

Pilgrim Nuclear's Toxic Waste Problem

Closing Pilgrim Nuclear solves only one of our largest safety issues.

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Almost 400 years ago, the Pilgrims landed on the eastern shore of Cape Cod Bay, met the Wampanoag Tribe, and settled in Plymouth on the mainland side of Cape Cod Bay. At about the same time, the Navajo Tribe was settling the lands of Arizona, New Mexico and Utah.

That seems like a long time ago, but it isn't when compared to the 10,000-year and more half-life of the radioactive fuel from a nuclear reactor.



What is this radioactive fuel and where does it come from?



Uranium mine on Navajo reservation

The Navajo know only too well the answers. From the end of World War II to 1986, uranium companies, under license from the US Government, mined the Navajo lands, creating more than 500 radioactive mine waste dumps. This resulted in drinking water sources with elevated levels of uranium, radium and other radionuclides that caused many Navajo deaths from cancer. The Navajo call uranium ore in the ground “yellow dirt” and now describe it as a “monster.” The Navajo gave the monster the name *Leetso*¹ and regret ever having helped the US Government mine uranium and release it from the earth. The US Environmental Protection Agency is now treating the mines and waste under the *Superfund* toxic waste

program, and the US Congress in 1990 passed the Radiation Exposure Compensation Act to help compensate mining victims. Nearly \$2 billion has been paid out in compensation to date. In 2014, the Federal Government also reached a \$5 billion legal settlement for the cleanup of thousands of long-contaminated sites².

Mined uranium³ is processed and then concentrated to form fuel rods for nuclear reactors. The uranium rods, when close together in the reactor, create intense heat; One-third of that heat generates electricity – the other two-thirds heats the environment.

As the rods build up fission byproducts (split and changed atoms) they become less efficient in generating heat. Every two years, the operator removes the oldest third of the fuel from the reactor and replaces it with new rods. This waste fuel, still highly radioactive and intensely hot from radiation⁴, is then stored onsite indefinitely.

What about the fuel at Pilgrim Nuclear?

Yes, the Navajo monster *Leetso* still lives above ground in Plymouth at Pilgrim Nuclear Power Station. After 42 years of accumulated spent radioactive rods, the many hundreds of tons of radioactive waste from the uranium fuel poses a threat to our safety, and it threatens to haunt us for hundreds of generations into the future.

Pilgrim Nuclear was commissioned in 1972, early in the age of civilian nuclear power, and has the same design model as the failed reactors at Fukushima, Japan. A lot of water has flowed over the nuclear fuel rods since 1972 and nuclear power is not as clean nor so safe as originally thought. In fact Pilgrim Nuclear has pumped and heated almost the entire volume of Cape Cod Bay since its creation in order to get rid of the excess heat constantly produced by the nuclear chain reaction. One can imagine the effect on the marine life.

During the 1980's, Pilgrim was plagued by technical and managerial problems:

“In 1982 the Nuclear Regulatory Commission (NRC) hit the company with the largest fine it had ever imposed, \$550,000, for a litany of management and physical problems at the facility. Boston Edison spent \$300 million on upgrades at the plant, but malfunctions continued to plague Pilgrim... In 1986 the NRC called Pilgrim one of the six worst-managed nuclear plants in the United States, and Boston Edison was forced to shut the plant down to make wholesale improvements.”⁵.

Boston Edison operated Pilgrim until 1999 when it sold the reactor to Entergy Corp.⁶ of Louisiana for a relatively small sum (\$14 million plus \$67 million for fuel.) The cost to build Pilgrim would be well over 100 times what Entergy paid for the reactor⁷. Entergy knew it was getting a “used car” for cents on the dollar. But it probably figured it could easily get its money back after a few years of operation, even if it had to put in money for repairs.

Pilgrim still has one of the worst track records for maintenance problems among the more than 100 nuclear reactors in the U.S.⁸ Nonetheless, Pilgrim's license to operate was renewed for an additional 20 years by the NRC in 2012.

Two sides of Pilgrim's activities create a risk for eastern New England's population.

- The nuclear reactor itself could seriously malfunction
- Radioactive spent nuclear fuel⁹ could have a cooling problem and catch fire

Each of these is a distinct risk/failure mode; and yet, each could result in the deadly release of radioactive materials into the air and water. As demonstrated in Fukushima in 2011, reactor core meltdown and spent fuel storage, both can be affected by a severe

climatological event, giving proof that these two major risks are, indeed, linked. Either type of accident could lead to the other since the radiation fields would prevent access to the equipment.

The catastrophic nuclear meltdown is burned into our consciousness by movies and documentaries. These images are what we readily associate with a nuclear catastrophe, whether at Pilgrim or other "nukes."

But even if Pilgrim were to be shut down, wouldn't the spent fuel storage issue still remain so long as it is on-site?

The "half-life" of spent fuel is on the order of 10,000 years and more¹⁰. This is to say that in 10,000 years, the radioactivity would decay slowly to about half of what it is now. Some ingredients in the spent fuel decay more quickly; some decay more slowly, such as Plutonium-239, which has a half-life of 24,000 years. Some isotopes contained in high-level wastes can take hundreds of thousands of years¹¹ to decay.

Ten thousand years is 400 generations of area residents who will live with a continued risk even after shutdown. On Cape Cod alone, there are approximately 215,000 residents. Include residents within ten miles of the reactor and the total number is over 320,000. Four hundred generations of residents with no growth in population will mean that more than 100,000,000 human beings will be exposed continuously to risks over their lifetimes.

**How will the risks of storage for spent nuclear fuel be solved?
Who will protect us?**

Are we now being asked to trust a corporation of only four generations since 1913, headquartered in New Orleans, to ensure the future safety of more than 100 million people across more than 400 generations?

Entergy, in effect, says, "No, don't look to us for long-term solutions, since storing spent fuel is not our responsibility – that's the responsibility of the U.S. Department of Energy (DOE)." The 2013 Entergy Corp. annual filing with the U.S. Securities and Exchange Commission states,

"Under the Nuclear Waste Policy Act of 1982, the DOE is required, for a specified fee, to construct storage facilities for, and to dispose of, all spent nuclear fuel and other high-level radioactive waste generated by domestic nuclear power reactors. Entergy's nuclear owner/licensee subsidiaries provide for the estimated future disposal costs of spent nuclear fuel in accordance with the Nuclear Waste Policy Act of 1982. The affected Entergy companies entered into contracts with the DOE, whereby the DOE is to furnish disposal services at a cost of one mill per net kWh generated and sold after April 7, 1983, plus a one-time fee for generation prior to that date.

Entergy accepted assignment of the Pilgrim, FitzPatrick and Indian Point 3, Indian Point 1 and 2, Vermont Yankee, Palisades, and Big Rock Point spent fuel disposal

contracts with the DOE held by their previous owners. The previous owners have paid or retained liability for the fees for all generation prior to the purchase dates of those plants."

Simply put, Entergy is saying the responsibility is DOE's, since Entergy is paying the fee per the law. In fact, in 2013 Entergy received \$72 million from the U.S. Department of Energy as a result of litigation regarding the storage of spent nuclear fuel.

If not Entergy Corp., who will keep us safe for the next 10,000 years?

Decades ago, the Federal Government wisely realized that spent nuclear fuel posed many risks, including the risk that plutonium could be used to make bombs as well as the public safety risk of an accident or fire. For those reasons, in 1982 the 97th United States Congress, under bi-partisan leadership of Tip O'Neill and Howard Baker, passed the Nuclear Waste Policy Act¹² to create two sites under Federal responsibility where spent fuel would be stored and discarded. Nuclear reactor operators would pay for this storage via a fee levied on their electricity generated. In effect, operators would "outsource" this storage problem to the Federal Government.



Yucca Mountain entrance

After years and billions of dollars for study, Yucca Mountain in Nevada was chosen as the first site. It is an uninhabited desert site next to the nuclear test range 90 miles from the nearest city. In 1987, Congress amended the Nuclear Waste Policy Act to designate Yucca Mountain, Nevada, as the only site to be characterized as a permanent repository for all of the nation's nuclear waste.

Then the Federal Government is responsible for storage and safeguards?

DOE proceeded to continue planning for the Yucca Mountain site, and the nuclear industry continued to operate with that plan in mind. By 2008, Yucca Mountain was one of the most studied pieces of geology in the world¹³; between geologic studies and materials science¹⁴ the United States had invested \$9 billion in the project. Studies and scientific work have indicated that Yucca Mountain is an ideal location for a high-level nuclear waste repository: a repository in the desert, under a mountain, on over 15,000 square miles of Federal land¹⁵ next to the nuclear weapons test site¹⁶, used as recently as 2012.



1951 test at Nevada Test Site

But, Harry Reid, the senior Senator from Nevada, naturally opposed the site in his state and worked behind the scenes to stop it. Gregory Jaczko served as Appropriations Director for Harry Reid and as Reid's science policy advisor. At age 34, Jaczko was sworn in as a Commissioner of the Nuclear Regulatory Commission in 2005.¹⁷

In 2008, Candidate Obama campaigned in Nevada and supported closing the Yucca Mountain site. On Nov 5, 2008 "Barack Obama won Nevada's 5 electoral votes in another battleground state victory" and clinched the presidential election¹⁸. In May 2009, then President Obama designated Gregory Jaczko the NRC's Chairman.

In September 2010, the NRC led by Jaczko ordered the Yucca Mountain license review halted, executing Obama's and Reid's goal of stopping the project.¹⁹ According to Harry Reid's web site,²⁰

"Nevadans are overwhelmingly opposed to dumping nuclear waste in Yucca Mountain, and they can rest safely now that the Obama Administration has put the project to rest.

The Yucca Mountain project no longer receives any federal funding, the Department of Energy's (DOE) Yucca Mountain project office has been closed, and the Nuclear Regulatory Commission has discontinued its review of the application to begin construction at Yucca Mountain."

Needless to say, this put a monkey wrench in the works after 28 years of study and planning. The 1982 law still places responsibility with the Federal Government, and the nuclear operators are still paying fees for that disposal service and planning to ship their spent fuel to the Federal storage site.



If not Yucca Mountain, then where?

The next step was to appoint a Blue Ribbon Commission²¹ to study the problem. So that Commission was formed and gave its report in January 2012. Basically the report "did not render an opinion on the suitability of the Yucca Mountain site or on the request to withdraw the license application for Yucca Mountain."²² Rather, it suggested that states and tribes should step forward and bid to become a disposal site, with incentives to do so. The L.A. Times wrote,²³

"The Obama administration created a blue-ribbon panel to find an alternative to Yucca Mountain, and in 2012 it recommended that the federal government create an "interim" storage facility somewhere in the nation for the nuclear waste, while it begin an entirely new political process to find a permanent site."

Meanwhile, the closing of Yucca Mountain was in violation of the law,²⁴ so the Courts got involved. In August 2013 the D.C. Circuit Court required the project move forward in accordance with the law. The L.A. Times wrote,²⁵

"The Nuclear Regulatory Commission is 'flouting the law' by not conducting a licensing review of the proposed Yucca Mountain nuclear waste dump in Nevada, a federal appeals court said Tuesday [Aug 13, 2013].

The ruling was a victory of sorts for those who want the proposed dump to open but may have little practical impact in the long-running dispute over Yucca Mountain. The Obama administration and Senate Majority Leader Harry Reid hope to kill the project.

The appeals court, in a 2-1 decision, said the NRC must resume a review of the license application, even though the agency has only enough funding for several weeks of technical work on the license."

There are now squabbles over *if* and *how* to fund the project. The L.A. Times wrote,

"Reid, a Nevada Democrat who has led the fight to kill Yucca Mountain, dismissed the importance of the ruling at an energy conference he sponsors in Las Vegas.

'The fact is, they have no money,' Reid told reporters. *'The place is locked up, it's padlocked. Nothing is happening with Yucca Mountain.'*

The federal government is legally obligated to take the waste from nuclear plants across the nation, which have accumulated so much waste that they could just about fill all of Yucca Mountain if it were opened today. So far, electricity consumers of nuclear power plants have paid \$35 billion into a trust fund to use for nuclear fuel disposal, and the delays have triggered another area of litigation that has cost the federal government millions of dollars."

So where are we now – back to square one?

The NRC has instructed nuclear operators they will have to store spent nuclear fuel on site, pending a resolution. Meanwhile, all the spent fuel accumulated over the years would fill Yucca Mountain, necessitating a second site to have been started already.²⁶ Since they have no place to which to ship it, the operators are putting the fuel into "interim" storage. The NRC recently has decreed that doing so is safe. According to the Cape Cod Times,²⁷

"The Nuclear Regulatory Commission approved a final rule Tuesday [August 26, 2014] that essentially concludes nuclear waste can be stored on-site for 160 years or more after a reactor has shut down.

While the rule is not meant to 'authorize or permit nuclear power plant licensees to store spent fuel for any length of time,' the NRC's press



Spent Nuclear Fuel Storage at Connecticut Yankee

release says, 'the accompanying environmental impact statement concludes nuclear waste can be safely stored in pools for several decades and in cement or steel casks for a longer period, even permanently should a deep geological repository never be built.' "

Harry Reid and Barack Obama say it's not safe to store nuclear waste 1000 feet under a heavily guarded Yucca Mountain, yet the NRC says it's now safe to store it outside only 25 feet above Cape Cod Bay in Plymouth²⁸.

Not only Pilgrim Nuclear, but 62 nuclear sites (35 have two or more reactors)²⁹ in the U.S. also become new terrorist targets for a very long time. So safety cannot be measured just environmentally or in terms of public health.

Where are we headed?

Fast-forward 17 years into the future and Pilgrim's license is nearing its expiration. Before then it's possible that Entergy Corp. will decide to close it, either for economic or public safety reasons.³⁰ At least then the movement of nuclear fuel through the reactor would stop.

Entergy would be responsible for "mothballing" the reactor, per the terms of its license, but it will not be responsible for storing indefinitely the pools of spent radioactive fuel that accumulated over the prior 60 years of operation. In effect, Entergy has said when it closes Vermont Yankee, it will leave the keys at the gate, with the Federal Government, which then will be in charge of the nuclear fuel storage for many, many centuries:

"The fuel will remain onsite in dry casks until it is removed by the federal government in accordance with its legal obligations".³¹

Fortunately, progress has been made in cost-effective clean and renewable energy production. So at least there is a safe alternative to replacing Pilgrim's electricity generation, which is only 2% of the region's total electric generation capacity.³²

But Eastern Massachusetts residents will live with the Navajo uranium monster *Leetso* in our midst for the foreseeable future, as the toxic radioactive waste storage problem continues to be the proverbial can kicked down the road with no end in sight.

Pilgrim's storage facility for that waste will have to be maintained, monitored and guarded for thousands of years, at a cost of millions of dollars per year. All expenses paid by the taxpayers -- in effect, a perpetual subsidy to Pilgrim Nuclear. It's like a pension fund for zombies. That equates to a huge unfunded liability of billions of dollars for future costs, many times more than the dollar total to build Pilgrim Nuclear in the first place.

As the blizzards of early 2015 demonstrated, residents continue to be put at risk with no effective emergency or evacuation plan. We are told Pilgrim is safe, but the reactor

is really safe only when it's shut down; and we won't be safe from the radioactive fuel waste until it's hauled away.

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¹ *Leetso, the Powerful Yellow Monster: A Navajo Cultural Interpretation of Uranium Mining* http://www.inmotionmagazine.com/hcare/db_npum.html

² About \$1 billion will address about 10 percent of the Navajo abandoned uranium mines. <http://bigstory.ap.org/article/feds-reach-515b-settlement-over-mining-cleanup>

Federal Actions to Address Impacts of Uranium Contamination in the Navajo Nation: <http://www.epa.gov/region9/superfund/navajo-nation/pdf/NavajoUraniumReport2013.pdf>

³ Today Kazakhstan is the largest uranium producer, followed by Canada, Australia, Niger, Namibia, Russia, Uzbekistan, and the USA. <http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Mining-of-Uranium/World-Uranium-Mining-Production/>

⁴ Standing near unshielded spent fuel could be fatal due to the high radiation levels. Ten years after removal of spent fuel from a reactor, the radiation dose 1 meter away from a typical spent fuel assembly exceeds 20,000 rems per hour. A dose of 5,000 rems would be expected to cause immediate incapacitation and death within one week.

http://en.wikibooks.org/wiki/Radioactive_Waste_Management/Spent_Nuclear_Fuel

⁵ Boston Edison Company History <http://www.fundinguniverse.com/company-histories/boston-edison-company-history/>

⁶ <http://en.wikipedia.org/wiki/Entergy>

⁷ see <http://www.eia.gov/forecasts/capitalcost/> Capital Costs estimated in 2012 dollars to be \$5,530 per kW, putting Pilgrim's 685 MW at \$3.8 billion.

⁸ Among the nine worst in 2013 per the Cape Cod Times <http://www.capecodonline.com/apps/pbcs.dll/article?AID=/20140814/NEWS/140819687/-1/NEWS39>

⁹ <http://www.nrc.gov/waste/spent-fuel-storage.html>

¹⁰ <http://www.scientificamerican.com/article/nuclear-waste-lethal-trash-or-renewable-energy-source/>

¹¹ <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/radwaste.html>

¹² http://en.wikipedia.org/wiki/Nuclear_Waste_Policy_Act

¹³ "References cited by U.S. Department of Energy for Yucca Mountain License Application". United States Nuclear Regulatory Commission. 2012-03-29. Retrieved 2014-03-07. Wikipedia™:

http://en.wikipedia.org/wiki/Yucca_Mountain_nuclear_waste_repository_-_cite_note-21

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- ¹⁴ McCright, R. Daniel (1997-04-01). "[Engineered Materials Characterization Report for the Yucca Mountain Site Characterization Project: Volume 3 Revision 1](#)". Lawrence Livermore National Laboratory. Retrieved 2014-03-07. Wikipedia™: [http://en.wikipedia.org/wiki/Yucca Mountain nuclear waste repository - cite note-21](http://en.wikipedia.org/wiki/Yucca_Mountain_nuclear_waste_repository_-_cite_note-21)
- ¹⁵ <http://www.nellis.af.mil/library/factsheets/factsheet.asp?id=18506>
- ¹⁶ [http://en.wikipedia.org/wiki/Nevada Test Site](http://en.wikipedia.org/wiki/Nevada_Test_Site)
- ¹⁷ [http://en.wikipedia.org/wiki/Gregory Jaczko](http://en.wikipedia.org/wiki/Gregory_Jaczko)
- ¹⁸ <http://usatoday30.usatoday.com/news/politics/election2008/nv.htm>
- ¹⁹ <http://articles.latimes.com/2013/aug/13/nation/la-na-nn-yucca-mountain-nuclear-waste-20130813>
- ²⁰ <http://www.reid.senate.gov/issues/yucca>
- ²¹ <http://cybercemetery.unt.edu/archive/brc/20120620211605/http://brc.gov/>
- ²² http://cybercemetery.unt.edu/archive/brc/20120620220845/http://brc.gov/sites/default/files/documents/disposal_report_updated_final.pdf
- ²³ <http://articles.latimes.com/2013/aug/13/nation/la-na-nn-yucca-mountain-nuclear-waste-20130813>
- ²⁴ <http://articles.latimes.com/2013/aug/13/nation/la-na-nn-yucca-mountain-nuclear-waste-20130813>
- ²⁵ <http://articles.latimes.com/2013/aug/13/nation/la-na-nn-yucca-mountain-nuclear-waste-20130813>
- ²⁶ <http://www.nytimes.com/cwire/2009/05/11/11climatewire-the-screw-nevada-bill-and-how-it-stymied-us-12208.html?pagewanted=all>
- ²⁷ <http://www.capecodonline.com/apps/pbcs.dll/article?AID=/20140827/NEWS/408270303/-1/NEWS39>
- ²⁸ <http://www.pilgrimpower.com/dry-fuel-storage.html>
- ²⁹ <http://www.eia.gov/tools/faqs/>
- ³⁰ Entergy decided in August 2013 to close down its [Vermont Yankee nuclear reactor](#), citing maintenance costs and low wholesale energy prices. Vermont Yankee and Pilgrim are both single-reactor sites with boiling water reactors of similar design. Source: <http://www.patriotledger.com/article/20130928/News/309289814/>
- ³¹ <http://www.entergy.com/vy/>
- ³² Boyle, Brian E. (2015-05-29), Getting Along Without Pilgrim Nuclear <http://capedownwinders.org/wp-content/uploads/pdf/GettingAlongWithoutPilgrim150529.pdf>