RAS # J-144

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

Entergy Corporation

Pilgrim Nuclear Power Station

License Renewal Application

Docket No. 50-293

PILGRIM WATCH POST-HEARING FINDINGS OF FACT

CONCLUSIONS OF LAW

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June 9, 2008

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PRELIMINARY STATEMENT

Pilgrim Watch responds in compliance with 10 CFR § 2.1209 pursuant to the Board's order [ASLB No. 06-848-02-LR] issued May 12, 2008, *Setting Deadlines for Findings and Conclusions on Contention 1.*

The Order: The ASLB on October 17, 2007, December 19, 2007 and January 11, 2008 considerably narrowed the original order saying that: the only issue remaining before this Licensing Board regarding Contention 1 is "...whether Pilgrim's existing AMPs have elements that provide appropriate assurance as required under relevant NRC regulations that the buried pipes and tanks will not develop leaks so great as to cause those pipes and tanks to be unable to perform their intended safety functions."[1]

[1] Memorandum and Order, LBP-07-12, 66 N.R.C. (October 17, 2007) (Summary Disposition Order);Order Revising Schedule for Evidentiary hearing and Responding to Pilgrim Watch's December 14 and 15 Motions, LBP-06-848-02 N.R.C.(December 19, 2007); Order Denying Pilgrim watch's Motion for Reconsideration, LBP-06-848-02 NRC (January 11, 2008)

The Aging Management Program:[2] The Buried Piping and Tanks Inspection Program includes (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components are inspected when excavated during maintenance. If trending within the corrective action program identifies susceptible locations, the areas with a history of corrosion problems are evaluated for the need for additional inspection, alternate coating, or replacement. A focused inspection will be performed within the first 10 years of the period of extended operation, unless an opportunistic inspection (or an inspection via a method that allows assessment of pipe condition without excavation) occurs within this ten-year period.

Entergy and NRC Staff Conclude that the AMPs are Sufficient: Entergy's Pre-filed Testimony at 15, NRC's Pre-filed Testimony at 18, and both Entergy and NRC in statements at the April 10 Hearing incorrectly concluded that the AMPs alone are sufficient to manage aging of the buried pipes under consideration such that there is reasonable assurance that Pilgrim Station's buried pipes containing, or potentially containing, radioactive liquid will maintain their intended functions for the period of extended operation and will not develop leaks large enough to prevent the pipes from fulfilling their intended purpose.

Pilgrim Watch Concludes the AMPs are Insufficient and that neither Entergy nor NRC Staff Provided Requisite Proof (Facts) Required To Support Their Position: In contrast, Pilgrim Watch concludes from facts presented, and enumerated below, that neither the Aging Management Program for buried pipes and tanks, nor the inspections and tests performed as part of routine maintenance and operation, provide reasonable assurance that the effects of aging will be managed such that the buried pipes within scope and under consideration will perform their intended functions consistent with the current licensing basis for the period of extended operation. They are not sufficient [Tr. Exh. 13, Gundersen A-4]. Therefore in order to protect public safety, the aging management program must be enhanced or supplemented with a more

[2] Pilgrim Nuclear Power Station License Renewal Application, Technical Information Appendix A Updated Final Safety Analysis Report Supplement, Page A-14,A.2.1.2 Buried Piping and Tanks Inspection Program

robust inspection system, cathodic protection, a base line inspection prior to license extension, and an effective monitoring well program or the Application must be denied [Tr. Exh., Gundersen A-23]. The supplements described by Pilgrim Watch's experts speak directly to the question – they spell out what is missing from the AMP in order for it to be sufficient.

10 CFR § 54.4 Scope: The Board's majority chose a narrow interpretation of license review regulations. We believe that it was based upon an incorrect reading of 10 CFR § 54.4 [3] that Pilgrim Watch contends simply says how components are to be determined to be within scope; it is not a restriction on what can be looked at once they are determined to be within scope.

This narrow interpretation of 10 CFR § 54.4 drove the course of the April 10, 2008 Hearing; and it served to effectively restrict the aging management review of buried piping and tanks containing radioactive liquids to the Salt Water Discharge [SSW] piping and to whether simply that section of one buried component within scope could remain functional during a design-basis event [Transcript at pages 667, 670, 718-720, 739], as defined in 10 CFR 50.49 (b)(1)(i)) to ensure the capability to shut down the reactor and maintain it in a safe shutdown condition.

However, even keeping within this limited constraint Pilgrim Watch was able to demonstrate that both loops in the SSW discharge system had degraded simultaneously; one had a through-wall hole and the other wall thinning. There was no redundancy, defense in depth. Leaks can develop within two years of loss of liner integrity. No proof was provided by the Applicant that it could not happen again so that the piping could collapse in a design basis event, such as an earthquake. As a result, the flow path of the discharge piping would be blocked and the piping could not remove heat from the heat exchanger. [Transcript 610,615, 622, 625, 627,694-5, 697-8, 707,730-1]

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[3] 10 CFR § 54.4 reads: (a) Plant systems, structures, and components within the scope of this part are--(1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions--(i) The integrity of the reactor coolant pressure boundary;(ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or (iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of this chapter, as applicable.

Entergy and NRC Staff failed to provide facts to the contrary. It is Entergy, the Applicant, who bears the ultimate burden of proof in a licensing proceeding [*Metropolitan Edison Co. (Three Mile Island Nuclear Station, Unit 1),* ASLB-697, 16 NRC 1265, 1271 (1982), citing 10 CFR 2.325]. Entergy failed in its responsibility to prove by a preponderance of the evidence that its' aging management program [hereinafter "AMPs"] is adequate.

To manage internal and external corrosion at Pilgrim Station, Entergy's Initial Statement, at 9, explains that the following will be relied upon during license renewal: metals, linings, coatings, soil, and handling; the Buried Piping and Tanks Inspection Program; water chemistry and the service water integrity program; and additional monitoring programs for the SSW Systems.

Further, the Applicant claimed in their Initial Statement [at 15] that the "AMPs for those buried components within the scope of license renewal...are programs that have been shown to be effective by operating experience, the GALL report, and NRC Safety Review and thus provide reasonable assurance that such components will continue to perform their intended function during the period of extended operation."

Contrary to the Applicant's conclusion, Pilgrim Watch will demonstrate why these measures do not provide reasonable assurance. Entergy failed to provide sufficient facts indicating otherwise.

Pilgrim Watch's expert summarized our position that, "based upon my review of Pilgrim's AMP, it is my opinion that the applicant has not shown that the proposed AMP is adequate to assess and assure that underground piping and tanks will be able to withstand the stresses of an additional 20-year license extension." [Tr. Exh., 14, Gundersen at page 3]

Entergy's claim is baseless on a very fundamental level. No reactor has operated 40 years, 50, years, 55 years or 60 years. There is no operating experience to base reliable projections upon. And as far as operational experience at Pilgrim Station to date, it was described in the SER as "limited experience with the inspection of buried piping" [Tr. Exh., 19, SER at 3-37]; and, even that limited experience showed that corrosion, pipe failure, occurred.

Defense-in depth: Entergy's logic that only the AMP is needed contradicts the fundamental approach to safety in the nuclear industry, defense-in-depth. Time and again, defense-in-depth is used to provide layers. The intent is to provide numerous, highly reliable layers. When multiple

layers are provided with each layer having as few and as small holes as possible, the risk that all the holes line up to cause all layers to fail is minimized. But Entergy wants a single layer, the AMP. If the AMP were 100 percent reliable, a single layer would suffice. But the record is abundantly clear that the AMP is not 100 percent reliable. The NRC's generic communications program is filled with reports of AMP failures.[4] If the AMP were full-proof, the continual expansions and revisions to it would not be present. There have been continual revisions, so it is not full-proof.

Risk Management Problem: The issue that the parties must address and the Board must weigh is a risk management problem. Risk is the product of consequences and probability. The consequences are by definition of 10 CFR § 54.4 potentially very high; therefore to reach the conclusion of an unacceptable risk, the probability of the pipes failure occurring does not have to be great.

In order to assess the probability of the SSW pipe discharge failing so that its safety function cannot be achieved with reasonable assurance requires a factual analysis of the following.

- The probability of the SSW Discharge piping (metal, coating, and/or the liner) failing to such a degree to impact its safety function.
- The probability of a design basis event, such as a seismic event; and both trains of the SSW discharge collapsing and then blocking the flow path of the discharge piping so that the piping could not remove heat from the heat exchanger.
- The probability that SSW Discharge piping failure will be identified and prevented by the proposed Aging Management Program so that it can be fixed or repaired before total failure.

[4] See, for example: http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/2007/in200701.pdf ;http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/2004/in200409.pdf ;http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/2004/in200405.pdf

PROPOSED FINDINGS OF FACT

I. PROBABILITY OF THE SSW DISCHARGE PIPING (METAL, COATING, AND LINER) FAILING TO SUCH A DEGREE IT CANNOT SATISFY ITS SAFETY FUNCTION

1. Entergy failed to satisfy its burden of proving that the SSW Discharge piping will not fail in a design basis event over the relicensed period due to unidentified leaks and wall thinning in the carbon steel pipe.

The SSW Discharge Piping - Description

2. The SSW discharge piping is made up of 240' of 22" nominal diameter standard weight carbon steel piping with 3/16" natural rubber lining. The piping consists of two Loops, or piping sections, Loop "A" and Loop "B." [Tr., Sullivan 657]

3. The piping contains (3) 45-degree elbows, (1) 90-degree long radius elbow, and an elevation change of over 22 feet. Straight piping is less susceptible to failure than welds, elbows and dead spots. [Tr. Exh., 13,Gundersen, A-13]

4. The piping is coated; rubber lined (excepting 40 feet on each loop); and has a cured in place liner (CIPP) that was installed in Loop "A" in 2003 and Loop B in "2002."

5. The carbon steel pipe is the structural component of SSW Discharge piping system – not the coating or liners. Therefore it is the metal pipe that can/must provide assurance that the pipe will be able to perform its function in a design basis event – not the coating, rubber liner or CIP liner.

6. The coating does not have a specified life. Entergy's own disclosure, Exhibit 70[5] says that, "...since the *coating does not have a specified life*, aging effects are evaluated as if the quality of steel was not coated." [Emphasis added].

[5] Tr. Exhibit 70, Report, No. AMRM-II, the Aging Management Review of the Saltwater Service S, Rev. 1, November 2, 2007, page 10 [PILLR00000658].

7. The rubber interior liner does not have a specified life. Entergy's expert testified that it degraded in 20 years [Transcript, Spataro, page 861]; and it was removed from 40 foot sections on each SSW Discharge Loop.

8. The CIP liner is not credited with being the structural component, either. The carbon steel pipe, and not the CIP liner, is the structural component of the pipe. The liner is there to keep the water inside under normal service, as long as it maintains its integrity. It is not ductile, nor earthquake proof. It is not seismically qualified [Tr., 618].

9. The SSW Discharge pipe is not seismically qualified if it has through-wall leaks of undetermined size and locations; and/or the pipe wall has corroded so that it has minimum wall thickness of undetermined size and locations.

10. SSW Discharge Piping had deteriorated in both Loop "A" and Loop "B", simultaneously. Therefore there is factual evidence of no redundancy with both trains degraded [Gundersen, Tr., 696-97].

11. Leaks can develop in the SSW Discharge within (2) years of loss of liner integrity. The through-wall hole [Tr. Exh., 66, photographs] developed in the SSW discharge pipe within 2 years. Mr. Woods, Entergy's expert, said that, "In 1995, an inspection was done and noted a little bit of degradation on the existing rubber lining. And then it was determined to go ahead and do another inspection in 1997 to monitor that area. And that was okay at the time. And then we looked at it again in 1999 and found that the rubber lining had actually -- a portion of the rubber had delaminated and actually torn away from it and, as a result, had the through-wall leak. So at that point in time, we replaced that section of pipe." [Tr., 638, lines 12-21]

12. The other SSW discharge pipe loop had wall thinning, deterioration. Specifically, Mr. Woods, Entergy's expert, said that, "We did find one area of degradation approximately eight foot in from the very end of the discharge. UT readings were taken. And that was slightly below the min. wall." [Tr., 638]

13. The simultaneous deterioration in both SSW Discharge loops was *identified* after 27 years of operations. There was no proof provided by Entergy that deterioration had not started to occur before that time; nor was there evidence that deterioration had not occurred in areas not inspected. Corrosion can occur quickly. Dr. Davis, NRC's expert witness, said at the Hearing that, "It really doesn't matter much. Once the corrosion starts, it goes fairly quickly [Tr., 729].

14. Both the "A" and "B" Loops are made of carbon steel that will corrode if either the cured-in-place-pipe liner (hereinafter, CIPP) or coating fails. Facts describing carbon steel corrosion and the probability of coating and CIPP failure follow.

Material

15. To manage internal and external corrosion at Pilgrim Station, Entergy stated that they relied, in part, upon the carbon metal claiming that it is "corrosion resistant." [Entergy Initial Statement, 8] They provided no supporting evidence to support this claim. All metals, including carbon steel, corrode. [Tr. Exh.,21, Brookhaven Report at 26]

16. Entergy also claimed that the soil surrounding the piping was not corrosive. The evidence does not support this assertion. [Facts 32-52]

17. The evidence presented by Pilgrim Watch shows that piping material, carbon steel, like all metals corrodes; that Pilgrim's site specific environment is corrosive; and that the piping's shape contributes to its susceptibility to corrosion. The evidence presented by Pilgrim also raises a serious question, not addressed by Entergy, as to whether the piping was made of substandard parts [Pilgrim Watch Prefiled Testimony, 16]

Corrosion of Carbon Steel Piping

18. The piping is made of carbon steel, 3/8 inch thick. [Tr., 611, Sullivan]

19. Carbon steel corrodes. The fact that carbon steel fails, is discussed in the literature. The Brookhaven Report says that it can fail by localized corrosion phenomena which is accelerated by stress or may be initiated due to poor design, installation, or maintenance [Tr., Exh. 21 (Brookhaven Report) at 26].

20. There is site-specific evidence of carbon steel pipe corrosion in both the SSW Discharge and SSW Inlet piping.

21. Both Loops of the SSW Discharge simultaneously degraded [Transcript 697, Gundersen]

22. The SSW Inlet piping originally was made of carbon steel, the same material as the SSW Discharge, today; it is located in an identical hydro-geological environment, for all practical purposes. The SSW Inlet piping was replaced with titanium piping in 1993 because it had reached the end of its service life [Tr., 753-54, Judge Cole and Sullivan]. The pipe replacement occurred after 23 years of plant operations; we were not told exactly when it was installed; perhaps a couple of years prior to start up.

23. Entergy presented no evidence to show how soon deterioration began after installation, so the only safe assumption for the Board to make is that it began very soon thereafter. Entergy, and the NRC Staff SER, *opined* that the SSW inlet pipe's deterioration was due to corrosion of the rubber liner from salt water - it came from the interior. Here again, there is no proof; and absent evidence to the contrary the only safe assumption for the Board to make is that the corrosion could have resulted in part, large or small, from exposure to corrosive exterior factors. Corrosion occurs both on external and internal surfaces. [Tr. Exh. 14, Gundersen at 7.2]

Bath Tub Curve Aging of Old Pipe

24. The majority of the SSW Discharge piping is old. Two 40' sections of the SSW discharge were replaced in 1999 in both Loop A, that measures 240' overall and in loop B that measures 225' overall. The sections that were replaced were also made of carbon steel [Tr., 631, 637-9, Woods/Sullivan]. Therefore (16.66%) of loop "A" and (17.77%) of loop

"B" will be 13 years old in 2012; and (83% and 84%) respectively of the piping will be approximately 40-45 years old in 2012 and 60-65 years old at the end of the license extension.

25. Industry experience is absent for degradation of buried components at nuclear reactors this old. However reports of leaks from buried components at reactors around the country points to the strong correlation of aging and pipe degradation.[6]

26. NRC's GALL XI M28 (10) says that, "Operating experience: Corrosion pits from the outside diameter have been discovered in buried piping with *far less* than 60 years of operation." [Emphasis added]

27. Aging and corrosion are, as recognized by experts in the field such as the Brookhaven Report, a serious problem. [Tr. Exh., Gundersen A-12]. "The older the pipe is, the more likely it is that corrosion and leaks will occur.

28. Engineers explain the aging phenomenon by using what is known as the "Bathtub Curve." The curve is a graph of failure rate according to age. The failure rate due to unidentified leaks is relatively high in the beginning when "kinks" are being worked out; it flattens out during the middle life phase; and it rises again sharply in the end-of-life or at the "wear-out phase." On average, 20- 30 years usually marks the beginning of the wear-out phase. The evidence shows that most of Pilgrim Station's pipes, wraps and coatings would be in this "wear out phase" during the relicensed period. As Mr. Gunderson explained, the accepted standard for aging management of systems is clear that inspections at Pilgrim must increase as any component ages. Piping, coatings and wraps age, and just like human beings, require more doctor visits.

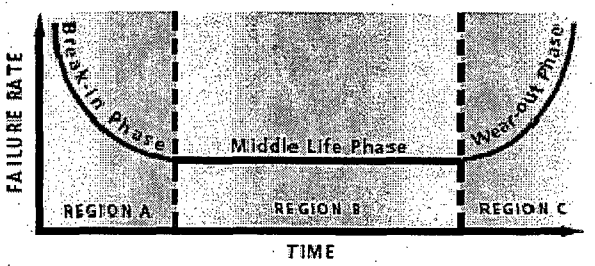
29. The rate of corrosion is not linear over time. Even the most meticulously maintained systems, like the Space Shuttles, which are a much newer engineered technology than

[6] NRC, Plant information http://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-info.html

Pilgrim, are reaching the end of their useful life due to the aging phenomena of the Bathtub Curve."

30. The Bathtub curve is more fully described for the Board in Exhibit 23, U.S. Nuclear Plants in the 21st Century: The Risk of a Lifetime, by David Lochbaum, Union of Concerned Scientists. (May 2004).[8] Thus, the chances of failure increase with time spent in Region C" [Union of Concerned Scientists Report, *supra*, at 4]. The renewal period of a nuclear plant would be its Region C, or wear-out phase. "As reactors approach or enter Region C [the wear-out phase] and become more vulnerable to failure, aging management programs should monitor the condition of the equipment and structures more frequently so as to affect repairs or replacements before minimum safety margins are compromised. Unfortunately, age-related degradation is being found too often by failures than by condition-monitoring activities" [Tr., Exh. 14, Gundersen at 20]. Likewise, Pilgrim's AMP's do not provide the required "condition-monitoring activities."

Figure 1 The Bathtub Curve



Source: NASA, 2001.

31. Entergy did not dispute the age of the piping or dispute the validity of the "Bath Tub Curve."

[8] Tr., Exh., 23, U.S. Nuclear Plants in the 21st Century: The Risk of a Lifetime, by David Lochbaum, Union of Concerned Scientists. (May 2004); and "Using Reliability-Centered Maintenance As The Foundation For An Efficient And Reliable Overall Maintenance Strategy," National Aeronautics and Space Administration (NASA), 2001.

Pilgrim's Site Specific Environment is Corrosive

32. The pipes are buried 10 feet below ground; and the soil surrounding the pipes is corrosive; Entergy did not offer any recent soil testing to demonstrate otherwise.

33. Soil/Environment was another factor listed by Entergy [Entergy Initial Statement, 8] that they relied upon to manage internal and external corrosion at Pilgrim Station during license renewal. They provided little to no supporting documentation –an unsubstantiated statement.

34. Pilgrim Watch, in contrast, documented and explained precisely why the soil and ocean water is corrosive [Tr. Exh., 13, A-12].

35. It is widely understood by the industry that structures age or deteriorate, especially if buried. Brookhaven Report [Tr., Exh. 21, at 147] says that, "Buried piping systems can degrade. Such deterioration potentially could impair the operation of the system that contains the buried piping, and thus impact the overall risk of an NPP."

36. Pilgrim's subsurface environment is corrosive. Corrosion occurs both on external and internal surfaces. [Tr., Exh. 13, Gundersen, A-12]

37. The Brookhaven Report explains [Exhibit 21, PW Prefiled Exhibit 8, at 32] that the rate of degradation of steel buried components is a function of environmental variables, metallurgical variables, and hydrodynamic variables.

38. External corrosion is especially important because (1) Pilgrim's soil environment is corrosive; and (2) if the coating degrades or is breached, the metal pipe below will corrode-the metal pipe provides the structure for the piping system.

39. **Water and Moisture**: It is basic that water and moisture are needed for external corrosion to occur [Tr. Exh. 21, Brookhaven Report at 26]. It deteriorates the outside

coating and wraps. Pilgrim sits on low land directly beside Cape Cod Bay. The FEIS describes the soil as sandy, silt and clay – soil types that retain moisture.[8] Entergy's Prefiled Testimony, at A83, tries to present a different picture. They say that, "...piping is placed on a bed of sand or specifically engineered fill before it is covered by another layer of fill. The sand or fill is very porous and allows water to percolate through. Thus it does not retain moisture and generally has high resistivity to corrosion." However, sand retains moisture. For example: the "drywell shell" at Oyster Creek corroded quite badly in the sand bed area and, a more mundane example, children build sandcastles regularly on the beach. In addition, over the years sand washes down and silt and clay soils above wash down into the area surrounding the pipe. Moisture increases from rain and snow percolating downwards. Water in the soil travels both vertically and horizontally; and it is obvious that the adjacent ocean provides a very moist environment.

External Corrosion

40. **Catholic Depolarizers**: If moisture is present and the coating has deteriorated, and we show that it will deteriorate, one needs additionally a cathodic depolarizer – a substance to further the cathodic reaction in order for corrosion to occur. This may be oxygen, certain microorganisms (bacteria, algae, fungi) or low pH generated by acid rain or the increased acidity of the ocean due to pollution; or the chloride ion (Cl).

41. **Oxygen:** The forgoing factors apply to Pilgrim's site and specifically to where the SSW discharge pipes are buried. For example, Entergy says in their discussion of corrosion of stainless steels [Tr. Exh., 27, BPTIMP] that, "Oxygen takes part in the cathodic reaction and a supply of oxygen is therefore, in most circumstances, a prerequisite for corrosion in

[8] **Topography source: Pilgrim Nuclear Power Station, Boston Edison** Company Docket No. 50-293, May 1972 – U.S. Atomic Energy Commission, Division of Radiological and Environmental Protection, Final EIS "The station site is along the rocky western shoreline of Cape Cod Bay. The geology of the site is recognized as primarily glacial deposits. The natural surface stratum in the station area consists of approximately 20 feet of silty and clayey fine sands with scattered boulders. Bedrock is about 30 to 90 feet below mean sea level." P. 9 "Surface topography is such that surface drainage from the station is seaward and surface water will not leave the Station property otherwise" P.10, TR EX 26, Exhibit 13.

soil. Entergy's Prefiled Expert Testimony [A-63] explains that the "CSS and SSW system buried piping...is covered with sand..." Pilgrim Watch knows that the supply of oxygen is high in sand and would further the cathodic reaction. Entergy stated further in the BTIMP [Tr. Exh., at 26] that, "...the supply of oxygen is comparatively large above the ground water table." We know that groundwater is generally encountered 20 feet below ground level. The distance from the ground surface to the SSW piping is 10 feet.

42. **pH**: Regarding pH: The pH scale goes from 0 to 14 with pH 7 as the neutral point; as the amount of hydrogen ions in the soil increases the soil pH decreases thus becoming more acidic. From pH 7 to 0 the soil is increasingly more acidic. Soils tend to become acidic as a result of: (1) rainwater leaching away basic ions (calcium, magnesium, potassium and sodium); (2) carbon dioxide from decomposing organic matter and root respiration dissolving in soil water to form a weak organic acid; (3) formation of strong organic and inorganic acids, such as nitric and sulfuric acid, from decaying organic matter; and (4) pollution –acid rain and increased acidity in ocean water. [9]

43. Ms. Pine Dubois, Jones River Watershed Association testified at the public hearing, April 9, 2008 and provided factual data to the Board specifically on the high acidity in local soils.

44. Entergy's Prefiled Expert Testimony, at A83, attempted to downplay the role the pH factor would play at PNPS. They said that, "During construction of PNPS, the site was excavated for the construction of various buildings. During excavation, all rock over six inches, shrubs and trees were removed from the soil...plants biodegrade, release compounds that may increase soil pH. (This) precaution serve(s) to reduce corrosivity of the soil environment." However the site was constructed in the 1960's, plants reappear in

[9] Soil pH, http://en.wikipedia.org/wiki/Soil_pH; Tr. Exh., 21,Brookhaven Report at 3.4]

less than 35 or 40 years. It rains in Plymouth; and New England receives carbon pollution from the mid-west resulting in increased acidity in our environment. Entergy claims the soil pH is 6.2 - 6.82, no studies are provided for evidence. Further we doubt their numbers because soil acidity varies – over time and over a small geographic area. If the numbers are in fact correct, a pH level of around 6.3-6.8 is the optimum range preferred by most soil bacteria – bacteria cause a cathodic reaction. [10]

45. **Chloride Ion**: Entergy's Exhibit 5, at 27, PW's Exhibit 14, says that, "Another of the most important conditions for corrosion to occur is the chloride ion CI)..." Chloride is naturally abundant in seawater. Pilgrim sits at the shoreline of Cape Cod Bay.

46. **Stray Currents**: Additionally underground corrosion is amplified by stray currents which are present in one degree or another at power generating stations [Brookhaven 3.4].

47. **Sand/Soil Particles:** Sand and soil particles move in the subsurface and are abrasive; the pipes were initially packed in a sand bed and the FEIS described the soils as sandy, silt and clay.

Soil Testing is Neither Current or Comprehensive

48. Entergy provided no documents showing that a recent analysis of the soils surrounding the specific pipes has occurred. Entergy mentioned, but failed to provide documentation for, simply two tests: A 1992 soil analysis taken near the SSW system loop "A" and loop

[10] Tr. Exh., 21, Brookhaven Report at 27 8, "Microbiologically Influenced Corrosion: Microbiologically influenced corrosion, known as MIC, is corrosion caused by the presence and/or activities of microorganisms in biofilms on the surface of the pipe. Microorganisms have been observed in a variety of environments that include seawater, natural freshwater (lakes, rivers, wells), soils, and sediment. The microbiological organisms include bacteria, fungi, and algae. They have been known to tolerate a wide range of temperatures, pH values, oxygen concentrations, and extreme hydrostatic pressure. These microorganisms can influence corrosion by effects such as the destruction of the protective surface films, creating corrosive deposits, and/or altering anodic and cathodic reactions depending on the environment and organism(s) involved. MIC affects most alloys such as steel (including stainless and galvanized), ductile iron, and copper. It is more common to find MIC inside buried piping; however, it may also occur on the outside of the pipe."

"B," a limited sample taken 16 years ago; and an October 2005 analysis of groundwater – claimed to be a good indicator of soil [Prefiled Testimony at A87].

49. Entergy understands the importance of regular soil testing. Entergy's *Buried Piping and Tanks Inspection and Monitoring Program* framework calls for "soil resistivity measurements...must be taken at least once per 10 years unless areas are excavated and backfilled or if the soil conditions are known to have changed for any reason." The program is voluntary and not yet put in place. [Tr. Exh., 8, at 11].

50. Entergy claimed that they had taken care of the soil issue by following procedures and precautions that they said "ensure piping structures are installed in non corrosive soil and are excavated and handled in a manner that does not damage the coating." They buried the pipes 7-10 feet above the water table. In order to reduce the effects of oxygen from moisture and acidity from decaying organic material, they removed vegetation and surrounded the piping, top and bottom layers, with a bed of sand [Entergy Prefiled, Entergy Dir. at A37].

51. Over a period of time vegetation reappears, decays and works its way down to the pipes. Soil above the sand migrates downward mixing with the sand to provide a moist environment. [Tr. Exh., 13, Gundersen A-12]. The pipes have been in the ground a long time. The low pH resulting from decayed organic matter, acid rain and stray electric currents will accelerate corrosion along with the oxygen from water seepage.

52. Mr. Gundersen concluded that, "Therefore, I believe that we (the NRC, Entergy, ASLB and the parties) are currently traveling "blind." [Ibid., Gundersen at A12] The SSW discharge piping is buried, 10' below grade [Tr., Sullivan, page 611]. And, unfortunately, when a pipe is buried, its condition is not readily apparent. Therefore pipes must be inspected more frequently. [Tr., Exh. 13, Gundersen A-12].

Internal Corrosion

53. Internal Corrosion is important because: (1) the SSW Discharge piping water contains ocean water, indeterminate amounts and types of chemicals, microbiological agents and is thermally hot; and (2) if the liner gets a hole or tear, the metal pipe will corrode from the inside and work its way outward- the metal pipe provides the structure for the piping system.

54. The rate of degradation on interior surfaces is a function of aggressive chemicals, pH level, dissolved oxygen and biological elements [Tr. Exh., 21, Brookhaven at 32].

55. Entergy has not provided an analysis of the corrosive quality of the chemicals that entered the SSW piping in the past and present. Ocean water is increasingly acidic due to global warming; salt water contains chlorides, oxygen and biological elements.

Thermal Variations and Lineal Expansion

56. The SSW discharge pipe is subject to thermal variations that result in stress. Outside soil temperature in late Fall, Winter and early Spring conservatively can be estimated at 30 degrees, whereas the inside water discharge temperature ranges from 60 degrees F- 100 degrees F. Therefore the exterior pipe wall will contract on the outside and expand on the inside. The coefficient of lineal expansion for carbon steel is about 0.00001 inches per degree centigrade. One hundred (100) feet of pipe is 1200 inches and temperature changes about 21 degrees centigrade. Multiplying (0.00001 x 1200 x 21 C) shows that the overall lineal expansion of the pipe resulting from that temperature change is about 0.25 inch. Overtime the metal would crack and break just as a paper clip eventually snaps from bending it back and forth. Additionally, carbon steel has a high degree of thermal conductivity; the coating and liner provides some insulation but no evidence to how much insulation it provides was provided. Entergy provided no analysis of the effect of this type of stress over time, 40-60 years.

Elbows and Welds

57. Elbows are particularly susceptible to corrosion. Each Loop of the SSW Discharge piping contains three 45-degree elbows and one 90-degree long radius elbow. As Mr. Gundersen stated, "...any entry-level engineer learns straight piping is less susceptible to failure than welds, elbows and dead spots." [Tr. Exh. 13, Gundersen A-13]

Counterfeit or Substandard Pipes

58. As Mr. Gundersen said [Tr. Exh., A-12], "... according to a 1990 United States Government Accounting Office Report Pilgrim Station may have received counterfeit or substandard pipe fittings and flanges. [Tr.Exh. 28]

59. Review of the documents and notices regarding counterfeit or substandard pipe fittings and flanges show that the NRC allowed the continued use of some or all of these components at numerous reactor sites. Neither Entergy nor the NRC has presented any evidence to show whether the NRC's decision to allow the use of these components was based upon Pilgrim's 40-year license or upon their use for a specific time period or an indefinite timeframe. [Tr. Exh.,13, Gundersen A-12]

60. Entergy has not established "whether or not the...SSW... piping has counterfeit and/or substandard pipe fittings and flanges... if any parts are counterfeit or substandard, then the probability of failure is increased." [Ibid.]

61. Entergy provided no evidence that there are not any suspect flanges in the SSW discharge piping; therefore the Board cannot properly conclude that there are not. The best current information is that there are four suspect flanges that have not been specifically tested.

Coating Failure

62. To manage internal and external corrosion at Pilgrim Station, Entergy stated further that they relied, in part, upon the coatings to insulate the piping from the environment. [Entergy's Initial Statement, at 9]. They provide no convincing evidence.

63. Pilgrim Watch, in contrast, documented how coatings could be breached exposing the metal underneath and site specific examples of coating failure.

64. Coating failure will result in exposure of the metal pipe to the corrosive elements in the soil, if left unchecked, leading to external corrosion – wall thinning and/or a hole. As the evidence presented by Pilgrim Watch shows, coatings eventually deteriorate, especially in moist soils such as Pilgrim's. Additionally there is a significant risk of coatings being improperly applied to the pipe and/or damaged during installation; or damaged later from other work in the field.

65. Mr. Davis, the NRC Staff's expert, in NRC Staff Response to Entergy's Motion of Summary Disposition, June 28, 2007, admitted, at 16 [Tr., Exh. 34] that, "...industry practice has shown that properly applied coatings will prevent corrosion *as long as* the soil is not extremely aggressive or *unless there is damage during application of the coating and handling of the pipe*." [Emphasis added]

66. GALL XI M28 Buried Piping and Tanks Surveillance Program: The Gall Report acknowledges the same, "Preventive Actions: "A cathodic protection system is used to mitigate corrosion where pinholes in the coating allow the piping or components to be in contact with the aggressive soil environment. The cathodic protection imposes a current from an anode onto the pipe or tank to stop from corrosion from occurring at defects of the coating."

67. Based on the evidence presented, this Board cannot conclude that the coatings were always properly applied. PNPS' QA programs may minimize the problem, but Entergy has not shown that such a program will eliminate it.

Excavation and Handling

68. Entergy claimed that piping structures are, "excavated and handled in a manner that does not damage the coating." The statement is overboard - human and mechanical error has occurred and is likely to occur again. For example, the SER, at 3-37 described a leak in the fire water underground distribution system and that the probable cause was induced, "most likely by fabrication anomalies compounded by marginal installation leaks." Although this example is not from the SSW Discharge system, the same PNPS QA personnel were involved.

69. Operating experience, as the SER explains, is limited. Based on operating experience, there is no basis for this Board to conclude that fabrication anomalies compounded by marginal installation leaks have not and will not occur. There was no factual evidence provided by Entergy that such similar mishaps could not occur with the SSW Discharge.

70. There is little site specific experience examining the condition of the coating and external surfaces of the piping in the SSW Discharge System. The only "evidence" provided by Entergy [Tr., Mr. Woods, at 637] is that they looked at the two 40' sections of the SSW discharge that were replaced in 1999 in both Loop "A", that measures 240' overall and in Loop "B" that measures 225' overall.

71. Entergy did not examine the exterior coating and piping exterior surface of (83% and 84%) respectively of the piping. The coating on all but two 40' sections will be approximately 40-45 years old in 2012 and 60-65 years old at the end of the license extension; its' condition rests on a sample of <20% of the piping. Hence there are *385 feet of unexamined SSW discharge pipe coating and pipe external surfaces.*

72. There was no factual evidence provided by Entergy – such as inspection reports - describing an analysis of the actual condition of the coating and piping of the 40 foot sections examined. Therefore any opinion expressed about their condition is unsupported by facts.

73. Examination of the SSW Discharge piping was done simply from the inside; Entergy said that only visual examinations would yield useful information. At the Hearing, Judge Abramson said, "So, if I understand you correctly, ultrasonic testing would not yield any useful information. So what would the staff think is appropriate: Visual inspection of the liner?" Dr. Davis replied, "Yes, visual inspection." Mr. Gundersen explained the reason, "... a perpendicular ultrasound would be impossible to detect any problem because you are going through several layers of varying thicknesses and roughness and things like that." [Tr., 708]

74. We can discount as overboard and unsupported by fact Dr. Davis' comment [Tr., at 642] that "Every time they have looked at the external coating, which is in the buried pipe and tanks inspection program, it has been intact after years with no degradation. The only degradation they have seen is from the inside." The amount of "seeing" done by Entergy does not constitute an acceptable sample to be considered proof.

75. Dr. Davis' speculations are not reassuring or sufficient; without looking at the outside there is no reasonable assurance of structural integrity. The Board's concern here is not about containing leaks but about the loss of structural integrity caused by the holes/wall thinning in the wrong place on the carbon steel pipe in a DBT that will cause the pipe to break.

Site Specific Historical Experience

76. On what appears to have been its best, and only, opportunity to examine the exterior coatings and surface of the original SSW inlet piping, Entergy did not do so.

77. Cox in Entergy's Motion for Summary Disposition at FN 6 [Tr. Exh., 24] said that, "The inlet SSW carbon steel piping that was replaced with titanium piping in order to prevent corrosion *was never removed from the ground so that the exterior coatings and surface of the original carbon steel SSW inlet piping were not examined*" [Emphasis added].

78. Since the piping was not removed from the ground or analyzed, there is no site specific historical experience upon which Entergy can rely.

Coatings Have No "Specified Life"

79. Entergy's own disclosures stated that coatings do not have a specified life upon which Entergy may rely.

80. Pilgrim Watch submitted an Exhibit at the Hearing to this effect that said,

    a. PILLR00000658, Entergy: Aging Management Review of the SSW (Draft 11/12/01)
    b. (3.1) "The piping that is underground is protected by a coating, but since the *coating does not have a specified life,* the aging effects will be evaluated for carbon steel." [Emphasis added].

81. The Exhibit was a Draft document and was replaced by Entergy by the final version of the document that had the same language, affirmed by Mr. Lewis [Transcript, 745] and entered as Exhibit 70 [Tr., page 745, line 14-16]. The Text was the same in both documents.

82. As Pilgrim Watch requested at the hearing, the record shows that Entergy had provided three other documents that say the same thing" [Tr., page 753, line 15-16].

83. In very plain English the documents say that the "*coating does not have a specified life;*" it can mean nothing else.

84. Similarly, Entergy did not provide any service life warranties for the coatings. Neither did they provide any factual evidence as to the life or current condition of the coatings, either by reports from recent and representative samples of actual investigations of the SSW Discharge piping.

85. Based on the evidence before it, there is no basis upon which the Board can properly conclude that the coatings will remain in good condition (provide reasonable assurance) for any period of time.

Internal Rubber Lining/Epoxy Coating on 40' Replaced Pipe Sections

86. There is no dispute that the SSW Discharge pipes will corrode from the inside if either the interior liner or coating fails.

87. To manage internal and external corrosion at Pilgrim Station, Entergy stated further that they relied, in part, upon the rubber lining and epoxy coating to protect the metal piping from the interior [Entergy Initial Statement, 8]. The evidence submitted does not establish that the lining and coating will do so.

88. Site specific documentation was provided. It described degradation of the rubber lining in the SSW piping system (inlet and discharge) exposing the metal underneath to corrosive elements in the environment. The piping had been in place > 20 years; however, and this is the important point, there is no evidence how soon after installation the degradation began.

Site Specific SSW Discharge Failure - Rubber Liner

89. The SSW Discharge piping rubber liner degraded, delaminated and tore away in sections. At the Hearing, Mr. Woods (Entergy's expert) described it as follows, "In 1995, an inspection was done and noted a little bit of degradation on the existing rubber lining. And then it was determined to go ahead and do another inspection in 1997 to monitor that

area. And that was okay at the time. And then we looked at it again in 1999 and found that the rubber lining had actually -- a portion of the rubber had delaminated and actually torn away from it and, as a result, had the through-wall leak. So at that point in time, we replaced that section of pipe." [Tr., 638]

90. As Mr. Gundersen said, moisture is likely to remain behind sections where the rubber liner was not removed prior to installing the CIPP; the inspection method used (crawler) would detect gross deformities in the wall but unlikely to detect smaller anomalies-bubbles. The moisture then would be against the interior of the carbon steel pipe leading to corrosion from the inside of the piping. [Tr., Gundersen, 709]

91. Judge Young questioned Entergy about their inspection of the rubber lining prior to installing the CIPP liner and asked whether "they had left anything in place where there would be a possibility of that moisture being behind the rubber lining" [Ibid]. If so, this could introduce corrosion on the metal from the interior.

92. Entergy said that prior to installing the CIPP liner, they inspected the interior with a "smart pig"/ or crawler device. However, and as Mr. Gundersen said, a crawler was not as precise as "eyeballs." A crawler might detect a bubble that might be six inches around and maybe a half-inch, but there is no evidence that smaller bubbles would be detected by that technique, which could mean there is still moisture behind that rubber barrier. Once moisture gets behind that rubber, the pipe can degrade. A "crawler" can only "see" the interior surface, not behind it [Ibid].

93. Entergy has not presented sufficient evidence to establish that there is not moisture behind the rubber liner and against the metal piping that would cause the piping to corrode from the inside out.

Site Specific SSW Inlet Steel Piping Failure of Rubber Liner

94. Operating Experience: The SER[11] [Tr. Ex., 30, 3-37] sites specific historical experiences – Salt Service Water system (SSW) - and states that,

> "...SSW system has had leaks on the buried inlet (screen house to auxiliary bays) piping due to internal corrosion. The original piping material was rubber-lined carbon steel wrapped with reinforced fiberglass, coal tar saturated felt, and heavy Kraft paper. The *leaks were determined to be results of the rubber lining degrading from contact with sea water*. These pipes were replaced in 1995 and 1997 with the same external and internal coating as for the original pipe." [Emphasis added]

Cured –In-Place (CIPP) Failure

95. To manage internal and external corrosion at Pilgrim Station, Entergy stated further that they relied, in part, upon the CIP to protect the metal piping from the interior [Entergy Initial Statement, 8]. There is no dispute that the SSW Discharge pipes will corrode from the inside if either the CIPP or interior coating fails.

96. At the Hearing, Entergy emphasized the importance of the CIPP – it would last 35 years and prevent degradation of the SSW discharge piping. Entergy gave the very strong impression that they placed most of their "eggs in one basket."

97. However in order for the Board and public to find like assurance, the Board must review (1) whether sufficient factual evidence was provided regarding Pilgrim's CIPP (not simply CIPPs theoretically) that it will maintain its integrity between the 10 year inspection interval; (2) whether the 10 year inspection, as described, is capable of

[11] NUREG-1891, Safety Evaluation Report, November 2007, ADAMS ML073241016.

determining the CIPPs integrity; and (3) because the CIPP protects simply the interior metal surface from corrosion, whether corrosion from the exterior can be ignored. This is the crux of AMP, and Entergy has failed to carry its burden.

Warranties & Testing Results on PNPS' CIPP

98. Entergy did not provide for the Board, nor did the Board request, Service Life Warranties. Entergy also did not provide for the Board, nor did the Board request, information about any CIPP liner testing results. The only information presented, and elicited from the Board, was simply an "infomercial" about CIPP liners in general, and this provided no particulars about Pilgrim's CIPP. [Tr., Gundersen, 700-701].

99. Entergy stated that the CIPP had an "approximate" 35 year life. It provided no evidence to support this contention. [Tr. 691]

100. Mr. Gundersen testified at the Hearing that, "We have an EQ program, equipment qualification. I have -- well, I heard an infomercial this morning on how wonderful the pipe is. I haven't seen a quality assurance document that says that this is a 35-year product. It's not on the record, Your Honor. We have got testimony based on a brackish water plant. And this is saltwater. That is a wonderful product. And, yet, in the nuclear industry on safety-related pipe, there is a procedure where one qualifies this stuff for the -- I've heard 35 years. I haven't seen either manufacturer's qualifications or the Pilgrim qualifications on a pipe that -- on an old pipe that had an old liner that then on that liner had applied this epoxy coating to give me any bases to say it had a 35-year life. This is testable. You can do this in a lab. You can pull it out. You can check it and then say, "Okay. It's got a 35-year life." But that's not on the record. I mean, we have heard individuals speak about experience at Indian Point but not in this environment. And it is a testable thing. To my knowledge, that document's not on the record. So we're hanging our hat on an infomercial" [Tr., Gundersen, 700-701].

101. Entergy has failed to carry its burden of establishing that the CIPP liner will remain effective for any period of time - certainly not for 10 years or 35 years.

102. Regarding installation, Entergy did not provide (and the Board did not ask for) significant evidence. There was no evidence, for example:

a. Whether or not there were any errors in field application. If, for example, there were problems identified in either Loop with the project implementation process at PNPS, the level of knowledge of PNPS and vendor personnel directly and indirectly involved in the work and the handling of the aborted CIPP liner and materials; if there were problems with the epoxy perhaps due to high ambient temperature conditions during the epoxy batching and the wet out process.

b. Whether during installation the liner severed and separated in any locations during the cool-down; and if so, whether any severed locations were at an elbow – a more susceptible area in the pipe to corrosion.

c. Whether, if there were installation errors, how the two Loops could be considered to be truly redundant.

103. Regarding testing: Entergy did not discuss (and the Board did not ask for) any evidence concerning testing of the CIPP that was installed at Pilgrim. There is no evidence, for example:

a. Whether, if testing was done, what were the testing assumptions – did they assume, for example that the SSW discharge pipe was in either a "partially deteriorated condition" or "fully deteriorated condition" or "where the existing pipe is in a partially deteriorated condition, providing support but has a hole." If that assumption was made then the partially deteriorated pipe steel pipe condition would have been an admission that PNPS plant experience, inspection results, and observation of the intact condition of the pipe and external pipe wrap on

previously excavated spools indicated degradation. If it was not so assumed, then the testing results would be totally bogus.

b. Whether, if testing were performed, was it meant to imply that the CIPP liner is designed in accordance with the totality of the ASME Code Section III criteria?

c. Whether, if testing was performed, how many samples were taken; were they sufficient in number and taken from representative sections along the entire piping; and were specimens left in place to re-test as the material aged.

d. Whether, if tests were performed, did they evaluate flexural modulus, flexural strength and tensile strengths and, if so, did any results fall below accepted values.

104. Consistent with the Board's responsibilities to assure that its decision protects public health and safety, any information the Board has concerning any of the above must be considered, whether or not formally in evidence.

CIPP Cracking Due to Stress

105. The SSW discharge pipe is subject to thermal growth and shrinkage that result in stress, particularly in the pipe elbows. Outside soil temperature in winter conservatively can be estimated at 32 degrees, whereas the inside water discharge temperature ranges from 32 degrees F when the water is shut down to up to around 100 degrees F. [12] Therefore the pipe wall will contract and expand as the water within it cools and warms. The coefficient of lineal expansion for carbon steel is (0.00001) inches per degree centigrade so that 100 feet of pipe has 1200 inches in temperature changes about 38

[12] Peak discharge temperatures in excess of 38 EC (100.4EF), NRC NUREG-1437, Sup. 29, July 2007, 4-36

degrees Centigrade. Multiplying 0.00001 x 1200 x 38 c = almost half an inch of growth in the overall length of the pipe as it warms and cools. Since the pipe is not free to move at its ends, this growth induces stress at the elbows and fittings which are fixed in the soil in relation to the straight pipe. Overtime the metal pipe would move, since it is ductile, but the CIPP liner is rigid and tightly adhered to the pipe. The liner will crack as the pipe expands and contracts due to its dramatically different structural characteristics between the ductile steel and the rigid CIPP. The most likely place for cracks in the CIPP also is at the elbows where pipe changes direction. The elbow restrains movement in pipe along the axis; the pipe wants to grow due to thermal growth, but the elbow turns the other way. This creates stress at elbow.

106. Entergy claims that the CIPP is firmly attached to the pipe. The ductile metal under the CIPP deforms, but the CIPP is not ductile. If the CIPP were ductile, it would withstand an earthquake as the elbow distorts the CIPP will crack at the joints. Test samples do not address ongoing distortion at the elbows. These cracks in the CIPP at the elbows will then cause corrosion at exactly the high stress points on the pipe that would induce failure in a design basis event. Entergy provided no analysis of the effect of this type of stress over time, 40-60 years.

Nuclear Industry Experience with CIPP Liners

107. Dr. Davis explained that NRC knew of no experience with CIPP liners in the nuclear industry. He said, "There are a number of different kinds used in service water. This particular one I'm not aware if it's used anywhere" [Tr., 668].

108. Mr. Cox said there was one at Arkansas I; but no evidence was provided as to its particulars [Tr., 691]; and Mr. Spataro said that one was used at Indian Point, again with no evidence as to its condition [Tr., 692]

109. Neither Arkansas nor Indian Point NPS are located on the ocean, and Entergy provided no evidence that the sites and liners at Arkansas I or Indian Point were comparable to PNPS. As Mr. Gundersen said, "The testimony was based apparently on experience of Indian Point 3. That is not a saltwater plant. That is brackish water and is nowhere near the conditions we are seeing here." [Tr., at 695]

Inspection Plan

110. The CIPP will be inspected in Loop 'B" in 2011 and in Loop "A" in 2013 [Tr., 648]. Although the Loops are inspected on the same frequency, every 10 years, there is a two year difference between when one Loop is inspected and the other Loop's inspection. This inspection time lag must be factored when making decisions whether or not there is redundancy and defense in depth.

111. A second troubling implication is whether the Board will have made its decision on whether to approve the license *before* the inspections occur. A condition of license approval should be that <u>all inspections have been completed and results from those analyses presented to this Board so that the Board can have the requisite assurance that the components are sound after nearly 40 years of operations</u>.

Manufacturing & Installation Errors

112. To manage internal and external corrosion at Pilgrim Station, Entergy stated further that they relied, in part, upon the claim that piping structures are, "excavated and handled in a manner that does not damage the coating" [Entergy Initial Statement, 8]; and ignored the impact of manufacturing errors.

113. However, as Mr. Gundersen explained in his testimony, "Human error either in manufacturing or installation may never be discounted [Tr. Ex 13, A-12].

Manufacturing

114. The potential risk of corrosion and leaks at Pilgrim is increased by the potential inadvertent use of counterfeit or substandard parts. [Tr. Ex., 14, Gundersen, 12.4.6.2]

115. Pilgrim's use of counterfeit or substandard pipe fittings and flanges is not explained adequately by Entergy. Gundersen explains, "... according to a 1990 United States Government Accounting Office Report Pilgrim Station may have received counterfeit or substandard pipe fittings and flanges. Therefore, I believe it should be factually established whether or not the ... SSW... piping has counterfeit and/or substandard pipe fittings and flanges." [Tr.,13, A13]

116. The Board agrees with Mr. Gunderson that, if any parts are counterfeit or substandard, then the probability of failure is increased. Review of the documents and notices regarding counterfeit or substandard pipe fittings and flanges, shows that the NRC allowed the continued use of some or all of these components at numerous reactor sites. If this information is indeed accurate, then both Entergy and the NRC should have documentation that would indicate whether the NRC's decision to allow the use of these components was based upon Pilgrim's 40-year license or upon their use for a specific time period or an indefinite timeframe." Entergy did not provide for the Board, and the Board did not ask at the hearing, for documentation.[13] It would be important to discern whether the SSW Discharge indeed has (4) flanges – from a vendor identified as providing substandard parts– and whether those particular flanges were removed for testing; but Entergy has not provided that information.

[13] NRC Bulletin 88-05, and Supplements 1 & 2: Nonconforming Material Supplied by Piping Supplies, Inc. at Folsom, New Jersey and West Jersey manufacturing Company at Williamstown, New Jersey, BECO 88-133, License DPR-35, Docket 50-293, September 9, 1988, states that SSW Discharge system has (4) flanges supplied by the suspect vendor Piping Supplies Inc. The four flanges were inaccessible so that they were not directly tested. They were identified as 22" ASTM A105 150# flanges. Subsequent evaluations of similar flanges from PSI indicated that, "they were acceptable for these applications." The BECO Report to NRC did not indicate whether the tests evaluated performance for 40 years or 60 years.

117. The NRC Groundwater Contamination at Nuclear Power Plants-Final Report, September 1, 2006, Task Force at Executive Summary, ii[14] warned that, "Some of the power plant components that contain radioactive liquids that have leaked were constructed to commercial standards, in contrast to plant safety systems that are typically fabricated to more stringent requirements. The result is a lower level of assurance that these types of components will be leak proof over the life of the plant"

118. The NRC's Lessons Learned Task Force raises another important question left unanswered about whether pipe spools and fittings "constructed to commercial standards", in contrast to plant safety systems that are typically fabricated to more stringent requirements, are in the SSW Discharge piping system. Entergy provided no facts one way or another so that the Board cannot simply assume that the SSW Discharge pipe spools and fittings are not constructed only to commercial standards.

Excavation and Handling

119. Site specific examples of human and mechanical error indicate that human error cannot be discounted; errors in quality assurance, identifying errors, cannot be discounted either.

120. The SER, at 3-37 [Tr. Ex. 30] described a leak in the fire water underground distribution system and that the probable cause was induced, "most likely by fabrication anomalies compounded by marginal installation leaks." Operating experience, as the SER explain, is limited; therefore we have no idea, and neither does the Applicant, what other fabrication anomalies compounded by marginal installation leaks has, or will, occur.

[14] Groundwater Contamination (Tritium) at Nuclear Plants-Task Force – Final Report, NRC, Sept 1, 2006, 3.2.2.3 Conclusions [Tr., Ex 20]

PROBABILITY & CONSEQUENCE OF A SEISMIC EVENT

121. Assessing the probability of the SSW Discharge piping failing so that its safety function cannot be achieved requires a factual analysis of the probability of the SSW Discharge piping (metal, coating, and/or the liners) failing to such a degree to impact its safety function. Entergy did not show factually that failure was improbable; and this Board may not base its conclusions on "wishful statements" or platitudes. Rather, it must consider the probability of a design basis event, such as a seismic event, and the potential that both trains of the SSW discharge could collapse and block the flow path of the discharge piping so that the piping could not remove heat from the heat exchanger.

Probability of a Seismic Event

122. Plymouth is not immune to seismic activity. Buried pipes/tanks are not flexible and the coatings become brittle with age; therefore they are more susceptible to breakage during seismic events.[15]

123. The potential for earthquakes in Southeastern Massachusetts occurring from 2012 to 2032 cannot be dismissed. New England is not immune to strong temblors and specialists say that a major event in only a matter of time.[16] It is only a matter of time before the Northeast is struck by a major quake, according to earthquake specialists at the US Geological Survey in Virginia, who have placed Boston on a list of the top 26 risk areas in the nation. Indeed, a major quake has occurred somewhere in the Eastern United States about every 100 years.

124. New data developed disclose a substantially higher likelihood of significant earthquake activity in the this area and although the probability that a major earthquake

[15] Tr. Ex.13, Gundersen, A13; Tr., Ex. 21, Brookhaven, Section 5

[16] Tr. Ex. 29, *New England not immune to strong temblors and specialists say that a major event in only a matter of time,* Boston Globe, Bryan Bender, April 16, 2006

will hit the Eastern US is much lower than in the West, the potential impact is significantly higher. In the Eastern United States, according to researchers, the rocks transmit earthquake waves more easily than in the West. Therefore, a rupture, brought on by pressure built up over hundreds of years, would be felt over a much larger geographic area. Smaller earthquakes occur regularly in the Eastern states, including New England. On November 17, 2005 a minor quake, measuring 2.5 on the Richter scale, was detected in Plymouth.

125. Whether the probabilities may be considered not high by some is not relevant because risk is a product of probability and consequences. The consequences of SSW discharge piping failing in a design basis event are too severe.

Seismic Event – Consequences SSW Discharge Piping

126. Salt Water Discharge [SSW] Piping Could Fail During Design-Basis Event.

127. Applying a narrow interpretation of 10 CFR § 54.4, the question becomes whether the Salt Water Discharge [SSW] piping could remain functional during design-basis events [Transcript at pages 667, 670, 718-720, 739]. The SSW discharge piping is relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)(i)) to ensure the capability to shut down the reactor and maintain it in a safe shutdown condition. The most likely design base event is a seismic event.

128. Entergy says that it relies on the pipe to meet seismic stresses, but that is not sufficient.

129. Entergy's attorney, Mr. Lewis said that "the cured in place piping inside it [the metal pipe] is not relied on to meet the seismic stresses" and "it's the pipe that's relied on to meet the seismic stresses" [Transcript, pages 618, 621]. This is repeated elsewhere in

Entergy's testimony.[17] For example, Entergy stated at the hearing that the CIPP is not relied upon to maintain structural integrity under seismic loads. Tr. at 618 ("it's the pipe that's relied on to meet the seismic stresses") (Counsel for Entergy arguing objections to introduction of proposed Pilgrim Watch Exhibit)

130. However, and as Pilgrim Watch's expert, Mr. Gundersen, demonstrated, both Loops in the SSW discharge system degraded in the past. They clearly could degrade again, and therefore they could collapse in a design basis event such as an earthquake. If they were to do so, the flow path of the discharge piping would be blocked so that the piping could not remove heat from the heat exchanger [Tr., 610,615, 622, 625, 627,694-5, 697-8, 707,730-1].

131. Entergy says that having two loops provide redundancy. But in view of the fact that both Loops degraded simultaneously in the past, and the absence of any proof that this could not happen again, there is <u>no redundancy</u> upon which this Board or the public may rely:

a. Chair Young: In the seismic context, you are talking about if there were holes that were either big enough on their own or several small ones together, that that is what you are worried about from a seismic standpoint, correct?
b. Mr. Gundersen: Correct. That could cause the pipe to collapse, which would affect the back pressure on the system and, hence, the relative flow through the heat exchanger. And, "My concern remains that if there is a leak, that it could cause catastrophic failure, as I have discussed earlier. This liner, just to make sure, is not a seismic barrier. It is a pressure barrier. And I want to make sure that we all understand that when you are doing the seismic analysis, you are assuming the pipe is relatively ductile and this liner is more brittle. So it is the pipe that has

[17] Tr. at 621 ("the cured in place piping inside it is not relied on to meet the seismic stresses") (Counsel for Entergy arguing objections to introduction of proposed Pilgrim Watch Exhibit).

to withstand the motion. So adding this liner doesn't strengthen the pipe from a seismic standpoint" [Tr., pages 706-707].

132. When questioned by Judge Abramson on the basis for his conclusion, Mr. Gundersen replied that it was based on, "My experience in other seismic analysis of pipe would indicate that a hole that size in the wall of a pipe that thin would cause it to fail in a design basis event; and adding clarity, "It's based on analysis the people who have worked for me have done" [Tr., pages 695, 696]

133. Mr. Gundersen provided greater detail, "let me address the core question of whether or not the existence of holes will appreciably increase the likelihood of failure? That answer depends upon the cause and nature of the holes. A thousand pinhole leaks distributed uniformly over the length of a 1,000-foot buried piping run is unlikely to cause its failure rate to rise. But the same area of through-wall leakage concentrated in one region - such as in a circumferential weld - might create an entirely different outcome." [Tr. Ex. 3, Gundersen,A11] Further at the hearing Mr. Gundersen explained that, "it is not about a single hole. It is about numerous small holes, maybe through-wall, but, as that picture indicates, too, where there are through-wall small holes, there is -- also between them the wall becomes much, much thinner. So that essentially while it may not be leaking that much water, in fact, there is no pipe there" [Tr., page 731].

134. Mr. Gundersen elaborated on this point at the hearing. He said that, "You could probably take a drill and put a three-quarter- inch hole in this pipe, and it would be just fine. My concern is that when smaller holes gang up in a more diffuse pattern, as indicated in that picture, that there is a broader area of wall thickening that can lead to stress risers in the event of a design basis event as that pipe flexes. So it is not about a single hole. It is about numerous small holes, maybe through-wall, but, as that picture indicates, too, where there are through-wall small holes, there is -- also between them the wall becomes much, much thinner. So that essentially while it may not be leaking that much water, in fact, there is no pipe there" [Tr., page 729].

Insufficient Probability that SSSW Discharge Piping Failure will be Identified and Prevented by the Proposed AMP

135. When the stakes - safety system failure – are high, the probability that the consequences of such a failure will be prevented cannot be low or questionable. The burden of establishing a very high probability rests on Entergy.

OVERVIEW

136. To manage internal and external corrosion at Pilgrim Station [Entergy's Initial Statement, at 8] explains that not only will the metals, linings, coatings, soil, and handling be relied upon; but also the Buried Piping and Tanks Inspection Program; water chemistry and the service water integrity program; and additional monitoring programs for the SSW Systems.

137. The Aging Management program is described in the License Renewal Application[18]. It includes two parts – an inspection program and preventive measures to mitigate corrosion. Entergy and NRC Staff find them adequate to provide reasonable assurance. The Board finds that the Aging Management Program is insufficient. It will not provide reasonable assurance that all of the buried pipes and tanks within scope of license renewal will protect the public health and safety over the license renewal period.

License Renewal Application

138. We refer to the Pilgrim Nuclear Power Station, License Renewal Application, Technical Information, Appendix A: Updated Final Safety Analysis Report Supplement

[18] Pilgrim Nuclear Power Station, License Renewal Application, Technical Information, Appendix A Updated Final Safety Analysis Report Supplement Page A-1, Appendix A: Updated Final Safety Analysis Report Supplement; Appendix B, Aging Management Program and Activities, 2006.

Page A-1, Appendix A: Updated Final Safety Analysis Report Supplement; Appendix B, Aging Management Program and Activities, 2006.

A.2.1.2 Buried Piping and Tanks Inspection Program (BPTIP): The Buried Piping and Tanks Inspection Program includes (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure- retaining capability of buried carbon steel, stainless steel, and titanium components. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components are inspected when excavated during maintenance. If trending within the corrective action program identifies susceptible locations, the areas with a history of corrosion problems are evaluated for the need for additional inspection, alternate coating, or replacement. A focused inspection will be performed within the first 10 years of the period of extended operation, unless an opportunistic inspection (or an inspection via a method that allows assessment of pipe condition without excavation) occurs within this ten-year period.

Appendix B: B.1.2 Buried Piping and Tanks Inspection: Program Description**:** The Buried Piping and Tanks Inspection Program at PNPS is comparable to the program described in NUREG-1801, Section XI.M34, Buried Piping and Tanks Inspection. This program includes (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components are inspected when excavated during maintenance. A focused inspection will be performed within the first 10 years of the period of extended operation, unless an opportunistic inspection (or an inspection via a method that allows assessment of pipe condition without excavation) occurs within this ten-year period. NUREG-1801 Consistency**:** The Buried Piping and Tanks Inspection Program at PNPS will be consistent with program attributes described in NUREG-1801, Section

XI.M34, Buried Piping and Tanks Inspection, with one exception. Exceptions to NUREG-1801: The Buried Piping and Tanks Inspection Program at PNPS will be consistent with program attributes described in NUREG-1801, Section XI.M34, Buried Piping and Tanks Inspection, with the following exception. Attributes Affected Exception: Detection of Aging Effects Inspections via methods that allow assessment of pipe condition without excavation may be substituted for inspections requiring excavation solely for the purpose of inspection.1. Methods such as phased array UT technology provide indication of wall thickness for buried piping without excavation. Use of such methods to identify the effects of aging is preferable to excavation for visual inspection, which could result in damage to coating or wrappings. Exception: Note: Appendix B Aging Management Programs and Activities Page B-18. Enhancements: None. Operating Experience: The Buried Piping and Tanks Inspection Program at PNPS is a new program for which there is no operating experience. Conclusion: Implementation of the Buried Piping and Tanks Inspection Program will provide reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

BPTIP – THE INSPECTION PROGRAM

139. The BPTIP is inadequate. It does not provide assurance. It is based on a number of false or otherwise inaccurate assumptions, and previous experience does not provide the necessary assurance.

140. A number of false and inaccurate assumptions concerning corrosion underlie Entergy's and NRC's claim that the Buried Piping and Tanks Inspection Program (BPTIP) will provide reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

141. Entergy's claim that the Board should find assurance based on a one-time inspection in ten (10) years incorrectly assumes that corrosion is gradual, linear and predictable. This Board finds that as components age they deteriorate more rapidly; the "Bathtub Curve" explains this phenomenon.

142. The vast majority of SSW discharge pipe is already old. 83-84% of the pipes will be approximately 40-45 years old in 2012; and they will be 60-65 years old in 2032. Therefore as the pipes enter the "wear-out" phase, they require more frequent inspections. The rationale that they are maintained so that they are "as good as new" lacks credibility. Living and non-living material can be well maintained; but that only slows deterioration, it does not stop it. There is additional uncertainty because there is no industry experience with reactors 40-60 years old and because inspections are not and cannot be 100%.

143. Entergy's claim that the Board should find assurance based on a one-time inspection in ten (10) years based on unspecified sampling also incorrectly assumes that corrosion is even across a component.

144. However the SSW discharge piping cannot be assumed to be constant throughout so that a sample here and there will accurately predict the status of a section in another part of the piping system. For example: metals vary as a result of the manufacturing process itself; different sections of a component are more susceptible to stress, such as elbows and welds; the CIP liner in the (2) SSW discharge loops is not identical in composition; and Entergy failed to identify to the Board whether the CIPP installation history was identical in both Loops.

145. Previously, degradation occurred in both loops simultaneously, demonstrating that there is no reliable redundancy. Past experience also shows that once degradation begins, it grows quickly; leaks in Pilgrim's SSW discharge piping developed within two years.

146. There was a through-hole leak in one loop and wall thinning in another loop, simultaneously. The hole developed in two years. Therefore the odds of a once-in-ten

year inspection coinciding with the appearance of a hole or significant wall thinning; and the once in (10) year inspection occurring right before a design basis event are slim – leaving public safety to happenstance. NRC's witness, Dr. Davis, stated that once degradation begins, it grows quickly [Tr., page 729].

147. In his testimony, Mr. Gunderson provided a thorough evaluation of BPTIP and showed that it is insufficient. [Tr. Exh.13, A-18]. As Mr. Gunderson said:

> Part (1) of the program notes that pipes are inspected if they are excavated during maintenance. The problem is that this leaves inspections and safety to happenstance and does not meet Pilgrim Station's Aging Management goals.
>
> Part (2) of the program requires a one-time inspection during the first 10-years of the license renewal period by either a visual or an as yet untested UT inspection. The problem here is that the program lacks specificity and provides merely a general framework. By allowing total flexibility for the licensee, this loose framework once again neglects the very specific requirements of Aging Management Programs in general and, in my opinion, certainly neglects the very goals developed by Entergy for its Pilgrim Station Aging Management Program. For example, the BPTIP allows: "*A determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience.*" [NUREG-1801, Rev.1, X I M34].

148. Mr. Gunderson's testimony also showed four problems with Entergy's plan.[Tr. Ex 13, A-18]

149. The first problem is that operating experience at Pilgrim Station is limited according to the SER. Entergy Pilgrim Station has not performed a thorough baseline examination of the pipes, which of course should be a prerequisite to any license extension program. [Ibid]

150. The second problem is that Pilgrim Station does not have a monitoring-well program that meets design standards, as shown by Dr. Ahlfeld's declaration. [Ibid]

151. The third problem is that Entergy's assessment of materials and the environment provided in Entergy's Initial Statement does not seem accurate. For instance Entergy's statements ignored the facts that all metals corrode, that Pilgrim's specific environment is conducive to corrosion, and that no recent hydrological and geological studies have been performed. [Ibid]

152. Fourth, there is no new hard data to review, as it seems that Entergy Pilgrim Station has only conducted cursory reviews of old studies via walkabouts on the property. [Ibid]

153. The BPTIP allows, "*Identification of the inspection locations in the system or component based on the aging effect; determination of examination technique; evaluation of the need for follow- up examinations if aging related degradation is found.*" However, this portion of the Entergy Nuclear Pilgrim Station plan does include a requirement concerning the number of sample inspections or the location of said sample inspections.

154. In the BPTIP statement "*An evaluation of the need for follow-up examination*", no mention is made regarding who will evaluate the need for follow-up examinations, and no statement as to the NRC's role is articulated. Furthermore, and more critical, is that there are no criteria whatsoever with which to determine when there must be "*follow-up examination(s).*" [Ibid]

155. In NUREG-1801, the BPTIP states: "*The inspection includes a representative sample of the system population, where practical, focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin.*" The obvious inadequacy is the phrase, "Where practical." Such loose terminology does not require that Entergy meet any engineering standards and allows Entergy's convenience and profit margins to be the driving force for inspection rather than "public health and safety" as required by federal statute.[Ibid]

156. Lastly, in the BPTIP it is stated: "*The one-time inspection, or any other action or program, created to verify the effectiveness of the AMP and confirm the absence of an aging effect, is to be reviewed by the staff on a plant-specific basis.*" The inference is that only on a plant specific basis will a "*one time inspection, or any other action or program*"... occur, depending upon the effectiveness of the AMP as determined and reviewed by the Pilgrim Station staff. Once again, this is not a commitment to an inspection with formal criteria and trigger points by which to deepen an inspection should specific triggers be uncovered. The loose wording simply suggests that the inspection may not occur if Pilgrim Station staff for any reason determines such an inspection is not warranted. [Ibid]

157. Part (3) of the BPTIP says that, "*Prior to entering the period of extended operation, the applicant is to verify that there is at least one opportunistic or focused inspection performed during the past ten years.*" Entergy has not stated when these inspections might occur or if they may have already occurred; and any inspections prior to license renewal that might take place have all the weaknesses described above. Of additional concern is the fact that if Entergy plans to count inspections that occurred early in 2000 as part of this process, and is allowed to do so, than conceivably at least 19 years might lapse between inspections. The critical nature of these pipes requires more than one inspection over the entire period of license renewal [Ibid].

158. NUREG-1801, Rev 1, XI M-107, September 2005 states that, " ...the applicant should schedule the inspection no earlier than 10 years prior to the period of extended operation...as a plant will have accumulated at least 30 years of use before inspections under this program begin, sufficient times will have elapsed for aging effects, if any, to be manifest." Again the wording here is problematic in that there does not appear to be any requirement that the specific component areas sampled be at least 30-years-old.

159. To summarize the key reasons that the BBTIP does not provide the required assurance:

a. There is not a requirement for a through baseline inspection prior to license renewal so that the NRC and Entergy know the condition of each component in order to make a rational Aging Management Plan for the renewal period;
b. Particularly because corrosion is not gradual and that as components age they wear out at a greater frequency as predicted by the Bathtub Curve, the required inspections are too infrequent. The components need to be inspected more frequently as time goes forward.
c. Entergy's AMP has no specificity in the program delineating what must be inspected. Engineering experience shows that certain areas of piping are more susceptible than others to corrosion, like welds, elbows, and dead spots.
d. There are no clear requirements for reporting, repair or replacement of degraded piping. [Tr.,Exh.,13, Gundersen A-17]

PREVENTIVE MEASURES TO MITIGATE CORROSION

160. At the Hearing, it was made clear by Judge Abramson and Dr. Davis that are routine maintenance programs are part of Pilgrims ongoing day-to-day operation and maintenance program, not part of the aging management program. The ASLB is required to judge the adequacy of the required aging management program – the once in 10-year inspection program, not programs that they say they do or may do as part of ongoing maintenance. [Tr.: Judge Abramson, 667;[19] Davis, 642].

[19] Transcript, 667: JUDGE ABRAMSON: Okay. But let's assume it's totally ineffective. What I am interested in is the applicant's proposed -- and let's remember this is part of its ongoing operation and maintenance program, not part of its aging management program. Arnd this is the reason we are in this odd circumstance here, because in order for them to get the license extension, they are required to demonstrate a sufficient aging management program. And the aging management program ...doesn't require them to do anything about their ongoing maintenance because that's handled by another part of the agency under other regulations.

Water Chemistry & Service Water Program

161. In addition to the BPTIP the Applicant claimed [Entergy Prefiled Initial Statement] that other more routine programs are effective in preventing corrosion, like the Water Chemistry & the Service Water Integrity Program and provide assurance for the public. These routine maintenance programs address internal corrosion, and do not provide adequate assurance even in combination with the other programs the Applicant outlined.

162. This is shown by the following factual analysis by Pilgrim Watch's expert, Arnold Gunderson [Tr. Exh. 13, A-19].

a. The water chemistry program is a mitigation program and does not provide detection for aging effects. More frequent complete inspections as part of the overall program are the only effective assurance that defects created by aging components will be uncovered. Tritium leaks at reactors across the country belie the effectiveness of water chemistry alone to prevent leaks.

b. In Entergy's Prefiled Testimony (Testimony at A93), Entergy stated that the Water Chemistry Program was effective because,

> "This is an existing program at PNPS that has been confirmed effective at managing the effects of aging on the CSS as documented by the operating experience review. See PNPS LRA at Appendix B, Section B.1.32.2, p. B-106-07. The continuous confirmation of water quality and timely corrective actions taken to address water quality issues ensure that the program is effective in managing corrosion for applicable components."

c. Entergy's statement alludes to problems within the water chemistry program, and identifies that it has had problems and has improved the program. However, Entergy's Chemistry Program Corporate Assessment, November 2003 [Tr. Exh. 72] indicates a list of "Areas for Improvement." Entergy never discusses the potential damage caused while operating under the older methodology, under recently identified errors and what remediation steps have been taken regarding any damage that occurred. Furthermore, Entergy provides no factual evidence to validate its verbal assurance that the new program is effective.

d. The Service Water Integrity Program addresses internal corrosion. In the Applicant's Testimony, A96, in Entergy's Initial Statement, they describe the program as,

> "(SPW): Under the program, the components of the SSW system are routinely inspected for internal loss of material and other aging effects that can degrade the SSW system. The inspection program includes provisions for visual inspections, eddy current testing of heat exchanger tubes, ultrasonic testing, radiography, and heat transfer capability testing of the heat exchangers. The periodic inspections include direct visual inspections and video inspections accomplished by inserting a camera-equipped robotic device into the SSW system piping. In addition, chemical treatment using biocides and chlorine and periodic cleaning and flushing of infrequently used loops are methods used under this program."

e. Entergy's expert says [at A97] that the program is effective because

> "This program has been effective in detecting degradation of the internal rubber lining in the original SSW system carbon steel piping. As a result, the inlet pipes were replaced with titanium pipe, and portions of the discharge pipes were replaced with carbon steel piping coated internally and externally with an epoxy coating, and the entire lengths of the discharge pipes were internally lined with cured-in-place pipe linings. Thus, this program has been successfully implemented at PNPS to manage

SSW system degradation from loss of material due to internal corrosion prior to the loss of its intended function. See PNPS LRA at Appendix B, Section B.1.28, p. B-92-93."

163. The problem is that the program's effectiveness is ascribed to the fact that there was serious corrosion, which was not identified until after 23 years of operations, and it was identified only as a result of prodding from NRC, Generic Letter 89-13. Entergy has not explained how long the serious corrosion problems had existed, or how long there were significant corrosion problems and how long the licensee would have waited if it were not for the generic letter [Ibid].

164. According to Entergy, Pilgrim replaced (2) 40' sections of SSW Discharge piping out of 240' in one loop and 225' in the other loop 1999. Once again there is insufficient data to make a valid assessment. However there is no indication of the condition of the remainder of these loops [Ibid]

165. In 2001, Entergy states that a new liner was placed in loop B and in 2003 a new liner was placed in Loop A. It strikes me as remarkably convenient that the life expectancy of the liners is given as 35-years, yet there is no factual data with which to corroborate that statement [Ibid]

166. Last at A98 in Entergy's Initial Statement, it say that,

> "...the Service Water Integrity Program will be used to monitor the newly installed liner (CIPP). As the CIPP approaches the end of its expected life, increased inspections will be undertaken of the CIPP. The in-service inspection program for the SSW currently requires PNPS to undertake a complete ultrasonic or visual examination of the CIPP, analogous to those undertaken for the original rubber lining, after the CIPP has been in service for 20

years, well before the end of its expected 35 year life."

167. Once again, there is no timeline delineating the "increased inspections" or enumerating how many inspections will occur. Just as importantly, no definition of "complete ultrasonic or visual inspection" is provided nor is it clear whether this would be a stem to stem inspection or only a partial inspection.

168. At the hearing, the Board was told that UT inspections from the interior would provide no useful information. Dr. Davis [Tr., pages 668-9] explained that UT could not go though all those layers (CIPP, remaining rubber, metal piping) to determine degradation. Judge Abramson [Tr., page 689] responded that, "So if I understand you correctly, ultrasonic testing would not yield any useful information. So what would the staff think is appropriate: visual inspection of the liner? Dr. Davis replied, "Yes, visual inspection"

169. Mr. Gunderson commented on the limitations of the machine used to go inside the pipe, the "Crawler." He said [Tr., page 708] that, "the technique they used would detect gross deformities in the wall. And by "gross," you know, I am thinking about a bubble that might be six inches around and maybe a half-inch. But smaller bubbles I'm not convinced would be detected by that technique, which would mean there is still moisture behind that rubber barrier. And given that we already have a history that do have a concern that a visual inspection of this pipe, which was done before this sock was applied -- we already have indications that the liner peeled. And it's not clear to me that there might not be moisture behind that liner in other places that were undetected. So that the possibility of a through-wall for moisture that remains there when the sock was put on to me is real."

Buried Piping and Tanks Inspection Program and Monitoring Program (BPTIMP)

170. On November 19, 2007, Entergy announced its initiation of a new, corporate,

voluntary program entitled: the *Buried Piping and Tanks Inspection Program and Monitoring Program.* [Tr. Exh.27] The stated purpose of Entergy's document was to provide a framework so that each site can develop a site specific program. According to Entergy, the Program specifies the content, scope, ranking methodology, priorities and inspection frequency of the BPTIMP.

171. The fact that Entergy developed a program is clear evidence that Entergy, like the Petitioner, recognizes that more should be done to detect leakage. We cannot accept Entergy's argument that the BPTIMP was simply developed in response to reports of offsite leaks proliferating around the country. Because Entergy offered it as part of their Prefiled Testimony and as an Exhibit, we can only presume that their intent was to somehow indicate that their day-to-day maintenance program would be a sufficient adjunct to the BTIP.

172. The following analysis of the BPTIMP by Mr. Gundersen describes the program's shortcomings. [Tr. Exh. 13, Gundersen, A-21]

173. Section 5.0, subsection [1] at page 7 acknowledges right at the beginning that "The risk of a failure caused by corrosion, directly or indirectly, is probably the most common hazard associated with buried piping and tanks."[Ibid]

174. Steps required in building a risk assessment tool are discussed in Section 5.0, subsection [2] on page 7. However the program fails in that it does not require a complete baseline review. There is no indication that the entire component is supposed to be examined; instead escape hatches are provided to the licensee - such as [at 2a] "the size of each section shall reflect practical considerations of operation, maintenance, and cost of data gathering with respect to the benefit of increased accuracy." Any program

worth its salt would require a thorough baseline inspection along the entire length of the pipe.[Ibid]

175. Section 5.2, Scope Program subsection [3] at page 8 acknowledges the validity of Pilgrim Watch's initial contention that, "The program shall include buried or partially buried piping and tanks that, if degraded, could provide a path for radioactive contamination of groundwater. Some examples are: Buried piping containing contaminated liquids." Entergy agrees that "radioactive contamination of groundwater" is an important issue and belongs in the Buried Piping and Tanks Inspection and Monitoring Program. [Ibid]

176. Section 5.4 Identification of Buried Piping and Tanks to be Inspected and Prioritized, page 9, Subsection [1] directs the licensee to develop a list of all systems containing buried piping and tanks and to identify those sections, collecting physical drawings, piping/tank installation specifications, piping design tables and other data needed to support inspection activities. The criteria must specify other key parts of the components, for example: wall thickness; number and location of welds, elbows, flow restrictions; blank flanges; high velocity portions; whether the component has substandard parts; the age of the components parts; cathodic protection; last inspection date and report number; and manufacturer's warranty, if any. This information is the type of information that is needed when the NRC Staff conducts their safety evaluation so that the SER Report will be meaningful; unfortunately it was not available. The license application decision should be delayed until the information is available and critically reviewed. [Ibid]

177. Subsection [4] categorizes the piping into high, medium and low impact. High impact components require prompt attention. The Board agrees that they should require prompt attention however Entergy's definition of "prompt" allows considerable delay – high impact buried sections shall be examined within 9 months of issuance of the procedure; and no date is given when the procedure shall be initiated. The impact assessment lists radioactive contamination as "High Risk," confirming the validity of

Pilgrim Watch's initial contention that radioactive contamination should be part of this adjudication process. Note Table 1 below:

Table 1 Impact Assessment

	High	Medium	Low
Safety (Class per EN-DC-167)	Safety Related	Augmented QP and Fire Protection	Non-Safety Related
Public Risk	Radioactive Contamination e.g. Tritium	Chemical/Oil Treated System gases	Untreated Water SW, Demin Water
Economics (Cost of buried equipment failure to plant)	>$1M or Potential Shutdown	>$100K<$1M	<$100K

Notes:

1. Any buried section with at least one High Impact rating gets an overall High Impact rating.
2. Any buried section with no High Impact Rating but at least one Medium Impact rating gets an overall Medium Impact rating.
3. Any buried section with all Low Impact ratings is to be rated as Low Impact.

178. Section 5.5, Table 4 on page 13, "Inspection Intervals vs. Inspection Priority" reflects the outcome from an assessment of the risks from buried piping and tanks.

179. Buried piping and tanks having high risk are specified as having an initial inspection period of 5 years with a re-inspection interval of 8 years. The time interval is too long [Ibid]

180. The Table does not tell how much of the component will be inspected.

181. There is no requirement to shorten a subsequent inspection based upon the degree of corrosion discovered at the time of the prior inspection. [Ibid]

182. Absent from this procedure is the prudent and practical guidance to conduct the inspection provisions of this procedure when opportunities present themselves, regardless of the inspection intervals in Table 4. For example, if a section of buried piping categorized as having "Low" inspection priority is excavated for other reasons, this excavation procedure should direct/require workers to take advantage of the opportunity

and perform inspections- corrosion is neither linear nor constant across the component's length. [Ibid]

183. In subsection [5], the determination of inspection locations may also consider the "ease of access to inspection point." However, ease of location and lack of corrosion do not necessarily go together. A component that is difficult to access may never been inspected – all the more reason that it should be inspected now. [Ibid]

184. Section 5.6, Parameters to be Inspected, page 13, lists: external coatings and wrapping condition; pipe wall thickness degradation; tank plate thickness degradation; and cathodic protection system performance, if applicable. The attributes that must be considered in tabulating risk are too narrow. They include: (a) soil resistivity measurement; (b) drainage risk weight; (c) material risk weight; (d) cathodic protection/coating risk weight. [Ibid]

185. The list in Section 5.6 should be expanded to include, for example, the age of the component's parts; the number of high risk corrosion areas in component such as welds, dead spots etc; counterfeit or substandard part not replaced. The list is silent on internal corrosion even though corrosion from the inside can bring about a failure. [Ibid]

186. Section 5.6 also is silent on the size of the sample required, its location, and the rational for the sampling protocol – if, in fact, a sample is taken and not an inspection of the entire component. [Ibid]

187. Section 5.7, on page 13, provides vague remarks about acceptance criteria for any degradation of external coating, wrapping and pipe wall or tank plate thickness. It says that they should be based on current plant procedures; and if not covered by plant procedures then new procedures need to be developed before the inspections. The pass/fail grade should be clearly defined. For example what precisely constitutes an "unacceptable" from an "acceptable" degraded external wrapping? The LLTF was very specific that "significant" and other such descriptions need definition. [Ibid]

188. Section 5.8, Corrective Actions, page 14, says that "a condition report (CR) shall be written if acceptance criteria are not met. Any and all inspections should generate a written 'condition report' regardless of what is or is not found to maintain a permanent paper trail of all inspections. [Ibid]

189. The Section also says that corrective actions *may* include engineering valuations, scheduled inspections, and change of coating or replacement of corrosion susceptible components, and those components that do not meet acceptance criteria shall be *dispositioned* by engineering. [Emphasis added]. This provides no assurance to public safety for the following reasons. [Ibid]

a. The corrective actions *may* include engineering valuations, scheduled inspections, and change of coating or replacement of corrosion susceptible components; but they also "may not." These should be required.
b. The licensee's own engineering department will deal with it; but there is no clear definition of how they will deal with it. There should be layers of supervision and that the NRC should have an oversight role in this program?
c. Who sees the Condition Reports – or to put it another way, where are the reports kept, who has access to those reports, do they have to be sent to the NRC and if so under what conditions and time schedule? A more basic issue is that Condition Reports are unlikely to be written or, if they are written, to actually say anything as explained directly below.

190. Section 5.12 Inspection Methods and Technologies/Techniques, subsection [1] on page 15 specifies steps to be taken for Visual Inspections of buried piping and tanks. Step (g) directs the workers: "A CR [condition report] shall be initiated if the acceptance criteria are not met." A review of steps (a) through (f) reveal a lack of objective, or even subjective, acceptance criteria that could trigger a condition report:

a. When opportunities arise, buried sections of piping and tanks "should be examined to quantify deposit accumulation…and those results documented." As

long as exposed piping is examined and damage chronicled, the acceptance criteria are met – no condition report.

b. "Look for signs of damaged coatings or wrapping defects"-as long as workers look the acceptance criteria are met. Only not looking would fail to meet the acceptance criterion and trigger a condition report.

c. "The interior of piping may be examined by divers, remote cameras, robots or moles when appropriate." The combination of "may" and "when appropriate" means the acceptance criterion is met when examinations are performed or not.

d. "Use holiday tester to check excavated areas of piping for coating defects." When coating defects are found for exposed area of piping using a holiday tester, the acceptance criteria is met and no condition report is written.

e. If visual inspection reveals coatings or wrappings not to be intact, further inspection of piping for signs of pitting, MIC, etc is required. If the additional inspection is performed, the acceptance criterion is satisfied and no condition report is warranted whether damage is found or not.

f. Inspect below grade concrete for indication of cracking and loss of material. As long as the inspection is performed, the acceptance criterion is satisfied whether damage is found or not. [Ibid]

191. Section 5.12 subsection [2] on page 16 specifies the steps to be taken for Non-Destructive Testing of buried piping and tanks. No steps direct workers to initiate condition report(s) regardless of how extensive the piping and/or tank damage is identified. [Ibid]

192. Section 5.9 Preventive Measures, at 14, "...the existing cathodic protection system *may* be updated or a new Cathodic Protection system *may* be installed. Pilgrim Watch has explained that cathodic protection *should* be installed. The emphasis should be on prevention not waiting to discover failures before acting. [Ibid]

193. In summary, reasonable assurance is not provided by this new program. The Program needs real commitments. The Board cannot properly approve this application

without the Program being upgraded, being put into place at Pilgrim, and then being evaluated.

ENTERGY CONTENTIONS THAT REASONABLE ASSURANCE IS PROVIDED BASED UPON CONFORMANCE TO NRC GUIDANCE, THE GALL REPORT, INDUSTRY PRACTICES, PNPS OPERATING EXPERIENCE, AND THE SER REVIEW

194. Entergy says that conformance to NRC Guidance, the GALL Report; industry practices, PNPS operating experience and the SER Review demonstrates that "reasonable assurance" is provided. The Board finds that Entergy has not presented evidence sufficient to carry its burden.

Conformance to NRC's Gall

195. Entergy has not chosen to follow the important section of GALL, XI M-28; instead they chose the less effective alternative, XI M-34. [Tr., Cox, page 768]

196. Gall XI M-28, focuses on adding cathodic protection. Pertinent portions of it say:

a. Scope of Program: "The program relies on preventative measures, such as coating, wrapping, and cathodic protection, and surveillance, based on NACE Standard RP-0285-95 and NACE Standard RP-0169-96, to manage the effects of corrosion on the intended function of buried tanks and piping respectively."

b. Preventive Actions: "A cathodic protection system is used to mitigate corrosion where pinholes in the coating allow the piping or components to be in contact with the aggressive soil environment. The cathodic protection imposes a current from an anode onto the pipe or tank to stop from corrosion from occurring at

defects of the coating." [20]

c. Detection of Aging Effects: "Coatings and wrappings can be damaged during installation or while in service and the cathodic protection system is relied upon to avoid any corrosion at the damaged locations. Degradation of the coatings and wrappings during service will result in the requirement for more current from the cathodic protection rectifier in order to maintain the proper cathodic protection protect potentials. Any increase in current requirements is an indication of coating and wrapping degradation. A close interval pipe-to-soil potential survey can be used to locate the locations where degradation has occurred."

d. Acceptance Criteria: "In accordance with accepted industry practice, per NACE Standard RP-0285-95 and NACE RP-0169-96, the assessment of the condition of the coating and cathodic protection system is to be conducted on an annual basis and compared to predetermined values."

e. Corrective Actions: The site corrective action program, quality assurance (QA) procedures, site review and approval process, and the administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. As discussed in the appendix of this report, the staff finds the requirements of 10 CFR Part 50, Appendix B acceptable to address the corrective actions, confirmation process and administrative controls."

f. Operating experience: "Corrosion pits from the outside diameter have been discovered in buried piping with far less than 60 years of operation. Buried pipe that is coated and cathodically protected is unaffected after 60 years of service. Accordingly, operating experience from application of the NACE standards on non-nuclear systems demonstrates the effectiveness of this program."

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[20] Entergy failed to mention this provision. Pilgrim's soil is corrosive, and Entergy has not provided any evidence to the contrary.

197. Mr. Gundersen noted that, "The GALL Report simply represents general guidance and is not a mandate. The NRC has repeatedly stated that plant specific data such as operating experience must be considered. Furthermore, the GALL Report is changed periodically informing us that it is neither plant specific nor a regulatory mandate." [Tr. Exh., 13, Gundersen, A-22].

198. Entergy has not conformed with GALL to the extent necessary to provide the "reasonable assurance" that is prerequisite to the Board granting the requested license extension. Entergy should agree to comply with the provisions of GALL, XI, M-28, and include corresponding requirements in its AMP. When that has been done, the Board will be able to re-address the issue of reasonable assurance [Ibid].

Conformance to NRC Guidance

199. Conformance to NRC Guidance does not provide the requisite "reasonable assurance." [Tr. Exh. 13, Gundersen, A-22]

200. NRC Guidance is simply "guidance not mandate" and like the GALL, NRC Guidance continues to evolve as industry-wide lessons are learned. The proliferation of leaks from buried pipes and tanks at nuclear power plants around the country is a good example of exactly why public health and safety standards are not met by nuclear power plants by simply referring these firms to either NRC Guidance or industry practices. [Ibid]

201. The NRC Groundwater Contamination (Tritium) at Nuclear Plants-Task Force – Final Report, Sept 1, 2006[21] studied radioactive leaks from a variety of sources. The LLTF stated in the Executive Summary ii, that,

> "The task force did identify that *under the existing regulatory requirements* the potential exists for unplanned and unmonitored releases of radioactive liquids to migrate offsite into the public domain undetected."

202. In this proceeding, ASLB previously ruled that it is not concerned with offsite leaks. The point, however, is that *under the existing regulatory requirements*, to say nothing of "Guidance," the potential exists for leaks. The LLTF stated in their Executive Summary ii that,"...relatively low leakage rates may not be detected by plant operators, even over an extended period of time." [Ibid]

203. A small leak left undetected can quickly grow to a large leak, long before the next 10 year inspection, and can compromise the structural integrity of the metal pipe in a DBT so that its safety function is not fulfilled [Tr., Ahlfeld , page 852,].

204. As Mr. Gundersen pointed out [Tr. Exh., 13, A-16] leaks not only continue to increase in flow, but in fact the rate of expansion for leaks actually accelerates once a

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[21] The Liquid Radioactive Release Lessons Learned Task Force (LLTF) was established by the NRC Director of Operations on March 10, 2006, in response to incidents at Braidwood, Indian Point, Byron and Dresden related to unplanned, unmonitored releases of radioactive liquids into the environment. The scope of the task force work included reviews of industry experience, associated public health impacts, the NRC regulatory framework, related NRC inspection and enforcement programs industry reporting requirements, past industry actions following significant releases, international perspectives, and NRC communication with public stakeholders. The focus of the Task Force was on releases of radioactive liquids that were neither planned nor monitored. The findings have a direct bearing on Pilgrim Watch's contention. [Tr. Exh. 20]

pinhole has been created in the pipe or tank wall. After the initial pinhole, water begins to exit the tank or pipe, at an ever-accelerating rate as the hole expands. Mathematically the leak rate growth is proportional to the square of the radius of the hole.

Industry Experience Nationwide

205. Industry experience nationwide similarly fails to provide the required assurance. Industry experience indicates that there has been a proliferation of leaks from buried components around the country. This is likely the result of both aging and licensees putting in place monitoring wells. Entergy has provided no evidence that Pilgrim is, or would be, different. There is no experience for reactors that are 40-60 years old.

206. A thorough baseline inspection has not been performed, so there is no baseline data by which to judge Pilgrim's past operating experience. Also, there is no industry-wide experience with which to compare corrosion and leakage in buried components at 40 to 60-year-old reactors [Tr. Exh.13, Gundersen, A-23]

207. Regrettably the NRC did not perform a thorough "autopsy" of the parts from reactors which have been closed and dismantled, like Yankee Atomic and Maine Yankee. Such an analysis and study of the impact of aging on various materials and components would have enabled the entire industry to make predictions based upon sound data.

208. There is no operating experience for the AMP, and the proposed UT examinations are completely untested. [Tr. Exh.13, Gundersen, A-22]

Pilgrim's Site Specific Experience

209. Pilgrim's Final Safety Evaluation Report was issued in November 2007. The document is considered an important part of the license renewal process by the NRC.

210. According to the NRC, "[t]he primary objectives of license renewal inspection activities are to review the documentation, implementation, and effectiveness of the programs and activities associated with an applicant's license renewal program to verify that there is reasonable assurance that the effects of aging will be adequately managed such that the intended function of components and structures within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation."[22]

211. The Staff Report is an important component of the licensing process, and will influence both the Board and the public's deliberations on the assurance provided by the AMP.

212. A recent report by the NRC Office of Inspector General (OIG), *Office of Inspector General's Audit of NRC's License Renewal Program*[23] made clear that the Board cannot rely on the SER's conclusion that aging will be adequately managed so that the intended functions will be maintained consistent with the CLB over the extended period.

213. The OIG's audit revealed that the NRC Staff's license renewal review process is so weak that reviewers often completely fail to address key evaluation criteria such as the licensee's operating experience. In Section C of the report, the OIG concluded that,

> "Operating experience plays an important role in license renewal and the license renewal staff is expected to review plant-specific operating experience, including corrective actions. Yet, audit team members *do not review operating experience consistently*. Furthermore, most audit team members do *not conduct independent*

[22] http://www.nrc.gov/reactors/operating/licensing/renewal/process.html#inspect-prog
[23] Tr. Ex 25, *Office of Inspector General's Audit of NRC's License Renewal Program*, OIG-07-A-15, September 6, 2007. NRC ADAMS ML072490486

verification of operating experience, instead relying on license-supplied information. This is because program managers have not established requirements and controls to standardize the conduct and depth of such reviews. In the absence of conducting independent verification of plant-specific operating experience, license renewal auditors may not have adequate assurances that relevant operating experience was captured in the licensee's renewal application of NRC's consideration." [Tr. Exh. 35, OIG-07-A-15, at 18]

214. The Board has been provided no evidence from which it can conclude that Pilgrim's SER does not fit this description.

215. The SER at Pilgrim says at 3-38 that, "The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience revealed no degradation not bounded by industry experience." In other words, the staff simply reviewed what was in the LRA and then asked the licensee if what they had put in the LRA was correct. There is no evidence of any independent verification or field work. Further, the information provided by Applicant's reports is limited. [Tr. Exh. 30]

216. Without extensive and comprehensive inspections (that have not been made) and a properly designed monitoring well program, Entergy does not, and cannot, know or report the extent of corrosion or whether there are leaks or breaks. To the extent any reports about leaks have been made, there is no assurance that those reports are complete.

217. The LLTF spoke of this at [Tr. Ex. 20, B-1] and recommended:

(5) Develop guidance to define the magnitude of the spills and leaks that need to be documented by the licensee under 10 CFR 50.75 (g). Also, clearly define

"significant contamination." Summaries of spills and leaks documented under 10 CFR 50.75 (g) should be included in the annual radioactive effluent release report (Section 3.2.1 and 3.4).

218. NRC did not make clear to the licensee what had to be documented; neither did it define "significant contamination." Therefore whatever NRC reviewed was self-selected or interpreted as "significant" by the licensee.

219. Regarding reporting requirements, the LLFT states at 19, [Tr. Exh.20]:

"No specific regulatory requirements for licensees to conduct routine onsite environmental surveys and monitoring for potential abnormal spills and leaks of radioactive liquids. However, 10CFR 50.72(g) requires that licensees keep records of information important to the safe and effective decommissioning of the facility. These records include information about known spills."

220. The key word is "known." Neither the NRC Staff affidavit provided by James Davis nor the Safety Evaluation Report indicated whether NRC Audit Staff had access to these records or not; and if they did have access, whether they reviewed these records.

221. The OIG found further fault with the review process in that there is no standard governing what is required in the report or the methodology to be used in the review. Quality assurance is missing [Tr. Exh. 35].

222. The Board concludes that no factual evidence sufficient to carry Entergy's burden of showing that the SER provides either the Board or the public with an adequate basis to pass judgment on whether the NRC's aging management programs for buried pipes and tanks in scope provide adequate protection to public health and safety during the license

renewal term, as required. Until the problems identified by the OIG are investigated for their site specific applicability to Pilgrim and then proper NRC staff inspections performed at Pilgrim, the license application cannot be approved.

223. In summary, reasonable assurance is not demonstrated by conformance to NRC guidance, the Gall Report, industry practices, PNPS' operating experience, or the assurances by the SER Final Report. Neither Entergy nor the NRC has provided the evidence necessary for Entergy to carry its burden.

THE AMP REQUIRES SUPPLEMENTS TO PROVIDE ASSURANCE THAT THE BURIED PIPES AND TANKS WITHIN SCOPE WILL PERFORM THEIR INTENDED SAFETY FUNCTION

224. The ASLB on October 17, 2007, December 19, 2007 and January 11, 2008 said that: the only issue remaining before this Licensing Board regarding Contention 1 is "...whether Pilgrim's existing AMPs have elements that provide appropriate assurance as required under relevant NRC regulations that the buried pipes and tanks will not develop leaks so great as to cause those pipes and tanks to be unable to perform their intended safety functions.

225. The Applicant has not carried its burden of proving that the AMPs are adequate as they currently exist.

226. As shown in the Pilgrim Watch filings - Prefiled Testimony, Rebuttal Testimony, and expert testimonies - the AMP is inadequate because it lacks key elements.

227. The supplements required for Entergy to carry its burden include: establishing critical baseline data; improving monitoring frequency and coverage; retrofitting cathodic protection; increasing the Monitoring Well Program to

actively look for leaks once they have occurred. [Tr. Exh.13, Gundersen, A-23]

BASE LINE DATA

228. In view of the fact that industry as a whole and Pilgrim, specifically, have experienced corrosion and leaks, as evidenced at Pilgrim by the recently discovered Tritium leaks, it is important that critical Baseline Data be collected via a top to bottom examination of the SSW Discharge piping prior to final license approval to determine the current status of the piping in order to assess an appropriate AMP and establish a corrosion rate going forward. [Ibid]

229. Such an inspection must entail special attention to points of vulnerability – such as at elbows, welds, joints, and at any dead spaces where liquid can sit. Examinations must include inspection both inside and outside. Special attention must also be given to those welds located upstream or downstream of a flow disturbance. [Ibid]

230. Since it is not possible to assess possible damage below the coating in the pipe body, in addition all piping must be pressure tested to at least twice the operating pressure. Inability to perform pressure tests for any reason should not be cause for relief. Baseline data is critical so that trending is established. NUREG/CR 6876 states, at 32, "...it is evident that predicting an accurate degradation rate for buried piping systems is difficult to achieve..." [Ibid]

CATHODIC PROTECTION

231. The Applicant can and should implement a thorough Cathodic Protection Program (CPP) on all buried components [Ibid].

232. Corrosion pits from the outside diameter have been discovered in buried piping with far less than 60 years of operation. Buried pipe that is coated and cathodically protected is unaffected after 60 years of service. Accordingly, operating experience from application of the NACE standards on non-nuclear systems demonstrates the effectiveness of this program. [GALL XI M-28, at 10, Operating Experience].

233. Cathodic Protection can be retrofitted [Tr., Gundersen, 722]. Retrofitting cathodic protection is not dangerous. It may introduce strays currents; however this is a design issue, not a design constraint. In order to retrofit cathodic protection requires a rectifier; if it malfunctions it does not necessarily require the reactor to automatically shut-down for repairs.[24]

IMPROVE MONITORING FREQUENCY AND COVERAGE

234. To minimize the size and frequency of leaks, the AMP should be augmented to require more frequent and more comprehensive inspections. Specifically a 100 percent internal visual inspection of all underground pipes and tanks must be implemented. The inspection cycle should be such that all pipes and tanks are inspected every ten years. The Applicant should be required to break the testing interval down such that one sixth of all pipes and tanks are inspected during each refueling outage. (This assumes 18 month refueling outages, or six every ten years.) The Applicant should be required to inspect one sixth of the lineal piping, one sixth of the elbows and flanges, and one sixth of the tank seams at each outage, even if such inspections lengthen the outage time. The Applicant Entergy should certify that each portion of the AMP on the pipes and tanks is accomplished in the order agreed upon and completed at every outage. [Tr. Ex. 13, A-23; Tr., Gundersen at pages 655, 722]

[24] *Affidavit of Dr. James A. Davis in Response to Pilgrim Watch Motion to Strike Testimony*, May 23, 2008, at page 5 and 6.

235. Site specific previous experience showed that both SSW Discharge Loops have had leaks below "minimum wall" thickness at the same time; leaks can develop within (2) years of loss of liner integrity therefore partial inspection of the SSW Discharge pipe should be accomplished at every refueling outage [Tr., Gundersen, page 722].

236. The interior of the SSW Discharge pipe is inspected by a "crawler;" it can be run through the entire pipe during an outage; Entergy objects to performing inspections at each outage because "it creates an undue burden." [Tr., Sullivan, page 722].

237. As an Intervenor with standing on Contention 1, Pilgrim Watch should be given copies of the certified piping inspection reports prior to the end of each outage to assure that the work was completed as ordered [Tr. Exh., 14, Gundersen Decl., at 18.3.4].

MONITORING WELL PROGRAM REQUIRED TO SUPPLEMENT THE AGING MANAGEMENT PROGRAM

238. If small leaks occur, they are indicative of corrosion that may be getting larger. If the corrosion rate is sufficiently rapid, then the structural integrity of the steel pipe may degrade to the point that it may be a safety risk in the event of an earthquake before the next 10 year inspection proposed by Entergy. [Tr., Dr. Ahlfeld, pages 852-3]

239. Leaks could be detected readily and inexpensively with a set of strategically placed monitoring wells because the ground water is fresh water so that if you had a leak from the SSW discharge piping, it would be salt water. [Tr., Dr. Ahlfeld, page 766]

240. A well designed monitoring well system could pick up a leak relatively quickly - approximately within weeks or months after the initiation of a leak, depending on the rates of groundwater flow and other factors; information that is attainable with site specific hydrological studies. Sampling wells is usually done about four times a year. [Tr., Dr. Ahlfeld, page 767]

241. Monitoring wells are "more that a nice thing to add but instead a crucial part of a full system." There is no assurance that the CIP will not leak, there was no proof of a 35 year life expectancy, and once corrosion starts that it grows quickly. [Tr., Dr. Ahlfeld, 856] Monitoring wells provide the capability to detect leakage before the size of the leak becomes too great.

242. Pilgrim's monitoring well system: Entergy installed a (4) well monitoring system at Pilgrim Station as part of NEI's voluntary groundwater monitoring program. The well location is provided [Tr. Ex. 37]. These are generally located between the reactor and the shoreline. The wells are spaced approximately 200 feet apart; there is no evidence of any recent hydrogeologic studies that have been conducted to determine current groundwater flow directions and rates. Hence, the suitability of these wells to actually intercept plausible leakage transport pathways is unknown; a 4-well monitoring system is more typical of that used for a retail gasoline station or a small municipal (non-hazardous) landfill. That it should be considered adequate for a large industrial facility such as PNPS is unrealistic. [Tr. Ex. 15, Dr. Ahlfeld]

243. The program at Pilgrim does not meet proper design criteria. A monitoring well program to supplement the AMP should be designed according to the general design criteria described by Dr. Ahlfeld, [Ibid]

244. Groundwater monitoring networks can be used as part of a leak detection system and are widely used for this purpose. Well-established protocols exist for proper design of monitoring networks including well and screen placement, sampling frequency and selection of sampled contaminants. The 4-well monitoring system apparently used by Entergy does not meet reasonable standards for monitoring network design. [Ibid, at 4]

CONCLUSIONS OF LAW

Entergy Failed to Satisfy Its Burden of Proving Reasonable Assurance

1. In an operating license proceeding, the licensee bears the ultimate burden of proof. *Metropolitan Edison Co. (Three Mile Island Nuclear Station, Unit 1)*, ALAB-697, 16 NRC 1265, 1271 (1982) (citing 10 C.F.R. § 2.325). The Board cannot renew Pilgrim's license unless Entergy shows that its aging management program provides reasonable assurance that the Current Licensing Basis ("CLB") will be maintained [10 C.F.R. § 54.29].

2. Licensing boards and courts have defined "reasonable assurance" with a showing of "clear preponderance" *North Anna Envtl. Coalition v. NRC*, 533 F.2d 655, 667-68 (D.C. Cir. 1976). Entergy must show by a clear preponderance of the evidence that its Aging Management program will ensure compliance with the CLB during license renewal, 2012-2032. It has not done so.

3. Entergy has not satisfied its burden of proving that the Aging Management Program it proposes will be effective, and has thus failed to carry its burden of proving "reasonable assurance."

Proving "Reasonable Assurance"

4. To prove that its Aging Management Program provides the requisite "reasonable assurance" Entergy must show, by a preponderance of the evidence, that there is at least a 95% level of certainty that the effects of aging will be managed so that the intended function of the pipes will be maintained consistent with the CLB during the license extension – that their aging management program is sufficient.

5. In *Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4)*, 54 NRC 3, 10 (2001), the Commission recognized that corrosion and other effects become more severe over the extended license period, and accordingly required an applicant for license renewal to demonstrate that its programs *will be effective* to manage the effects of aging:

> Part 54 requires renewal applicants to demonstrate how their programs will be effective in managing the effects of aging during the proposed period of extended operation. . . . Applicants *must identify* any additional *actions*, i.e., maintenance, replacement of parts, etc., *that will need to be taken* to manage adequately the detrimental effects of aging. [60 Fed. Reg. 22,462 (May 8, 1995) at 22,475. 54 N.R.C. at 7 (emphasis added).

6. 10 CFR 54.21(a)(3)[25] is clear that the "will be effective" standard extends to each component within scope of the license renewal rules. For each component, Entergy must establish, to a 95% level of confidence, that for each component the effects of aging will be effectively managed so that the intended functions will be maintained consistent with the current licensing basis (CLB) over the period of extended operations.[26]

95% Level of Confidence Is Required

7. The U.S. Supreme Court [*Daubert v. Merrell Dow Pharms.* 509 U.S. 579, 592 (1993)] held that scientific evidence must conform to the accepted convention of 95 percent probability to be admissible. This 95% standard of proof was followed in state courts - for example, in the Texas Supreme Court in *Merrell Dow Pharms., Inc., v. Havner*, 953 S.W.2d 706, 723-24 (Tex. Sup. Ct 1997). Further it was supported by federal government scientists as the minimum that is acceptable to prove each scientific fact in a case. [*See, e.g., U.S. v. Chase*, 2005 WL 757259, (Jan. 10, 2005 D.C. Super); *See generally,* Frederika A. Kaestle, et al., *Database Limitations on the Evidentiary Value of Forensic Mitochondrial DNA Evidence*, 43 Am. Crim. L. Rev. 53 (2006)]

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[25] 10 CFR 54.21, Tr., Exh., 3

[26] Using the word "appropriate" rather than "reasonable," the Licensing Board's Memorandum and Order, October 17, 2007 was consistent with the CFR requirement:

> The only issue remaining is ...whether Pilgrim's existing AMPs have elements that provide *appropriate assurance* as required under relevant NRC regulations that the buried pipes and tanks will not develop leaks so great as to cause those pipes and tanks to be unable to perform their intended *safety functions*.

8. Probably most important, the 95% confidence standard has been accepted and applied by the NRC as the measure of "reasonable assurance" [Tr., Exh., 17, Transcript of ACRS Meeting (Sept. 6, 2001)]

9. In Entergy's Initial Statement[27], at 3, it sought to define "reasonable assurance" by referring to the Nuclear Power Plant License Renewal Final Rule, 60 Fed Reg. 22,461, 22,479 (1995) ("... [the license renewal] process is not intended to demonstrate absolute assurance that structures or components will not fail, but rather that there is a reasonable assurance that they will perform such that the intended functions...are maintained consistent with the CLB").

10. However the rule is not inconsistent with NRC's acceptance of the 95% confidence standard. Ninety-five percent is not "absolute assurance;" but it is what "reasonable assurance" requires.

11. So-called "engineering judgment" does not provide reasonable assurance, at least unless that judgment is backed up with verification – facts that have been established at the required 95% confidence level. "Engineering judgment" resulted in the bridge that collapsed in Minneapolis, the Big Dig in Boston with its leaking tunnels and falling ceiling tiles, the Challenger crash, and Entergy's and NRC Staff's engineers failure to identify corrosion in Vermont Yankee's cooling tower wall before it collapsed.

Entergy's Failure to Provide Assurance

12. *Florida Power & Light Co.,* pointed to the need for "sufficient inspections and testing." The once in 10 year inspection by either a visual exam or UT examination proposed by Entergy, does not meet this test, particularly since there is no operating experience to rely on. This is

[27] Entergy's Initial Statement of Position on Pilgrim Watch Contention 1, January 8, 2008

so whether or not the once-every-ten year inspection might perhaps be supplemented by an "opportunistic inspection."

13. An inspection that only might occur every ten years is insufficient to provide the requisite assurance that cracks, hole(s) or significant wall thinning in the buried SSW Discharge piping are likely to be identified. Past experience shows that degradation occurred in both loops simultaneously. If left undetected, degraded piping could collapse in a design basis event, such as an earthquake. As a consequence, the flow path of the discharge piping would be blocked and the piping could not remove heat from the heat exchanger.

14. To provide the required assurance, prior to license extension Entergy should enhance or supplement its Aging Management Program with a more robust inspection system, cathodic protection, base line inspection, and an effective monitoring well program.

Entergy Failed to Provide Factual Evidence

15. Entergy did not meet the 95% confidence level for scientific evidence in their answer to the Board's question whether the SSW Discharge pipes would not develop leaks so great as to cause those components to be unable to perform their intended safety function. Entergy did not prove the requisite assurance that the SSW Discharge pipes would not develop leaks so great to cause those components to be unable to perform their intended safety function.

16. Entergy, for example, failed to provide warranties showing the service life of the liners and wraps; we suspect that they do not exist. They failed to provide analyses to factually demonstrate the present condition of the metal piping, welds, coating and liner; failed to provide current soil resistivity rates; and failed to provide site specific information at the Hearing regarding the cured-in-place liner (CIPP), problems encountered during installation and methodology and results from testing.

The NRS Staff Review Does Not Provide Reasonable Assurance

17. The Board cannot find reasonable assurance in the NRC Staff Safety Review. As pointed out by the NRC Office of Inspector General, NRC Staff Safety Reviews did not even purport to be the result of independent and thorough examinations. See Petitioners Docket 50-219-LR, January 3, 2008. It appeared clear that the NRC Staff relied on conclusory statements from the Applicant – and as discussed above those statements is not enough.

Risk Management

18. In large measure, the issue before the Board is one of risk management: does the AMP provide reasonable assurance that risk will be effectively managed over the license renewal period?

19. Risk is the product of consequences and probability.

20. **Consequences:** The potential consequences are by definition (10 CFR § 54.4) very high.

21. Potential consequences go beyond the narrow but important scope of this Board's review.

22. Additional consequences of leaks from buried piping containing radioactive liquid also include: exposing members of the public to unknown, and perhaps excessive doses of radiation by radionuclides migrating offsite in violation of NRC regulation; exposing workers on site via inhalation, especially in the winter or during heavy rains when radioactive contaminated water could rise to the surface and become airborne; and risking Pilgrim becoming an expensive legacy site. Any of these consequences may impair public health and safety and result is very large future costs. They cannot properly be disregarded.

23. **Probability:** Probability is directly related to the confidence level. Even if Entergy's AMP provides a 95 level of confidence that it will effectively manage the effects of aging so that the intended function of the pipes will be maintained consistent with the CLB during the license extension, the risk that it will not do so is necessarily five percent (5%).

24. Entergy did not prove that Pilgrim's existing AMPs will provide even a 95% level of confidence, the level of required under relevant NRC regulations, that the buried pipes will not develop leaks so great as to cause those pipes to be unable to perform their intended safety functions.

25. Similarly, Entergy failed to prove that the AMP will insure that in a design basis event such as an earthquake, there is 95% confidence that the flow path of the discharge piping will not become blocked .the piping could not remove heat from the heat exchanger [Transcript 610,615, 622, 625, 627,694-5, 697-8, 707,730-1].

Cost /Benefit

26. Risk is real, unnecessary and unacceptable. Entergy has not proved that its aging management program reduces risk to the level require to provide the requisite reasonable assurance.

27. An aging management program that provided reasonable assurance[28] would not be "burdensome." There is only one ready explanation for Entergy's reluctance to provide an effective program to detect leaks and wall thinning – it really doesn't want to know. Based

[28] The aging management program that required, for example, critical current baseline data; cathodic protection to reduce the future corrosion rate; improved monitoring frequency and coverage; and a well-designed monitoring well program to determine the existence of leaks once they have occurred.

on experience at other plants, Entergy seems rightly to fear that if it should look for a problem it likely will find one – a buried pipe that is corroded and may fail, or an actual leaking of radioactive liquid from a buried pipe. Apparently, Entergy doesn't want to accept one consequence of finding a leak – shutting down until it is fixed; but it seems more than ready accept another – a risk to public safety.

To Provide reasonable Assurance, The Board Should Require Entergy to Supplement Its AMP

28. Pilgrim's operating license does not expire until 2112, some four years from now. There is no need, or any good reason, for the Board to "rush to judgment."

29. Before the Board renders its decision, it should require Entergy to obtain, and provide to this Board, important now absent facts and information, including: analytical reports documenting the present condition of the buried components from UT inspections on the exterior and visual inspections from the interior focused especially on the more susceptible areas to corrosion; and analysis of soil resistivity of the soils immediately surrounding the piping, today.

30. All reports, including full data and analysis, should be made available to the NRC Technical Staff and public for independent review.

31. Additionally the Board's decision should wait until a decision is rendered on the January 3, 2008, Petition filed by Intervenors at Pilgrim, Vermont Yankee, Indian Point and Oyster Creek with the U.S. Nuclear Regulatory Commission to suspend the currently pending license renewal proceedings with regard to the NRCs Office of Inspector General's Report on the NRC Staff's Safety Reviews [Docket 50-219-LR].

Broader Review is Essential

32. Pilgrim Watch's original contention, filed May 25, 2006, said that, "The Aging Management program proposed in the Pilgrim application for license renewal is inadequate because (1) it does not provide for adequate inspection of all systems and components that may contain radioactively contaminated water and (2) there is no adequate monitoring to determine if and when leakage from these areas occurs. Some of these systems include underground pipes and tanks which the current aging management and inspection programs do not effectively inspect and monitor."

33. Subsequent orders issued over the past two years narrowed Pilgrim Watch's contention to simply 460 feet of piping in the SSW Discharge system; and to only whether or not the AMPs will provide assurance that there is redundancy in both "Loops" so that there is assurance that the system will perform its safety function specified in 10 CFR § 54.4, (i) – (iii); or to put it another way that in a design basis event, such as an earthquake, both loops will not fail so that the discharge water is backed up interfering with the heat exchanger.

34. Pilgrim Watch continues to hold that the license renewal rules can be properly interpreted to allow a larger range of components and functions to come under review.

35. 10 CFR § 54.4 Scope: The board's majority chose a narrow interpretation of license review regulations. This interpretation was based upon an overly narrow reading of 10 CFR § 54.4.[29] That CFR simply says <u>how components are to be determined to be within scope. It is not a restriction on what can be looked at once they are determined to be within scope.</u>

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[29] 10 CFR § 54.4 reads: (a) Plant systems, structures, and components within the scope of this part are--(1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions--(i) The integrity of the reactor coolant pressure boundary;(ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or (iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of this chapter, as applicable.

36. 10 CFR § 54.21 [Contents of application--technical information] explains what has to be looked at in an aging management review of the components once they are determined to be within scope by 10 CFR § 54.4 (3). It says,

(3) For each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

37. The CLB (Current Licensing Basis) means that Entergy is required to fully comply with its license and all NRC regulations. This means compliance not simply with some of NRC's regulations but all of NRC's regulations that pertain to these important safety components.

38. Pertinent regulations in the CLB for the buried components include, for example:

10 CFR 50 Appendix B: According to 10 CFR 50 Appendix B leaks are required to be repaired and Entergy must look for leaks and fix them when found in order to comply with its CLB during the relicensed period. This regulation makes absolute sense because if there are any unidentified leaks in the aforementioned pipes, such leaks may jeopardize the design and intended function of safety related systems and components at the Pilgrim Nuclear Power Station. Corrosion cannot be assumed to be gradual. In fact, Dr. Davis, NRC Staff expert, said at the Hearing, "once corrosion starts it goes quickly" [Tr., page 729].

The Board Decision is Inconsistent with Current NRC Regulations [CLB]

39. Current NRC Regulations require Pilgrim to improve its current inspection and monitoring programs and prohibit unmonitored releases of radioactivity to be released offsite. Therefore the board was simply wrong when it removed this aspect of Pilgrim Watch's original contention from the license review process.

40. Current regulations require the Applicant to have in place an effective program for monitoring radiation on-site and off-site.[30] Although on-site monitoring wells to detect

[30] **10 CFR § 20.1302 Compliance with dose limits for individual members of the public:** (a) The licensee shall make or cause to be made, as appropriate, surveys of radiation levels in unrestricted and controlled areas and

radiation in groundwater are not specifically required in these regulations (unless the water on-site is used for drinking, which it is not at Pilgrim), recent events make such a scheme a natural addition to the Pilgrim Aging Management Plan. 10 CFR § 20.1302 and §50 Appendix A Criterion 60 require that NRC's licensees demonstrate that effluents, including those from 'anticipated operational occurrences,' do not expose members of the public to excessive radiation doses.[31] Effective monitoring systems are required in order comply with

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radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with the dose limits for individual members of the public in § 20.1301.

10 CFR § 50 Appendix A: *Criterion 60--Control of releases of radioactive materials to the environment.* The nuclear power unit design shall include means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences. Sufficient holdup capacity shall be provided for retention of gaseous and liquid effluents containing radioactive materials, particularly where unfavorable site environmental conditions can be expected to impose unusual operational limitations upon the release of such effluents to the environment.

Criterion 64--Monitoring radioactivity releases. Means shall be provided for monitoring the reactor containment atmosphere, spaces containing components for recirculation of loss-of coolant accident fluids, effluent discharge paths, and the plant environs for radioactivity that maybe released from normal operations, including anticipated operational occurrences, and from postulated accidents.

[31] **10 CFR § 20.1302 Compliance with dose limits for individual members of the public:**(a) The licensee shall make or cause to be made, as appropriate, surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with the dose limits for individual members of the public in § 20.1301. (b) A licensee shall show compliance with the annual dose limit in § 20.1301 by--(1) Demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit; or (2) Demonstrating that--(i) The annual average concentrations of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the values specified in table 2 of appendix B to part 20; and (ii) If an individual were continuously present in an unrestricted area, the dose from external sources would not exceed 0.002 rem (0.02 mSv) in an hour and 0.05 rem (0.5 mSv) in a year.

10 CFR § 50 Appendix A: *Criterion 60--Control of releases of radioactive materials to the environment.* The nuclear power unit design shall include means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences. Sufficient holdup capacity shall be provided for retention of gaseous and liquid effluents containing radioactive materials, particularly where unfavorable site environmental conditions can be expected to impose unusual operational limitations upon the release of such effluents to the environment. *Criterion 64--Monitoring radioactivity releases.* Means shall be provided for monitoring the reactor containment atmosphere, spaces containing components for recirculation of loss-of coolant accident fluids, effluent discharge paths, and the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents.

these regulations. While leaks of radioactively contaminated water into the ground for extended periods of time may not have been operational occurrences anticipated when the facilities were initially designed and licensed, they can scarcely be "unanticipated" following the series of occurrences around the country. As those events demonstrated, unless nuclear facilities aggressively monitor for leaks both off-site and on-site, a leak can go undetected for years, and potentially life threatening releases of radiation can migrate off-site before any problem is detected. The public is not provided with assurance from a voluntary program such as the BPTIMP – voluntary programs are not enforceable. The new (4) well monitoring program installed at Pilgrim, November 2007, does not meet accepted design criteria and four wells are suited for a corner service station, not a nuclear reactor on the shores of Cape Cod Bay. [Tr., Exh. 2, Dr. Ahlfeld]

41. In the alternative if the Board persists on regarding unmonitored radioactive leaks offsite as outside license renewal then it is clear, as argued previously by Pilgrim Watch, that all buried piping and tanks within scope should be on the table. It is not reasonable for the board to claim that radioactivity is not relevant and then to restrict the inquiry to simply those components that contain radioactive liquids. The absurdity of the Board's decision was touched upon at the hearing when Judge Abramson opined that the SSW inlet piping was a bigger problem than the discharge piping [Tr., Judge Abramson, page 720].

Citizen Witnesses Were Candid; Some of Entergy's and NRC's Were Not

42. Dr. David Ahlfeld, a hydrologist, and Arnold Gundersen, a nuclear engineer, are both fully qualified as evidenced by their CVs. They are not employees of Entergy or the Nuclear Regulatory Commission, and neither job security nor economic reward influenced their testimony. During the proceeding, Citizen's experts provided correct and straight-forward information to the Board. Their testimony was carefully considered, scrupulously implemented, and rigorously correct. In contrast Entergy's and NRC's were at times inconsistent, at variance with the record, and misleading and may have misled members of the Board and public at the hearing.

CONCLUSION

43. For the foregoing reasons, Entergy's application to relicense the Pilgrim Nuclear Power Station should be denied. It does not meet the "not inimical" to public safety mandate of the AEA.

Respectfully submitted,

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June 9, 2008

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of | Docket # 50-293-LR

Entergy Corporation

Pilgrim Nuclear Power Station

License Renewal Application | June 9, 2008

CERTIFICATE OF SERVICE

I hereby certify that the following was served on June 9, 2008 by 2008 by electronic mail and by U.S. Mail, First Class to the Service List Pilgrim Watch Post-Hearing Findings of Fact and Conclusions of Law

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