Economic Impact on Massachusetts of a Nuclear Accident

A Trillion Dollar Risk

October 31, 2015 | by Brian E. Boyle, Ph.D.

Summary

If Pilgrim Nuclear Power Station (PNPS) were to have an accident, the economic impact in Massachusetts could be on the order of $1 trillion and more. The radioactive plume from Fukushima's nuclear accident in Japan in 2011 carried significantly farther than 50 miles. Three-quarters of the state's economy and property value lies within 50 miles of PNPS, which the US Nuclear Regulatory Commission (NRC) has now listed at the lowest of its operating reactor ratings. PNPS is also the same reactor design as the one in Fukushima.

Massachusetts Senate Bills S.1797 and S.1798 are several measures that can be taken now to mitigate the economic risk.

S.1797 would help address the tons of radioactive nuclear fuel, accumulated from 43 years of operation and now stored in an overcrowded pool of water in the attic above the reactor. When moved to air-cooled dry storage casks on the ground and away from the reactor, the fuel won't catch fire and create a radioactive plume if PNPS loses electric power to run its water-cooling pumps. Last winter it lost power during a storm, and had to rely on backup diesel generators.

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S.1798 helps fund the timely dismantling of the PNPS site at the expense of the owner and not the taxpayer. As long as the site is not properly decommissioned, the risk of accident remains, along with the devastating economic consequences. And without the remediation of the site, it cannot be used for other productive purposes.

How property values are hurt

Have you ever tried to sell a house with "problems?" Buyers avoid a house with any of these, and other, chronic problems:

- Mold
- Termites
- Lead Paint
- Radon

In most towns, these must be disclosed by a Seller to a potential Buyer. Imagine your house with concentrations of Radon gas inside. Once realtors brand a property as "a problem" they stop showing it to their Buyers and it sits on the market unsold.

Houses within the nuclear accident radiation plume

Now imagine that your house was within the radiation plume of an accident at Pilgrim Nuclear. That plume would likely deposit radioactive particles on your house and land. How would that affect the economic value of your property, most likely your largest asset? Keep in mind that homeowner insurance policies exclude loss from nuclear accidents.

The radiation falling on your property would originate from the Uranium fuel rods that are used to power the reactor. These rods are used for 6 years to produce heat and electricity, but still are incredibly hot and very, very radioactive. They are then removed and stored in a pool of water above the reactor. PNPS has over 3000 of these used rods containing tons of Uranium. In addition to Uranium, they also contain material that once was Uranium but was transformed into other radioactive elements during the nuclear fission reaction, such as Caesium-134/137, Iodine-131, Strontium-90, and Plutonium isotopes.

Hot air from a fire or explosion, such as the one at Fukushima in Japan, will carry this material in the form of radioactive particles in a plume across the countryside, until it falls on the land below. The level of radiation would generally depend on how far from PNPS you live, and how the winds blew on the days after the accident. In Fukushima, the radioactive plume carried over 100 miles.

The radioactive particles include a number of highly radioactive atomic elements. These particles decay very slowly, and can remain radioactive for centuries and much longer. More than 10,000 years is the length of time that radioactivity will be present and dangerous.

How does this relate to Radon?

Left on its own, without being bombarded by neutrons inside a nuclear reactor, Uranium will eventually decay into Thorium, which in turn will decay into Radium. Radium in turn decays into Radon gas, which can be found in some soils and accumulate in houses. So the Radon we test for when selling or buying a house is the great-grandchild of Uranium nuclear reactor fuel.

Whether it is Uranium and related radioactive particles, or Radon, both emit radiation.

How much stronger is Uranium-fission radiation than Radon?

Radiation levels are commonly measured in millisieverts per hour, abbreviated mSv/h. Household Radon can be found at levels of approximately 0.001 mSv/h.

Using Fukushima as a model, radiation levels from a nuclear accident can occur on the order of 0.005 to 0.05 mSv/h in the countryside[1]. This is 5 to 50 times higher than naturally occurring Radon levels.

How big a problem would this be for my house?

So after an accident at Pilgrim Nuclear that exposes a property, it will be dramatically more radioactive than if it failed a Radon test.

Needless to say, this property would have a new "problem" and would not sell. It would remain on the market until after the radiation decays. But the radiation will last much, much longer than the materials used to construct a house. So the prognosis of the uninhabitable house is a slow deterioration over time.

This in effect would render the property worthless. In some cases, it might be possible to remediate the problem, but this would be expensive and trained workers to perform such an onerous task would be in extremely short supply. Furthermore, the home would then be tainted for a considerable length of time as having been radioactively contaminated. Homeowner insurance policies do not cover nuclear accidents, so the homeowner would suffer the entire loss[2].

What would be the economic impact on the town?

With property values falling so dramatically, property taxes would all but dry up. Since this is the main revenue source for town government services, that funding would be significantly curtailed, causing mass layoffs and elimination of services. Surely private sector economic activity in the town would grind to a halt.

What would be the economic impact on Massachusetts?

According to the Federal Reserve Bank, in 2014 the Total Gross Domestic Product for Massachusetts was $460 billion[3]. Property values for the entire state are on the order of $1 trillion[4]. GDP and Property Values together total about $1.5 trillion.

The great majority of the economic activity and property value resides in Eastern Massachusetts, well within range of Pilgrim Nuclear in Plymouth.

As shown in the table below, 8 of 14 county seats are in eastern Massachusetts and within 50 miles of PNPS. These 8 counties contain 75% of the population, and even more of the household income. It would be reasonable to assume that they also contain three-quarters of the GDP and property values.

Massachusetts Counties **(in order of proximity to Pilgrim Nuclear Power Station)**

County	2012 Census Population	% of total	Median Household Income	County Seat	Miles to PNPS
Plymouth	498,393	7.5%	$74,722	Plymouth	0
Barnstable	214,947	3.2%	$60,424	Barnstable	22
Bristol	550,856	8.3%	$55,995	Taunton	27
Suffolk	746,039	11.2%	$52,700	Boston	35
Norfolk	682,078	10.3%	$84,087	Dedham	36
Dukes	16,834	0.3%	$65,896	Edgartown	38
Middlesex	1,537,149	23.1%	$81,420	Cambridge	39
Essex	755,970	11.4%	$66,918	Salem	42
SUBTOTAL	**5,002,266**	**75.3%**			**<50**
Nantucket	10,241	0.2%	$83,546	Nantucket	51
Worcester	805,353	12.1%	$65,968	Worcester	66
Hampden	465,997	7.0%	$49,729	Springfield	104
Hampshire	159,791	2.4%	$61,264	Northampton	108
Franklin	71,535	1.1%	$53,298	Greenfield	112
Berkshire	130,120	2.0%	$47,513	Pittsfield	141
TOTAL	**6,645,303**	**100.0%**	**$67,948**		

So three-quarters of our state's $1.5 trillion in GDP and property values could be significantly damaged by an accident at PNPS.

We have an uninsured $1+ Trillion risk.

How can we mitigate this risk?

1. Move the over 3000 highly radioactive fuel rods out of the water pool in the reactor's attic and into relatively safer air-cooled dry storage casks. This will help prevent a fire or explosion that could create a radioactive plume.

The more fuel rods that are moved to dry cask storage means the fewer number of rods that will be left in the pool, and the smaller the potential radioactive release due to a spent fuel pool accident.

Massachusetts **Senate Bill S.1797** establishes a fee on the storage of spent nuclear fuel left in pools, thereby providing an incentive to reduce the number of spent nuclear fuel assemblies not moved to dry casks.

2. Accelerate the decommissioning of PNPS to reduce these economic risks as quickly as possible. Ensure this effort is adequately funded before PNPS stops operation so the decommissioning can occur soon thereafter, before the trained workforce finds employment elsewhere.

   The Nuclear Regulatory Commission[5] provides, in their words, only a "generic decommissioning estimate," and doesn't require a site-specific funding estimate. Generic costs understate the cost of work of this nature in New England. Not only are our electricity costs higher in New England, so are our costs of dismantling a nuclear reactor. Vermont Yankee Nuclear Power Station provides a much more comparable estimate of dismantling costs. Reports from Vermont Yankee indicate that the Pilgrim Nuclear decommissioning fund is at least $500 million short.

   Mothballing PNPS using the innocuous sounding "SAFSTOR" or "deferred dismantling" process[6] as the NRC calls it, without proper decommissioning activities, can leave the risks in place for up to 60 years. The real hope underlying such a process is that an underfunded decommissioning trust fund will grow faster than the cost of dismantling and eventually catch up to it. But with interest rates at an historic low, the trust fund growth will be modest. And with the labor of dismantling being a highly technical skill, it is likely to escalate quickly. For example, Vermont Yankee's cost estimate grew 70% between 2007 and 2014. So the more time that passes, the larger the deficit will likely grow between the trust fund balance and the real cost of dismantling.

   The recent letter to the NRC signed by all 11 members of the Massachusetts delegation to the US Congress asks to "ensure the adequacy of Entergy's decommissioning fund for Pilgrim in order to enable the quick decommissioning and remediation of the site so it can be used for other purposes."

   Massachusetts **Senate Bill S.1798** establishes funding to provide for postclosure activities, thereby helping insure a more timely decommissioning process and reducing the economic risks. It further provides for cleaning up the Pilgrim site so that it can be used safely by future generations, and not just become an unusable radioactive landfill for centuries.

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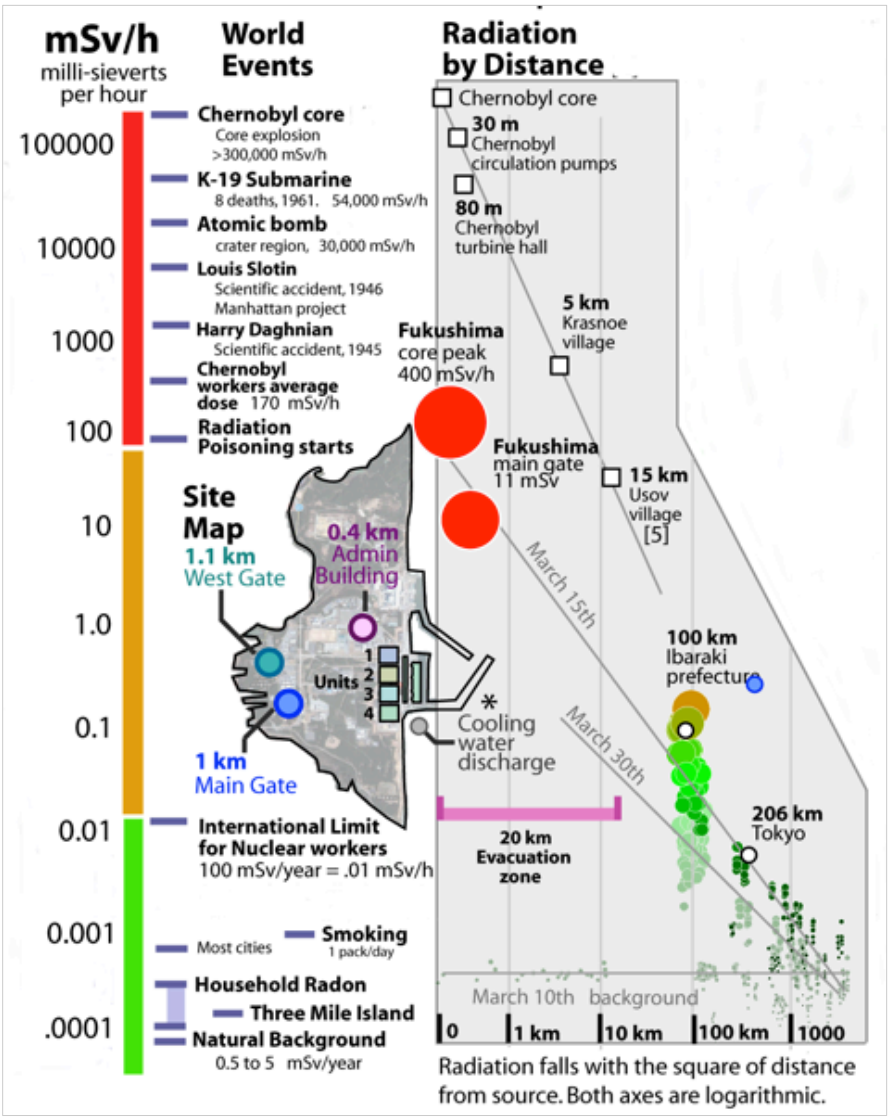
Endnotes

[1] Figure 1 – Radiation Levels Comparison



Source:
Dr. Rama C. Hoetzlein

http://www.rchoetzlein.com/website/fukushima/

http://elements.geoscienceworld.org/content/7/2/77.full.pdf

https://commons.wikimedia.org/wiki/File:Fukushima7.png

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[2] http://www.insure.com/home-insurance/exclusions.html
Q: A nuclear power plant problem irradiated my home. Are my home and possessions covered?
A: No. Nuclear accidents are a standard exclusion.

USAA Homeowners Policy: “We Do Not Pay For Nuclear Losses Or War Losses”

[3] https://research.stlouisfed.org/fred2/series/MANGSP

[4] Extrapolated from an analysis of assessed values at 6 cities and towns totaling 14% of the state’s population, plus an allowance for 15% of additional value of property held by tax-exempt entities.

Sample Towns in the Commonwealth of Massachusetts:

Town of **Winthrop** 2006
Total Value of Real Estate = $2,024 million (per 2006 Annual Report) Population 17,497 (2010 Census)

Town of **Needham** FY2007
$ 92,034,843 Total Expenditures; $7,042 million Total Assessed Value

Town of **Salem** 2014
$ 167,594,234 Total Expenditures; $3,963 million Total Assessed Value

Town of **Truro** 2014
$ 17,298,058 Total Expenditures; $2,084 million Total Assessed Value

City of **Worcester** 2013/14
$ 800,933,000 Total Expenditures; $11,030 million Total Assessed Value

City of **Boston** 2014
$ 2,745,693,000 Total Expenditures; $ 99,832,813,000 Total Assessed Value
http://www.cityofboston.gov/images_documents/F_243589_14_CityofBoston_CAFR_US_tcm3-49432.PDF

Also, in 2006 a report was prepared for the MA Attorney General studying this issue. See: *Report To The Massachusetts Attorney General On The Potential Consequences Of A SpentFuel-Pool Fire At The Pilgrim Or Vermont Yankee Nuclear Plant*. Jan Beyea, Ph.D. May 25, 2006 Available at: http://www.madownwinders.org/wp-content/uploads/2006May25_Beyea_Pilgrim_Vermont_Yankee_Report_MassAG.pdf

This report used a figure of $132,000 in property value per capita in the U.S. Given a population of 5 million within 50 miles, would imply $660 billion in property values in that area, if the US average was used. Eastern Massachusetts property values are significantly higher than the U.S. average, and 9 years of property value increases have occurred since the report. In addition we know have the benefit of seeing the effect of an actual radioactive plume on the Fukushima countryside. This substantiates the approximate $1,000 billion estimate in current property value.

[5] Nuclear Regulatory Commission website excerpt:
http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/decommissioning.html#funds

Decommissioning Funds

Before a nuclear power plant begins operations, the licensee must establish or obtain a financial mechanism – such as a trust fund or a guarantee from its parent company – to ensure there will be sufficient money to pay for the ultimate decommissioning of the facility.

Each nuclear power plant licensee must report to the NRC every two years the status of its decommissioning funding for each reactor or share of a reactor that it owns. The report must estimate the minimum amount needed for decommissioning by using the formulas found in 10 CFR 50.75(c). Licensees may alternatively determine a site-specific funding estimate, provided that amount is greater than the generic decommissioning estimate.

[6] http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/decommissioning.html#discuss