuel. Heat produced by burning of the cladding would release volatile radioactive material to the atmosphere. Heat from combustion of cladding would be ample to raise the temperature of adjacent fuel pellets to well above the boiling point of cesium.

**Potential for Release from a Cask and Consequences:** Dr. Thompson observed that casks are not robust in terms of its ability to withstand penetration by weapons available to sub-national groups. A typical cask would contain 1.3 MCi of cesium-137, about one-third to one-half, depending on age of fuel, the total amount of cesium-137 released during the Chernobyl reactor accident of 1986. Most of the offsite radiation exposure from the Chernobyl accident was due to cesium-137. Thus, a fire inside an ISFSI module, as described in the preceding paragraph, could cause significant radiological harm.<sup>18</sup>

The amount of radiation released likely would far exceed the EPA's one rem release limit, and the resulting off-site damage to property and health would be unimaginable.

**How long will fuel be stored onsite.** Contrary to NRC Staff availability of offsite storage is unlikely to occur anytime soon. The NRC assumption that "the spent fuel is stored in an onsite ISFSI for 16 years before the spent fuel is transmitted to either an offsite ISFSI or a permanent geologic repository" is based on DOE's Strategy for the Management and Disposal of Used Nuclear Fuel and High -Level Radioactive Waste, January 2013. DOE said that: "**With the appropriate authorizations from Congress**, (Emphasis added) the Administration currently plans to implement a program over the next 10 years that:

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<sup>18</sup> Environmental Impacts of Storing Spent Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Nuclear Waste Confidence Decision and Environmental Impact Determination, Gordon Thompson, February 6, 2009; Comments on the US Nuclear Regulatory Commission's Draft Consequence Study of a Beyond Design Basis Earthquake Affecting Spent Fuel Pool for a US Mark 1 Boiling Water Reactor, Gordon Thompson, August 1, 2013, pg., 30

- Sites, designs and licenses, constructs, and begins operations of a pilot interim storage facility by 2021 with an initial focus on accepting used nuclear fuel from shut-down reactor sites.
- Advances toward the siting and licensing of a larger interim storage facility to be available by 2025 that will have sufficient capacity to provide flexibility in the waste management system and allows for acceptance of enough used nuclear fuel to reduce expected government liabilities; and
- Makes demonstrable progress on the siting and characterization of repository sites to facilitate the availability of a geologic repository by 2048. Full implementation of this program will require legislation to enable the timely deployment of the system elements noted above

Legislation should also include the requirements for consent-based siting; a reformed funding approach that provides sufficient and timely resources; and the establishment of a new organization to implement the program, the structure of which should balance greater autonomy with the need for continued Executive and Legislative branch oversight

We are nowhere near “appropriate authorization from Congress;” therefore, neither licensees nor NRC can assume that waste will leave decommissioned sites any time soon. NRC in fact stated in its Continued Storage of Spent Nuclear Fuel (Waste Confidence) ruling that waste may remain onsite indefinitely. Therefore, the decommissioning rule, licensee’s decommissioning plans, and the Decommissioning Trust Fund should plan for long term storage and maintenance and security costs that will occur.

### **NRC’S PROPOSED RULE CHANGES**

The document proposed several regulatory changes. Those most relevant are directed to:

- Emergency Preparedness,
- Physical Security,
- Cyber Security,

- Fitness for Duty,
- Minimum Staffing and Training Requirements,
- Decommissioning **Funding Assurance**,
- Offsite and Onsite Financial Protection Requirements and Indemnity Agreements,
- Application of the Backfit Rule,
- Aging Management, and
- PSDAR, Decommissioning Options, and Decommissioning Timeframe

### **GRADED APPROACH**

We agree with Commissioner Baren that, “The draft proposed rule lays out a 4-level graded approach for emergency preparedness, physical security, cyber security, and insurance requirements. Because radiological risks decline after a reactor permanently shuts down and as the site advances through different stages of decommissioning, a graded approach generally makes sense.”

Level 1 (shutdown), Level 2 (number months it takes for the spent fuel to be cool enough that it would take 10 hours without cooling to reach a temperature where fuel cladding would ignite), Level 3 (all fuel in dry cask storage), Level 4 (all fuel offsite).

**We believe that Level 2 should be eliminated because the risk of a catastrophic accident exists until the pool is emptied of spent fuel -explained previously.**

### **EMERGENCY PREPAREDNESS**

The rule eliminates requirements for offsite radiological emergency planning, including emergency planning zones (EPZs) and all state & local funding to effectuate those plans ten months after the reactor shutdowns for BWR’s and 16 months post shutdown for PWR’s.

**We believe we need phased levels of offsite emergency planning, paid for by the licensee, until the spent fuel - the risk - leaves the site.**

Commissioner Baran<sup>19</sup> noted among other points that state's all hazards emergency plans did not work for radiological emergencies, and that FEMA and states such as Massachusetts opposed the exemption.

The NRC allowed the exemption largely based on its incorrect beliefs that: (1) There is a, "very low probability of beyond-design-basis events" that could initiate a zirconium fire in the spent fuel pool; and (2) the staff's conclusion that, if such an event occurred, ten hours from the loss of spent fuel pool cooling "would be sufficient time to initiate appropriate [spent fuel pool] mitigating actions" and take any necessary offsite protective actions using an all-hazards emergency plan that would allow evacuation in a timely manner.

Further, NRC's assumptions are not supported by FEMA, MEMA, Multi-State Committee on Emergency Response Planning of the Conference of Radiation Control Program Directors (CRCPD), the States of Ohio, Massachusetts, Vermont, Connecticut, and New York,<sup>20</sup> the Massachusetts legislature created Nuclear Decommissioning Citizen Advisory Group,<sup>21</sup> EPZ Boards of Selectmen and Emergency Planning Director,<sup>22</sup> or numerous public interest groups.<sup>23</sup>

**NRC's assumptions are not credible:**

- First, although the events that could cause a spent fuel pool fire or release from a dry cask may be fewer than from an operating reactor, radiological emergency planning has never been exclusively based on the probability of an accident; instead, it is based on preparation to protect public health and safety in the event an accident occurs. Unless you can say there

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<sup>19</sup> <https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML19305C739>

<sup>20</sup> <https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML19305C739> NRC Commissioner Baran's Dissent SECY-19-0078:Request by Entergy Nuclear Operations for Exemptions from Certain Emergency Planning Requirements for the Pilgrim Nuclear Power Station, Footnotes 5-19.

<sup>21</sup> <https://www.mass.gov/orgs/nuclear-decommissioning-citizens-advisory-panel> 2018 Annual Report, pg., 16.

<sup>22</sup> The Towns of Duxbury and Plymouth, for example, have made specific requests to the Pilgrim's licensee to continue financing offsite radiological planning. Documents can be provided on request. The Town of Duxbury at its Annual Town Meeting have voted in support of the licensee to continue funding radiological emergency planning until the spent fuel leaves the site-Article 29, 2014 and Article 39, 2019 available Duxbury Town Clerk.

<sup>23</sup> Examples: Clean Water Action, Toxics Action Center, MASSPIRG, Greater Boston Physicians for Social Responsibility, Plymouth League of Women Voters.

is no evacuation potential, you need radiological emergency planning. See Commissioner Baren's Comment on SECY 19-0078, pg., 1)

- Second, FEMA, MEMA, local emergency directors and a long list of others agree radiological disasters are unique and existing all hazards emergency plans are not sufficient. Third, absent monies for state and local radiological emergency plans that allows training, communication equipment, notification, traffic control, decontamination equipment and centers etc., NRC's statement that the public could evacuate within 10-hours is absurd on its face.

### **Risks and Consequences:**

- A spent fuel pool fire can result from: a canister that weighs 40 tons drops in the pool during transfer and punctures the floor; a terrorist attack; malfunction of transfer equipment; an earthquake. The consequences, according to studies by the MAAGO,<sup>24</sup> NRC and Princeton University showed potential contamination to an area (4) times the size of Massachusetts and hundreds of billions in damages and cancers.<sup>25</sup>
- A spent fuel dry cask disaster can result from acts of malice; stress corrosion cracks in the 0.5" thin canister shell; and an earthquake. Each of the 61 dry casks contain 68 spent fuel assemblies, and ½ the Cesium-137 released at Chernobyl.
- A fire onsite in contaminated building during decommissioning can spread radiation offsite.

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<sup>24</sup> The Massachusetts Attorney General's Request for a Hearing and Petition for Leave to Intervene With respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Pilgrim Nuclear Power Plants Operating License and Petition for Backfit Order Requiring New Design features to Protect Against Spent Fuel Pool Accidents, Docket No. 50-293, May 26, 2006 includes a Report to The Massachusetts Attorney General On The Vulnerability of Pilgrim's Spent Fuel Pool- Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants, Gordon Thompson, May 25, 2006.

2. References: Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants-A report for the Massachusetts Attorney General, Dr. Gordon Thompson, May 25, 2006; Comments on the US Nuclear Regulatory Commission's Draft Consequence Study of a Beyond-Design Basis Earthquake Affecting the Spent Fuel Pool for a US Mark I Boiling Water Reactor, Dr. Gordon Thompson, August 1, 2013; Environmental Impacts of Storing Spent Nuclear Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Waste Confidence Decision and Environmental Impact Determination, Dr. Gordon Thompson, Feb 6, 2009. Documents available on NRC Electronic Library, ADAMS

<sup>25</sup> Richard Stone, "Spent fuel fire on U.S. soil could dwarf impact of Fukushima," *Science*, May 24, 2016. (available at: <http://www.sciencemag.org/news/2016/05/spent-fuel-fire-us-soil-could-dwarf-impact-fukushima>)

Evacuation in the event of a radiological accident was impossible, for example, when Pilgrim was operating, and without off-site emergency planning it is even less adequate today.

### **Consequences Extend Beyond the 5-town, 10-mile Emergency Planning Zone**

To use Pilgrim as an example, MEMA will lose its yearly assessment needed to fund its radiological emergency planning department. Plans and equipment are needed not only for the towns close to the reactor but also for communities impacted that are downwind but further distant - well beyond 10 miles.

Fearing a spent fuel pool fire at Fukushima, the US State Department recommended citizens within 50-miles of Fukushima evacuate. The outer ring on the map below marks 50-miles from Pilgrim. The Japanese Prime Minister, Nato Kan, said if Fukushima's spent fuel pool went, Tokyo, 149 miles from Fukushima, would need to be evacuated and the Japanese economy would crumble.

Second, citizens close to Pilgrim's site in a disaster will eventually evacuate and bring radiation with them on their cars, bodies, personal belongings, and pets. No planning means no decontamination centers. Therefore, where the evacuees travel, stop, washup, and lodge will become contaminated too - spreading contamination though the state and neighboring states.

Third, absent timely evacuation and decontamination, the probability of radiation-linked health impacts increases - cancers, birth defects and reproductive disorders. These will be costly to the state in health care and employment losses.

**Who should Pay for Radiological Emergency Planning?** The licensee should pay. For example, at Pilgrim, neither the Commonwealth nor the impacted towns can afford to pay; nor should they pay. It is after all a risk brought on by one party – Pilgrim's licensee. Now that off-site radiologically emergency planning has officially ended due to NRC's decision, the State will lose over a million dollars a year and towns in Pilgrim's emergency planning zone, that annually

negotiate funding with Entergy, will lose approximately \$85,000/yr. to \$295,000/yr. (depending on the town) plus monies for training and equipment.

Holtec Pilgrim LLC, Pilgrim's owner, and Pilgrim Decommissioning International LLC, Pilgrim's operator can well afford to pay. Holtec bought the site for roughly \$1,000, received ratepayers Decommissioning Trust Fund (\$1.03 B) to decommission the site, and is likely to make a profit of over a billion-nice work for an approximate \$1,000 dollar investment to buy the site.

### **EMERGENCY RESPONSE DATA SYSTEM (ERDS)**

ERDS sends real-time electronic data directly between the licensee's computer system and NRC's Operations Center so that NRC can monitor critical parameters during an emergency. ERDS is only required for operating reactors. The proposed rule would not change that but would require licensees with plants in Level 1 to "maintain a capability to provide meteorological, radiological, and [spent fuel pool] data (e.g., level, flow, and temperature data) to the NRC within a reasonable timeframe following an event."<sup>26</sup> The NRC staff proposes to drop this requirement when a plant reaches Level 2.

**We disagree - Nuclear power plant licensees should maintain ERDS until all fuel leaves the site because although lower probability of risk than when operating, the risk of a serious accident with offsite consequences is not zero.** It would be important to be able to transmit data to the state so it could make timely emergency plans for the public.

### **PHYSICAL SECURITY**

The rule provides that, once all spent fuel is in dry cask storage, a licensee may follow the physical security requirements for specifically-licensed independent spent fuel storage installations. This is based on the incorrect assumption that risk of a dry cask accident is negligible. **ISFI's are vulnerable-the rule should but does not provide for that. Has the NRC learned nothing from Ukraine?**

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<sup>26</sup> Draft *Federal Register* Notice, Proposed Rule at 70.

The ISFI's in the US, unlike Switzerland Zwilag facility<sup>27</sup> are not hardened and therefore vulnerable to attack with weapons available today-discussed above.

Zwilag stores nuclear fuel thick walled dry casks in hardened buildings for additional security and environmental protection. With 24 hour remote continuous monitoring systems of various types, they can identify and fix problems BEFORE radioactive releases.

The US stores cask and thin-walled canister systems outdoors at existing nuclear waste generating stations in what are called Independent Spent Fuel Storage Installations (ISFSIs). Many of these outdoor sites, like Pilgrim's, are located in areas vulnerable to numerous security and environmental risks.

Thin-wall canisters are pressure vessels yet have no continuous radiation monitoring, no pressure monitoring, no helium monitoring, and no ability to thoroughly inspect the canisters or repair or other problems. We will only know after canisters fail and release highly radioactive particles and only then if the utilities and NRC choose to tell us about the radioactive releases.

The only thing missing from Pilgrim's ISFSI, located a football field's distance from a public road in full view, are bulls-eyes painted on each cask.



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<sup>27</sup> [https://www.zwilag.ch/en/cask-storage-hall-\\_content---1--1054.html](https://www.zwilag.ch/en/cask-storage-hall-_content---1--1054.html)

## CYBER SECURITY

Under current regulations, cyber security requirements only apply to operating nuclear power plants. However, the rule extends cyber requirements to shutdown plants in Level 1. **We believe that cyber security should extend until all the fuel is offsite.** Attacks on the ISFSI are credible<sup>28</sup>, as we showed. The consequences could be severe. A cyber-attack could indeed disrupt perimeter detection, security communications, or disable access control doors and gates.

The Commonwealth knew better. It should not have to pick up the pieces where NRC failed. It included in its Settlement Agreement (paragraph 23) with the licensee a requirement for cybersecurity<sup>29</sup>.

23. HDI shall, within thirty (30) days of the Effective Date, certify to the implementation of a cybersecurity plan at Pilgrim, which shall, at the very least, include the following cybersecurity measures:

(a) Maintain an accurate inventory of digital assets related to safety, security, and emergency preparedness functions (“Critical Digital Assets”) and eliminate exposure of this equipment to external networks to the extent Pilgrim currently uses such Critical Digital Assets now or in the future.

(b) Implement network segmentation and apply firewalls.

(c) Use secure remote access methods.

(d) Establish role-based access controls and implement system logging.

(e) Use only strong passwords, change default passwords, and consider other access controls.

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<sup>28</sup> <https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/21/statement-by-president-biden-on-our-nations-cybersecurity/>

<sup>29</sup> <https://holtecinternational.com/wp-content/uploads/2021/02/Settlement-Agreement-Commonwealth-of-MA-and-Holtec.pdf>

- (f) Maintain security systems with no exposure to external networks (i.e., air gapped) or maintain awareness of vulnerabilities and implement necessary patches and updates for Critical Digital Assets, whichever is applicable.
- (g) Develop and enforce policies on the use of mobile devices at the Site such as laptops, portable external hard drives, USBs, or flash drives.
- (h) Implement an employee cybersecurity training program.
- (i) Involve senior management (e.g., site vice president) in cybersecurity briefings and key decision-making; and
- (j) Implement measures for detecting compromises and develop a cybersecurity incident response plan.

## **INSURANCE**

**Off-Site Liability Insurance:** The rule would reduce the required amount of offsite liability insurance from \$450 million to \$100 million and onsite property insurance from \$106 billion to 50 million once shutdown reactors reach Level 2. Instead, **we recommend that insurance remain until the fuel leaves the site for the simple reason that risk remains.**

The NRC justifies this reduction in required insurance because there is less risk of an accident once a reactor is permanently closed. Although the probability of an accident is reduced, the risk does not disappear, as we explained in the foregoing. Any such accident will have significant offsite economic consequences. Until all spent fuel has been moved from the spent fuel pool into dry casks, the risk of a spent fuel pool fire remains, resulting from acts of malice, a fuel handling accident during transfer, equipment failure or human error. The NRC estimated that the offsite consequences of a major pool fire could include contaminating as much as 38,610 square miles of land, forcing the evacuation of millions, and trillions of dollars in damages. There is less risk after all the spent fuel has been moved into dry casks; but dry casks are subject to sabotage, corrosion, and leaks that cannot be repaired. Each of the 62 or more dry casks that will remain indefinitely at Pilgrim, for example, will contain 1/3 to 1/2 Cesium-127 as was released at Chernobyl, depending on the fuels age. Also, offsite consequences may also result from a significant fire in a contaminated building or from leakage of contaminants into Cape Cod Bay.

**On-Site Liability Insurance:** The rule reduced on-site liability insurance from \$1.06 Billion to \$ 50 million based on the same argument presented for the reduction of off-site insurance.

**Reducing off and onsite liability insurance provides no protection to the states and its citizens if the reactor is bought and being decommissioned by a limited liability company with no parent guarantee,**

## **FINANCES**

We agree with Commissioner Baran that **“There are...no provisions to strengthen decommissioning funding assurance.”** This is a serious omission.

Financial insurance is important. The NRC agrees that a shortfall in decommissioning funding would place public health, safety, and the environment at risk. Financial assurance is critical, and a licensee must ensure that sufficient funds are available throughout the decommissioning process:

The NRC has a statutory duty to protect the public health and safety and the environment. The requirements for financial assurance were issued because *inadequate or untimely consideration of decommissioning, specifically in the areas of planning and financial assurance, could result in significant adverse health, safety, and environmental impacts.* The requirements are based on extensive studies of the technology, safety, and costs of decommissioning (53 FR 24018). The NRC determined that there are significant radiation hazards associated with non-decommissioned nuclear reactors. The NRC also determined that the public health and safety can best be protected if its regulations require licensees to use methods which provide reasonable assurance that, at the time of termination of operations, adequate funds are available so that decommissioning can be carried out in a safe and timely manner and that lack of funds does not result in delays that may cause potential health and safety problems (53 FR 24018, 24033). *The purpose of financial assurance is to provide a second line of defense, if the financial operations of the*

licensee are insufficient, by themselves, *to ensure that sufficient funds are available to carry out decommissioning* (63 FR 50465, 50473).<sup>30</sup>

Sufficient funding assurance is less likely when reactors are being sold to decommissioning companies that are limited liability companies, with no assets or parent guarantees, dependent solely on the decommissioning trust fund.

**NRC's cost formula- needs to be updated in the rule.** It only considers the costs of "decommissioning," no other costs such as spent fuel management or restoring the site for future use. The NRC's formula also is generic, not site specific. It relies upon the age of each nuclear plant, the power level at which the nuclear plant was operated, and whether it is a boiling water reactor (BWR) or pressurized water reactor (PWR). It does not consider hazardous materials, radiological leaks or other environmental or radiological damage to the specific site environment, the cost of massive site remediation, or the conditions, topographical and geological challenges that actually exist at Pilgrim.

The NRC admits that the formula "provides only a "reference level established to assure ... that the bulk of the funds necessary for a safe decommissioning are being considered and planned for early in facility life," and that it "does not represent the actual cost of decommissioning."<sup>31</sup> Our understanding is that the decommissioning formula created by and applied by the NRC has never correctly estimated the true cost to decommission any nuclear power plant in the United States.

Our understanding is that no commercial nuclear reactor has been decommissioned for the formula amount. For example, the estimated cost to decommission Big Rock Point was \$220 million; the actual cost was almost twice as much - \$390 million.<sup>32</sup>

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<sup>30</sup> NRC, *Questions and Answers on Decommissioning Financial Assurance*, at 1 (ADAMS Accession No. ML111950031).

<sup>31</sup> NRC Questions and Answers on Decommissioning Financial Assurance, <https://www.nrc.gov/docs/ML1119/ML111950031.pdf>

<sup>32</sup> <https://www.nrc.gov/waste/decommissioning/faq.html#19>; [https://en.wikipedia.org/wiki/Big\\_Rock\\_Point\\_Nuclear\\_Power\\_Plant](https://en.wikipedia.org/wiki/Big_Rock_Point_Nuclear_Power_Plant)

The NRC formula does not and is not intended to ensure that there is enough money in the Pilgrim DTF, or any other, to do the job. Neither does it provide decommissioning cost information that would enable states to make rational decisions. Simply knowing how much money is currently in a decommissioning fund and then arbitrarily comparing that fund balance against the formula does not make it possible for any governing or regulating body to make an informed decision about how much it really will cost to decommission and clean-up the site, and what costs the state, and its taxpayers will have to pay.

**The Commonwealth and Pilgrim Watch Motions to Intervene on Pilgrim’s LTA, and subsequent filings by the Commonwealth and Pilgrim Watch to the NRC, explain in detail the reasons that there are insufficient funds in the Decommissioning Trust Fund (DTF) to decommission Pilgrim. They provide lessons to other sites and how the decommissioning rule should, but does not, address them to provide reasonable assurance.**

The principal reasons are that (i) Holtec’s estimates of the cost properly to complete decommissioning are too low, (ii) there is not enough money in the DTF to pay them,<sup>33</sup> (iii) no other Holtec entity will agree to make up any shortfall, and (iv) the NRC has no ability to force Holtec International or any other company that has the necessary assets to do so. There are valuable lessons are to be learned from these filings.

**No Parent Company Guarantee:** The NRC has the ability to ask a parent company, such as Holtec International, to provide a parent company guarantee (PCG). A “PCG is defined in Appendix A to 10 CFR Part 30; it is a guarantee between the parent and its subsidiary-licensee stating that the parent company will pay a specific amount of the decommissioning costs of its subsidiary-licensee, if the subsidiary-licensee fails to meet its decommissioning obligation.”<sup>34</sup> Holtec has refused to provide such a guarantee. Holtec also has refused to use any of its assets or any assets of any of its other subsidiaries, to pay for decommissioning costs if the DTF funds run out. The

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<sup>33</sup> See “Costs the DTF will not be able to pay,” below.

<sup>34</sup> <https://www.nrc.gov/docs/ML1119/ML111950031.pdf>

likely need for a PCG or some other guaranteed source of additional funds is increased by two facts:

1. the NRC has allowed Holtec to use the DTF for spent fuel management and site restoration activities costs, although those funds by regulation are restricted only for radiological decommissioning and permitting them to be used for other purposes will reduce the amount of money available for decommissioning.<sup>35</sup>
2. Holtec will sue the Department of Energy (DOE) to recover, and put in its profit pocket, at least the \$500 million it will spend on spent fuel management costs – even though none of this money was Holtec’s but rather was taken out of the DTF funded by the public.<sup>36</sup>  
**The rule must require if the DTF can be used for spent fuel management costs then recovery from DOE must reimburse what was taken out of the DTF.**

**NRC Regulations provide no guarantee:** The NRC Staff’s statements that the NRC has “the ability to take action on any actual or potential funding deficiencies” are wrong and ignore reality. NRC regulations say a *licensee* must make-up the balance of any shortfall (10 CFR 72.30(g)), but these regulations apply only to licensees, i.e., only to Holtec Pilgrim (whose only assets are Pilgrim, a lot of spent fuel, and the DTF) and Holtec Decommissioning International (that has essentially no assets). They do not apply to Holtec International, Holtec Power, Nuclear Asset Management Company, SNC-Lavalin or Comprehensive Decommissioning International.

The reality is that that if the DTF runs out of money no licensee, neither Holtec Pilgrim not HDI or any other, absent a state settlement agreement, will have any assets or other ability to eliminate “any actual or potential funding deficiencies;” An essentially bankrupt licensee cannot “make-up” anything; and the NRC has no legal ability or power to require a non-licensee – such as Holtec

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<sup>35</sup> <https://www.nrc.gov/docs/ML1919/ML19192A086.pdf>;

<sup>36</sup> See Holtec’s Expected Profit, below

International, Holtec Power, Nuclear Asset Management Company, SNC-Lavalin or Comprehensive Decommissioning International - to pay anything.

Examples showing that many of Holtec's assumptions are wrong, that the DTF is not sufficient, and that Holtec Pilgrim and HDI are not financially responsible and have not provided financial assurance include the following. These same issues will occur at other reactors and should be addressed and corrected in the rule.

**1. Higher decommissioning costs resulting from inflation:** Holtec based its decommissioning costs on the faulty assumption that decommissioning costs will not increase with inflation during the decommissioning period.

“The decommissioning costs presented in this report are reported in 2018 dollars. Escalation of future decommissioning costs over the remaining decommissioning project life-cycle are excluded.” (PSDAR, p. 19; DCE, pp. 7, 18)

That assumption is flatly contradicted by both the NRC and history.

The NRC's Questions and Answers on Decommissioning Financial Assurance<sup>37</sup> are clear: decommissioning costs will increase at a rate higher than the rate of inflation, and that over a period of only 20 years (40 years less than the 60 year period allowed for decommissioning) there will be 2.5 to 5.6 times increase in costs, i.e., *the annual increase in costs will be 5% to 9%*:

The NRC formulas represent the cost to decommission today, not in the future. *Due to rising costs, the future value of decommissioning will be much larger than the NRC formula calculated today.* For example, using the range of cost escalation rates based on NUREG - 1307, the **increase in cost over a 20-year license renewal period would range from 2.5 to 5.6 times today's estimated cost, not counting costs that are**

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<sup>37</sup> NRC Electronic Library, Adams, Accession Number ML1119/ML111950031

**not included in the formula, such as soil contamination.** *The rates of increase in decommissioning cost are higher than general inflation.* (Emphasis added)

Callan Associates produces an annual analysis and report of decommissioning funds and costs.<sup>38</sup> Its 2015 Nuclear Decommissioning Funding Study said, “Total decommissioning cost estimates have risen 60% since 2008,” and that “2014 decommissioning cost estimates rose approximately 11% from the previous year.” The 2018 Study reported that decommissioning costs increased by about 80% (from \$55 billion to \$89 billion, an annual rate of about 5 percent) from 2008 and 2017. The trend continued in 2019: “cost estimates rose \$7.4 billion (8.4%) from a year earlier to over \$96 billion in 2018.

Simply stated, the NRC says that decommissioning costs will increase, and Callan Associates says that they have increased, at an annual rate that is much greater than inflation. There is no reasonable basis for Holtec’s “no inflation” cost estimates.

**2. Costs to remove hazardous materials and radiological contamination- Holtec assumes the site is essentially clean.** The NRC’s Decommissioning Rule, 10 C.F.R. §20.151 recognizes the importance of a site assessment and an evaluation of “the magnitude and extent of radiation levels; and the concentrations of residual activity.” In the Federal Register notice establishing this rule, the NRC was quite clear that “To adequately assure that a decommissioning fund will cover the costs of decommissioning, the owner of a facility must have a reasonably accurate estimate of the extent to which residual radioactivity is present at the facility, particularly in the subsurface soil and groundwater,” that “soil or ground-water contamination can increase decommissioning costs” and “increase decommissioning costs above the original estimate.” 76 Federal Register 33514, 33517. | **What is needed is the decommissioning rule to require an EIS at the beginning of the decommission process-not as now at the end.**

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<sup>38</sup> <https://www.callan.com/library>

Holtec, however, admits that when it prepared its site restoration estimates *it did not know* what radiological and hazardous waste actually exist on Pilgrim's site.<sup>39</sup>

Nonetheless, Holtec based its decommissioning and site restoration costs estimates on the baseless, and incorrect, assumption that there is "no significant contamination" on the Pilgrim site (DCE, p. 22). It compounded its error by including **only** "those costs associated with conventional dismantling, demolition, and removal from the site of structures and systems" (PSDAR, p 19) in its **estimated \$40 million site restoration cost**. Peanuts.

Pilgrim Watch and the Commonwealth knew, and we suspect that Entergy and Holtec also know, that there is "significant contamination" on the Pilgrim site, and that site restoration will require far more.<sup>40</sup>

Pilgrim opened with bad fuel and no off-gas treatment system. Later, it blew its filters prompting Mass Dept. Public Health to do a case-control study of adult leukemia, finding a four-fold increase, and confirming the hypothesis that the closer you lived or worked at Pilgrim there would be an increase in leukemia.

Radionuclides, including for example tritium, manganese-54, cesium-137, Sr-90, I-131, cobalt-60, Plutonium, and neptunium have been found off-site, and also in the surface water, groundwater, and soils at Pilgrim at levels exceeding "background" levels. Monitoring wells placed onsite from 2007 forward show consistent levels of radiological contamination-contamination not yet removed. Hazardous waste was illegally buried onsite. See Pilgrim Watch Motion to Intervene, pp 36-46.

The Commonwealth's Motion to Intervene included a declaration from John M. Priest Jr, director of radiation control MDPH and a former Pilgrim employee. Mr. Priest said that:

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<sup>39</sup>Revised Post-Shutdown Decommissioning Activities Report and Revised Site-Specific Decommissioning Cost Estimate for Pilgrim Nuclear Power Station NRC Electronic Library, ADAMS Accession No. ML18320A040, (Holtec PSDAR 8-11; DCE pg., 14)

<sup>40</sup> Pilgrim Watch Petition to Intervene & Request for Hearing, NRC Electronic Library, Adams, Accession Number ML19051A019; Commonwealth Petition to Intervene & Request for Hearing, NRC Electronic Library, Adams, Accession Number ML19051A114

9. Based on my site knowledge, contamination has previously been identified by the utilities in the soil in the vicinity of the condensate water storage tank, the reactor truck lock and radioactive waste building. Further, there were other releases into the environment associated with a former condenser tube refurbishment building east of the radioactive waste truck lock. Historically, contaminated soil from previous site remediation has been “stockpiled” on a small hill along the east protected area fence. DPH does not know whether these sites and others were captured as part of decommissioning records required by 10 C.F.R. § 50.75(g), communicated to Holtec and evaluated by Holtec in its decommissioning cost estimate. Based on my knowledge of this site and experience at other nuclear power plants, it is reasonable to assume based on this site’s history that other contaminants will be identified once excavation and demolition begins.

10. Long-lived radionuclides are likely to be found in soils and groundwater far from the small excavation made to repair the leaks that likely allowed reactor condensate to enter into the site soils for many years. In addition, these same long-lived radionuclides are likely to be found in many other structures, systems, and components, which may also have unknowingly leaked over the decades into soils and the groundwater at the Pilgrim property

**Experience at other decommissioned reactors showed significant cost increases from “unknown” contamination discovered only later.** At Connecticut Yankee, for example, previously undiscovered strontium-90 contributed to the actual cost of decommissioning Connecticut Yankee being *double* what had been estimated. Connecticut ratepayers had to pay a \$480 million shortfall for cleanup of CT Yankee.<sup>41</sup> During the decommissioning of Maine Yankee, the licensee encountered pockets of highly contaminated groundwater dammed up by existing structures, leading to cost increases. The Yankee Rowe site in Massachusetts incurred significant

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<sup>41</sup> Hartford Current, November 12, 2005 <http://www.courant.com/news/local/cynukemess.artnov12,0,6222764.story?col l=hc-headlines-home>)

cost increases during decommissioning when PCBs were discovered in paint covering the steel from the vapor container that housed the nuclear reactor, as well as in sheathing on underground cables. Other plants have also ended up costing much more than what was estimated for decommissioning- Diablo Canyon 1&2, San Onofre 2&3.<sup>42</sup>

At this point in time, no one knows how much hazardous waste and radiological contamination must be removed from the Pilgrim site, or what the actual cost of removing it will be. However, three things are clear – the site is contaminated, there is no money in the DTF to pay to remove it, what the costs will be, and unless these contaminants are properly removed they will end up in Cape Cod Bay and perhaps the Plymouth-Carver Aquifer underneath the site. **Again, this will repeat itself at other reactors until NRC decommissioning rule requires an EIS at the very beginning of the process.**

**3. Spent fuel costs after 2062. The rule cannot allow “pie-in-the-sky” estimates of when the fuel will leave the site. The rule must require inclusion in cost estimates of indefinite onsite storage, maintenance, repackaging etc.** The spent fuel management costs projected in Holtec’s PSDAR, DCE and LTA rest on at least three unexplained and unlikely assumptions: that DOE will remove all spent fuel from the Pilgrim site by 2062. (Holtec PSDAR, pgs., 23 and 58); that Holtec will never have to repair or replace any failed casks or pads, and that Holtec will not have to repackage spent nuclear fuel into new containers approved by DOE for transportation. None of these assumptions is justified.

Holtec’s projected costs assume that “DOE will commence acceptance of PNPS’s spent fuel in 2030 and ... the spent fuel [will] be fully removed the Pilgrim site in 2062” (DCE, p. 23) is based on DOE’s January 2013 *Strategy for The Management and Disposal of Used Nuclear Fuel and High -Level Radioactive Waste*. (“DOE Strategy”).<sup>43</sup> But the Holtec cost estimates ignore that

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<sup>42</sup> See, e.g., NRC, SECY-13-0105, at Summary Table, available at <http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2013/2013-0105scy.pdf>.

<sup>43</sup> U.S. Department of Energy, *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste*, January 2013. <http://www.energy.gov/sites/prod/files/Strategy%20for%20the%20Management%20and%20Disposal%20of%20Used%20Nuclear%20Fuel%20and%20High%20Level%20Radioactive%20Waste.pdf>

the DOE Strategy is simply “a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel” (DOE Strategy, p. 1). The strategy does not even try to guess by when an interim or geologic repository to which the spent fuel would be moved might actually exist.

The DOE Strategy itself says that it is nothing more than a “plan” or “goal” for which “legislation is needed in the near term” (DOE Strategy, pp.13-14) Seven years have now passed. There is no Congressional legislation or appropriation, and no plan has been implemented.

The NRC has been more realistic. Its 2014 Continued Storage Rule envisions onsite storage for 300 years,<sup>44</sup> and the casks and pad would need to be changed every 100 years.

Holtec estimated on-going spent fuel storage costs would be \$7.2 million per year in 2018 dollars. Even if one were to assume that there would be no greater-than-inflation increase in those costs and the fuel, if the spent fuel were to remain on-site for 100 years after Pilgrim shut down, the 57 additional years of spent fuel would add more than \$380 million to Holtec’s estimated cost. The NRC’s predicted 5% to 9% annual cost increases would add billions.

**4. Cost of repackaging spent fuel canisters for shipment offsite.** DOE 's Standard Contract under the Nuclear Waste Policy Act requires reactor operators to pay to repackage fuel into new DOE approved containers prior to transportation to an offsite storage facility or repository (Brewer Decl, pg.,8). Repackaging spent fuel so that it can be transported off-site will be expensive, but that cost has been ignored by Holtec. According to Task Order 12: Standardized Transportation, Aging, and Disposal Canister Feasibility Study, Option 3 (1 PWR/1 BWR/13.1/U) it will cost \$34,311,000,000 to repackage 140,000 MT; the per ton cost is \$245,078.00.<sup>45</sup> Dr. Alvarez says that repackaging at the Pilgrim site could add \$261,770,600 to the predisposal costs.<sup>46</sup> No repackaging costs are included in Holtec’s estimates. And again, repackaging would be required

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<sup>44</sup> <https://www.nrc.gov/docs/ML1423/ML14238A326.pdf>

<sup>45</sup>

[https://curie.ornl.gov/system/files/documents/not%20yet%20assigned/STAD\\_Canister\\_Feasibility\\_Study\\_AREVA\\_Final\\_1.pdf](https://curie.ornl.gov/system/files/documents/not%20yet%20assigned/STAD_Canister_Feasibility_Study_AREVA_Final_1.pdf) (p-5-2)

<sup>46</sup> Robert Alvarez Analysis For Pilgrim 2018, <https://Ips-Dc.Org/Ips-Authors/Robert-Alvarez/>; 3 U.S. Government Accountability Office, Gao-10-48, Nuclear Waste Management: Key Attributes, Challenges, And Costs For The Yucca Mountain Repository And Two Potential Alternatives 55 (Nov. 2009), <https://www.gao.gov/assets/300/298028.pdf>.

no matter when the spent fuel is shipped, so it is not likely that the cost would be reimbursed by DOE.

**5. Cost of a spent fuel transfer facility to repackage canister.** There are a number of circumstances in which Holtec will have to move spent fuel from one canister to another. One is when a canister has failed. Another is when spent fuel is moved into the canisters that will be stored at a long-term geological depository such as Yucca Mountain.

Dr. Brewer's declaration filed with the Attorney General's Motion to Intervene says that the construction of a Dry Fuel Transfer Station needed to move spent fuel from one canister to another would cost between \$150 and \$450 million. This estimate assumes that Holtec will need one large, centralized repackaging facility handling the entire projected SNF inventory. If Holtec or another reactor operator has to establish repackaging infrastructures at decommissioned or closed reactors, the repackaging becomes an even more expensive proposition.

The Holtec estimates do not include this cost. Since the need for a transfer facility would exist no matter when the spent fuel is shipped, it is not likely that the cost will be reimbursed by DOE.

**6. Cost of repackaging spent fuel canisters for shipment offsite.** DOE 's Standard Contract under the Nuclear Waste Policy Act requires reactor operators to pay to repackage fuel into new DOE approved containers prior to transportation to an offsite storage facility of repository (Brewer Declaration, pg.,8). Repackaging spent fuel so that it can be transported off-site will be expensive, but that cost has been ignored by Holtec.

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<sup>47</sup> [https://curie.ornl.gov/system/files/documents/not%20yet%20assigned/STAD\\_Canister\\_Feasibility\\_Study\\_AREVA\\_Final\\_1.pdf](https://curie.ornl.gov/system/files/documents/not%20yet%20assigned/STAD_Canister_Feasibility_Study_AREVA_Final_1.pdf) (p-5-2)

\$261,770,600 to the predisposal costs.<sup>48</sup> No repackaging costs are included in Holtec’s estimates. And again, repackaging would be required no matter when the spent fuel is shipped, so it is not likely that the cost would be reimbursed by DOE.

**7. Costs resulting from decommissioning delays – Time is Money.** A slide presentation made by Holtec International (“Holtec” and Comprehensive Decommissioning International (“CDI”) to the Pilgrim Nuclear Decommissioning Citizens Advisory Panel (“NDCAP”) on November 14, 2019, shows that Holtec’s planned decommissioning already has slipped at least 2-3 years and has increased in duration. Both the delay and longer decommissioning period will further increase costs to decommission Pilgrim.

In a supplement to its Motion to Intervene the Massachusetts Attorney General said that delay to-date will add **\$85-\$102 million** to the project in management overhead alone compared to cost estimates given by Holtec in its PSDAR. The time it will take to cleaning up previously known and unknown radiological and non-radiological contamination will additionally delay and lengthen the work schedule, further escalating costs. There inevitably will be other delays as there always are in large projects. Holtec is new to decommissioning; severe and more frequent storms are occurring.

**8. Holtec’s Decommissioning Cost Estimate (DCE) fails to consider costs likely to result from climate change impacts. This will occur all over the country.** Based on current levels of greenhouse gas prediction, the recent UN Intergovernmental Panel on Climate Change (IPCC) Report concluded that sea levels will rise more rapidly; severe storms will occur more frequently, coinciding with high tides and exceptional wave heights, that groundwater tables will rise, and floods will be more severe. The numerous negative impacts resulting from climate change not considered by Holtec and other licensees that would likely increase decommissioning costs

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<sup>48</sup> Robert Alvarez Analysis For Pilgrim 2018, <https://ips-dc.org/ips-authors/Robert-Alvarez/>;3 U.S. GOVERNMENT ACCOUNTABILITY OFFICE, GAO-10-48, NUCLEAR WASTE MANAGEMENT: KEY ATTRIBUTES, CHALLENGES, AND COSTS FOR THE YUCCA MOUNTAIN REPOSITORY AND TWO POTENTIAL ALTERNATIVES 55 (Nov. 2009), <https://www.gao.gov/assets/300/298028.pdf>.

include increased flooding and storm surge resulting from climate change likely to cause corrosion of underground piping, tanks and structures and subsequent leakage.

Severe storms and flooding can result in loss of offsite power and potential damage to the diesel generators. The spent fuel pool requires electricity to operate its safety systems. At Fukushima, extreme weather conditions at the site prevented workers to perform necessary mitigating actions. Severe storms and flooding could present conditions at Pilgrim and other reactors so that workers could not perform their jobs. Finally, climate change impacts on the site are likely to both decrease the licensee's capability to cleanup and cause delay in work schedule; both will increase costs.

**9. Cost estimate assumptions cannot ignore the cost of managing Low Level Radioactive Waste (LLRW)- especially for non-compact states.**

**10. Other Costs that the DTF will not be able to pay – cost estimates ignore the costs of mitigating radiological accident(s). This is due largely to the NRC's and its decommissioning rule ignoring spent fuel pool and dry cask storage risks.** Potential accidents include, fuel handling accidents unloading fuel from pool, canister drop in pool; spent fuel pool water loss, human error, terrorist attack; line of sight or air attack on dry casks that each contains about 1/3 Cesium-137 released at Chernobyl; corrosion cask and radiological leaks.<sup>49</sup> A Spent fuel pool fire could result in contamination of 38,610 square miles and force the evacuation of millions.<sup>50</sup> An NRC study

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<sup>49</sup> Email from Dr. Gordon Thompson, February 19, 2022: "...specified a Reference MPC (cask) at Pilgrim. The Reference MPC will, in 2029, contain 25 PBq of Cs-137. Thereafter, its Cs-137 inventory will decline by 50% every 30 years. A frequently-cited estimate of the Cs-137 release from Chernobyl is 85 PBq. Earlier: Environmental Impacts of Storing Spent Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Nuclear Waste Confidence Decision and Environmental Impact Determination, Gordon Thompson, February 6, 2009; Comments on the US Nuclear Regulatory Commission's Draft Consequence Study of a Beyond Design Basis Earthquake Affecting Spent Fuel Pool for a US Mark 1 Boiling Water Reactor, Gordon Thompson, August 1, 2013, pg., 30

<sup>50</sup> Frank N. von Hippel, Michael Schoeppner, "Reducing the Danger from Fires in Spent Fuel Pools," *Science & Global Security* 24, no.3 (2016): 141-173 <http://scienceandglobalsecurity.org/archive/sgs24vonhippel.pdf>; Richard Stone, "Spent fuel fire on U.S. soil could dwarf impact of Fukushima," *Science*, May 24, 2016. (NRC variable at: <http://www.sciencemag.org/news/2016/05/spent-fuel-fire-us-soil-could-dwarf-impact-fukushima>

estimated a severe spent fuel pool accident would render an area larger than Massachusetts uninhabitable for decades and displace more than 4 million people.<sup>51</sup>

**11. Holtec ignores potential costs from fires in structures, systems and components containing radioactive and hazardous material.** Fire in a building would result in increase in mixed waste adding to cost and also impact worker and potentially public health. Holtec's cost estimates should, but do not, include the cost of an adequate study to locating sites where potential masses of contaminated material susceptible to ignition might accumulate during decommissioning and the costs of forestalling a fire by removing or limiting heat, oxygen, and/or fuel. Holtec's and other reactor's cost estimates also should include costs for training and equipment for offsite fire personnel that are counted on in an emergency.

#### **Holtec's Likely Profit**

NRC's decommissioning rule must avert licensees gaining outsized profits while leaving the states "holding the bag." For example, when Holtec purchased Pilgrim (likely for about \$1,000) it was given a DTF worth more than a billion dollars. According to Holtec's PSDAR and new financial report, decommissioning will cost more than a billion dollars, only a very, small percentage of the DTF will be left over.

The reality is that that the DTF likely will run out of money, and there will be nothing left over. Moreover, no licensee will have any assets or other ability to make-up any shortfall.; neither NRC nor the Commonwealth has the legal ability or power to require a non-licensee – such as Holtec International, Holtec Power, Nuclear Asset Management Company, SNC-Lavalin or Comprehensive Decommissioning International - to pay anything; and the cost to the Commonwealth likely will be hundreds-of-millions, if not more than a billion, dollars.

**Nonetheless, Holtec may walk away with as much as \$800 million- to a billion in "profit."**

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<sup>51</sup> Consequence Study of a Beyond Design-Basis Earthquake Affecting the Spent Fuel Pool for A U.S. Mark I Boiling Water Reactor (October 2013) at 232 (Table 62) and 162 (table 33), Adams Accession NO ML13256A342)

How could this be true? The answer seems remarkably simple.

- a. A Holtec representative told Pilgrim Watch that Holtec had included its expected profit in its estimated decommissioning costs. Our understanding is that, for a project of this magnitude that will extend over a number of years, a company would expect a profit in the range of not less than 25% to 35%, i.e., a profit of between about \$250,000 and \$350,000 on a billion dollar job.
- b. Many years ago, DOE entered into a contract with the nuclear industry in which DOE agrees to remove spent nuclear fuel from nuclear reactor sites by 1998. It has not done so. As a result, the owners of nuclear power plants have regularly sued DOE to recover their spent fuel costs, and they have regularly won.
- c. In filings with the NRC, Holtec has said that it expects to spend over \$500 million of the approximately \$1 billion in the DTF for spent fuel management, and that it expects to recover these costs from DOE.
- d. Holtec has consistently refused to agree to put the money it will recover from DOE back into the DTF, even though money from the DTF was used to pay the very same spent fuel management costs that DOE would have reimbursed. **No NRC regulation requires that money recovered from the DOE be used for decommissioning. This requires correction in the rule.** It seems clear that Holtec plans to keep this \$500 million as additional profit.
- e. **Total likely Holtec profit: \$250-300 million profit built into Holtec's estimated costs of decommissioning, and another \$500 million in profit from DOE.**

### **TIMEFRAME FOR DECOMMISSIONING**

**Instead of allowing licensees to complete decommissioning anytime within 60 years, the rule should require decommissioning to be completed as soon as possible.** There are several reasons for this. (1) Prompt decontamination can *take advantage of the first-hand knowledge* of the workers who recently operated the plant- a safety plus. (2) States, local communities, and plant workers have expressed a strong interest in prompt decommissioning because of the employment and land

redevelopment benefits it provides. Reactor closure is an economic hit to the host community and workers. A prompt decommissioning can soften the blow.

(3) IAEA safety standards state that “[t]he preferred decommissioning strategy shall be immediate dismantling” unless it is not practicable<sup>52</sup> (4) Decommissioned reactors have shown a rapid decommissioning is doable. (5) Finally, longer decommissioning timeframes can increase overall costs as a result of maintenance, security, and other long-term expenses.

## DECOMMISSIONING METHODS

As Commissioner Baran pointed out in his comment on SECY “The **ENTOMB option should be eliminated** from guidance. As IAEA explains, “Entombment ... is not considered a decommissioning strategy and is not an option in the case of planned permanent shutdown. It may be considered a solution only under exceptional circumstances (e.g., following a severe accident.”<sup>53</sup>

## DECOMMISSIONING PLAN - PSDAR

NRC’s current regulations require a licensee to submit a post-shutdown decommissioning activities report (PSDAR) within 2 years of shutdown. A PSDAR includes “the licensee’s proposed decommissioning activities and schedule through license termination, a discussion of the reasons for concluding that the environmental impacts associated with the proposed site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements, and a decommissioning cost estimate.”<sup>54</sup>

**NRC does not approve or make comment on the PSDAR, nor does NRC reply to comments from the state’s or public.** NRC takes public comment on the PSDAR; but it is a foolish exercise for the public to comment. No matter how valid public comments are, NRC takes no action on them as it does not

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<sup>52</sup> International Atomic Energy Agency, *Decommissioning of Nuclear Power Plants and Research Reactors* (1999) at 9-10, 17..

<sup>53</sup> International Atomic Energy Agency, *Decommissioning of Facilities* (2014) at 3.

<sup>54</sup> Draft *Federal Register* Notice, Proposed Rule at 19-20.

approve the PSDAR. Therefore, the NRC, state, and the public have no real decision making role with decommissioning plans at the site. It is left to the licensee.

Commissioner Baren's comment on SECY (pgs., 4-5) explained the negative consequences of NRC not approving the PSDAR.

the lack of agency approval of the PSDAR has two significant consequences. First, no National Environmental Policy Act (NEPA) environmental review is required before decommissioning activities commence. Second, there is no opportunity for stakeholders to challenge the activities outlined in the PSDAR in an agency adjudicatory hearing. In fact, the current process was designed to postpone the licensing action, NEPA review, and opportunity for a hearing until the License Termination Plan is submitted at the very end of the decommissioning process – potentially decades later – when all of the key decisions have already been made, the vast majority of the decommissioning work has been completed, and the decommissioning trust fund may have been entirely expended.

Further he explained that the rule made matters worse.

It would water down the already limited environmental information in the PSDAR by no longer requiring licensees “to make the definitive conclusion that impacts will be bounded” by previous environmental impact statements<sup>55</sup> The rule also would eliminate NRC approval of a licensee's irradiated fuel management program and drop the requirement that the PSDAR's site-specific cost estimate include the projected cost of managing spent fuel.

## **NEPA ENVIRONMENTAL REVIEWS**

NRC approval of a decommissioning plan will be a major federal action. As a result, the agency must perform its NEPA environmental review to inform that licensing decision. **A NEPA review at this early stage of the decommissioning process makes much more sense than at the time**

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<sup>55</sup> Proposed rule at 146, Fed Reg

**of license termination**, when the major decisions would already have been made and nearly all the impacts of decommissioning would have occurred. Absent a NEPA Review cost estimates will remain unreliable.

Because NRC approval of a decommissioning plan will be a licensing action, stakeholders will have an opportunity to request an adjudicatory hearing at that time. Like the NEPA review, the opportunity for a hearing will be most beneficial at the beginning of the decommissioning process rather than at the end.

### **Holtec's Plan to Discharge Radioactive Contaminated Water into Cape Cod Bay- Example**

Holtec Pilgrim LLC and HDI LLC's announced December 1, 2021, its intent in early 2022 to discharge one million gallons of radioactive contaminated water into Cape Cod Bay- a protected ocean sanctuary<sup>56</sup>.

**This proposal would not have been given serious consideration had a NEPA review occurred at the beginning of the decommissioning process; and if NRC approval of the decommissioning plan was required so that stakeholders had an opportunity for an adjudicatory hearing.**

In this example, if a NEPA review and NRC approval were in place at the start of the decommissioning process, it would result in significant savings to licensees, the state ,and stakeholders. Absent those changes, if Pilgrim's licensee decides to dump, there will be lawsuits that will delay decommissioning (time is money) and cost the company attorney fees. Likewise, the state and public will face continuing expense fighting the proposal.

**Facts:** Pilgrim's licensee says it has three options to "dispose of" one million gallons of Pilgrim's radioactive water - dump it directly into Cape Cod Bay, evaporate it and then ship, or send all out-of-state to an existing radioactive waste site. Vermont Yankee asked and received permission

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<sup>56</sup> The water come from: Spent Fuel Pool- 350,000 gal; Condensate tanks (2) each 275 gal- total 550 gal; Containment; Torus; Dryer-Separator

from NRC to send its two million gallons of radioactive water to a waste site in Idaho rather than dumping it into the Connecticut River.

There is no acceptable reason for Holtec not to do the same. Experience makes clear, Holtec will take the cheap route. The Nuclear Regulatory Commission (NRC) says that Holtec can dump whenever it wants to, and Holtec says it will do anything the NRC allows, but that does not make it right or even achievable for Holtec after opponents of the plan litigate.

Cape Cod Bay, and the three bays fed by Cape Cod Bay due to tides (Plymouth Bay, Duxbury Bay, and Kingston Bay) are all protected ocean sanctuaries. Cape Cod Bay is a critical habitat for right whales, listed as critically endangered, and other endangered species. NRC allowing industry to rely on the outdated SEIS, done during license extension, is dishonest. The overall pollutant burden in the bay has increased deterioration of the environment the whales inhabit. The numbers of whales have decreased.

Updated research on the impact on threatened species and the food chain that they depend on of radioactive and chemical discharge from Pilgrim has not been done. There is no basis to say the impact would be negligible.

Dumping this radioactive water into them is not safe. Most important it is not perceived by consumers as safe. It would cause incalculable economic damage and would harm both the environment and public health.

Holtec planned to dump the water in the Bay the first quarter of 2022. Public outcry changed its mind, and the company will not dump in 2022 but instead will evaluate its options this year.

Dumping into Cape Cod Bay is clearly the cheapest way for Holtec to dispose of the contaminated water.

**Transportation:** Holtec argues against transporting the waste claiming the risk of “potential accidents.” This is pure hypocrisy and amounts to nothing more than an excuse to dump, rather than transport. For years, Holtec has told everyone that transporting radioactive waste and debris is perfectly safe. A Holtec/CDI slide presented at NDCAP’s November 2021 meeting says

Pilgrim shipped over 2,000,000 pounds (about 1,000 tons) of radioactive waste to WCS in Andrews County, Texas in the first 9 months of 2021. In connection with its plans to build spent nuclear fuel storage site in Southeastern New Mexico, Holtec has assured the NRC that it will be perfectly safe to transport thousands of tons of spent nuclear fuel from all over the U.S. to that site using Holtec's "robust and safe transport casks." ([HI-STORE CISF - Holtec International](#)).

The NRC recently found that it would be safe for Vermont Yankee to transport two million gallons of contaminated water to a disposal site in Idaho. But according to Holtec transporting half as much contaminated water than Vermont Yankee to another facility would not be safe. Holtec said in its letter to NDCAP in January 2022 that it would not only require "hundreds of truck trips" (Holtec Fact Sheet, p. 3), which would cost Holtec money, but that transportation also "creates the potential for accidents." (Fact Sheet, p. 3; see letter, p. 2: "risk of vehicle incident") What Holtec forgot to say is that a spill from a truck can be cleaned up; you cannot clean up radioactivity that has been discharged into Cape Cod Bay.

**Evaporation** The public correctly fears that in evaporating the water radioactive contamination would be released into the air.

**Dumping** is Holtec's favorite option. They argue that Pilgrim during operations routinely dumped into Cape Cod Bay, and no one complained then so why the ruckus now? This is a red herring. Holtec has a choice now to follow Vermont's example and ship out of state-a far safer solution. Holtec does not have to dump. The general public was unaware of Pilgrim's past history of dumping. Those few who closely followed Pilgrim knew; objected; and were careful where the food they put on their family's dinner table came from. Bioaccumulation is another important factor. The bay and coastal waters are already affected by an array of pollution ranging from previous Pilgrim discharges, excessive nitrogen, to other chemicals like PFAS. More insults make no sense at all-especially when there is no need to do so.

Dumping is not in the public interest for the following reasons. Reasons not analyzed by NRC or Holtec.

Economic Damage: The economic harm from Holtec's threatened dumping cannot be overstated. Dumping is not and will not be a secret.

The state's premier aquaculture industry is here. This summer, seventy-seven million seed oysters will be planted in Duxbury alone.

Fish, oysters, clams, and mussels filter the water for their food. A single adult oyster can filter as much as 50 gallons of water a day. Consumed radionuclides bioaccumulate as they move up the food chain to our dinner tables.

The fishing and aquaculture industries fear that dumping will contaminate the water, and millions of oysters, lobsters, mussels, clams, scallops, and fish. They rightfully believe that public perception of radioactive contamination of our waters could destroy a hundreds-of-millions-of-dollars aquaculture and other fishing industry.

Holtec's planned dumping can have similar serious impacts on many boat and marine industries, to say nothing of real estate, tourism, and our beaches, on which the livelihoods of our towns depend.

Our economic viability depends on the public believing that the waters in Cape Cod Bay and Plymouth, Duxbury, and Kingston Bays are clean. How many consumers might not buy our seafood because they fear it might contain long-lived and toxic radiation?

Dumping Is Not Safe: The NRC says that Holtec's dumping is safe. Not so, among other things, the NRC allowable release

- Ignores more recent scientific evidence showing much greater risk from radiation.
- Allowable doses focus only on cancer and underestimate its actual impacts. The increased risks to pregnant women and the embryo/fetus include early miscarriages, malformations, and genetic defects.
- Does not calculate harm to the wider population, only to an individual.

- Forgets that it is not possible to filter some very harmful radionuclides such as Tritium. And forgets organically bound tritium produces more serious health risks than tritiated water for the same amount of tritium intake
- Does not consider the economic or environmental effect of the release.
- NRC relies on what Pilgrim reports, and only reviews Pilgrim's discharge program and past releases annually. MDPH does not monitor the releases at all.

Holtec says that it is safe to dump one million gallons of radioactive contaminated water in the bay because it will be below NRC's allowed threshold. However, Ken Buesseler a radio-chemist from Woods Hole Oceanographic Institution (WHOI) who studies the fate of radioactive elements in the ocean, explained that it is not possible to determine the impact "Until we have an accounting of what different radioactive elements that will be released and their concentrations... actual values for the stored water today, by isotope, detection limit, volume." Buesseler explained "radioactive contaminants have vastly different fates in the ocean depending on their chemical nature. Some dilute and mix and are transported the same as water, like tritium. Others are more likely to be associated with marine sediments, like cobalt-60, and others accumulate in marine biota. Usually cesium isotopes and strontium-90 are of concern."

#### Circulation of Contaminants in Cape Cod, Plymouth, Kingston, Duxbury Bays

Cape Cod Bay is not a good place to dump one million gallons of radioactive contaminated water. An ocean currents expert at Woods Hole Oceanographic Institution (WHOI), Irina Rypina, explained the water would be trapped in the bay rather than filtering quickly into the ocean.

The shape of the land creates a semi-enclosed space. Whatever is put in the bay would stay there a long time and would not flush out quickly. She explained that a tracer released into Cape Cod Bay would recirculate and stay in the waters within the bay for a long time and then likely end up in the sediment on the ocean floor or on the beaches inside the bay. The same thing would happen to radionuclides and other contaminants in the released water, confirming the fears of fishing community and coastal property owners.

Daily tides will bring the contaminants into Plymouth, Kingston, Duxbury Bays, and likely up rivers such as Jones River, Eel, and Blue Fish Rivers, and into the march lands that are also semi-enclosed spaces.

These bays are rich in marine life and aquaculture. The bottom of the Bays supports huge populations of numerous kinds of invertebrates, most of which filter feed. The most abundant are various types of bivalve mollusks – oysters, (clams, and mussels. They filter out and consume huge amounts of phytoplankton, as well as bacteria and other particles, thereby making an enormous contribution to maintaining water quality. They remove microscopic food particles that risk being contaminated from Pilgrim’s releases. The radionuclides bioaccumulate as they move up the food chain. Studies have shown that an individual mussel or oyster can filter over a gallon of water per hour.

The following figures provided by the Massachusetts Water Resources Authority,<sup>57</sup> show circulation in Massachusetts and Cape Cod Bays.

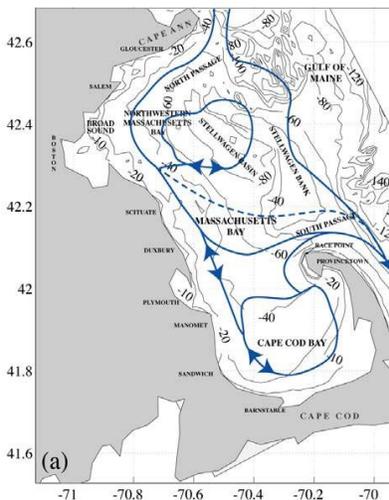


Figure 4-1 Summary of circulation within Massachusetts Bay (Lermusiaux et al. 2001.)

<sup>57</sup> Physical and Biological Oceanography of Massachusetts, Wendy Leo, Rocky Geyer, Mike Mickelson [http://www.mwra.state.ma.us/harbor/enquad/pdf/ms-085\\_04.pdf](http://www.mwra.state.ma.us/harbor/enquad/pdf/ms-085_04.pdf)

The dispersion of discharges also varies seasonally as shown in Figure 4-12 below.

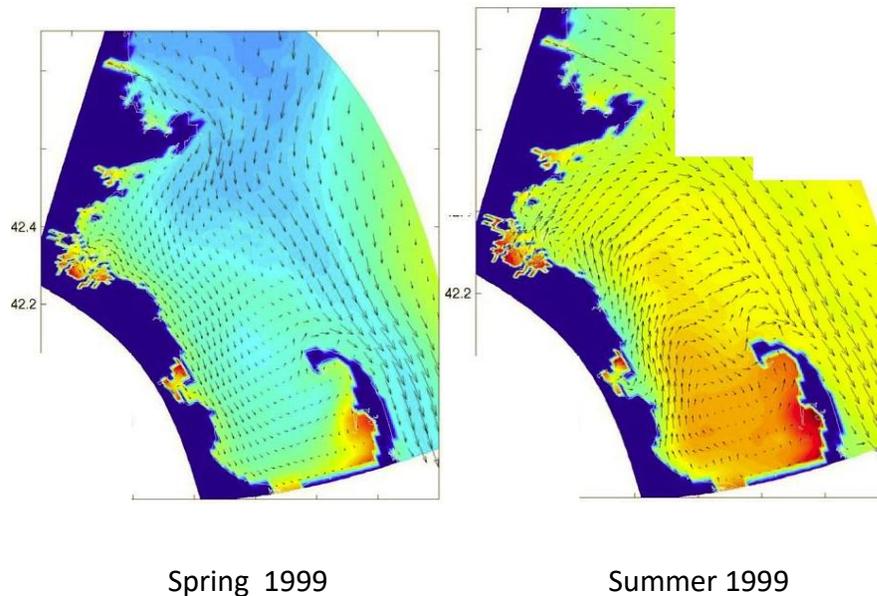


Figure 4-12 Modeled surface temperature and circulation patterns in spring 1999 (top panel) and summer 1999 (bottom panel) showing northward flow along the coast (figure courtesy Mingshun Jiang, UMass/Boston.) Color shows surface temperature (4-8 C in spring, 10-20 C in summer).

**Commonwealth’s Authority to stop Dumping:**

The NRC does NOT have exclusive authority over all nuclear reactor issues. The Commonwealth CAN prevent Holtec’s planned dumping – but it will cost all parties monies that could be avoided by changing the decommissioning rules to require a NEPA at the beginning of the decommissioning process and NRC approval of the decommissioning plan.

**PARTICIPATION:**

The rule does nothing to increase state, local government, and the public’s involvement in decommissioning decision making. As a result, site specific knowledge is missed. Each site has a unique operational history; unique geographic setting; unique demographics-no decommissioning rule nor generic environmental impact statement fits all.

Respectfully submitted, August 22,2022

Mary & James Lampert

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