LBP-08-22

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Ann Marshall Young, Chair
Dr. Paul B. Abramson
Dr. Richard F. Cole

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| In the Matter of: | Docket No. 50-293-LR |
| ENTERGY NUCLEAR GENERATION COMPANY AND ENTERGY NUCLEAR OPERATIONS, INC. | ASLBP No. 06-848-02-LR |
| (Pilgrim Nuclear Power Station) | October 31, 2008 |

**Concurring Opinion of Administrative Judge Ann Marshall Young to INITIAL DECISION issued October 30, 2008**

## I. Introduction

I agree with the result reached in the majority decision. In my view, however, the decision would benefit from, and indeed requires, more support in the way of detailed findings of fact, as well as more in-depth analysis of the application of relevant law, including the "reasonable assurance" standard of 10 C.F.R. § 54.29, to those facts. I recount herein the facts that I find to be relevant on the issues presented in Contention 1, and discuss the legal conclusions that I find follow logically from those facts.

I would note that Contention 1 as admitted states:

> The Aging Management program proposed in the Pilgrim Application for license renewal is inadequate with regard to aging management of buried pipes and tanks that contain radioactively contaminated water, because it does not provide for monitoring wells that would detect leakage.[1]

As illustrated in the Majority Decision, there were subsequent occasions in which the Licensing Board, or a majority thereof, further clarified or otherwise spoke to the scope of the contention. At bottom, however, the contention deals with the adequacy of Pilgrim's aging management programs for buried pipes in providing "reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the [Pilgrim] plant's [current licensing basis]," as required at 10 C.F.R. § 54.29(a), and whether monitoring wells are required in order to provide such "reasonable assurance," in light of alleged inadequacies.

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[1] *Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), LBP-06-23, 64 NRC 257, 315 (2007).

As the Majority Decision notes, two systems are at issue: the condensate storage system (CSS) and the salt service water system (SSWS or SSW system).[2] The facts regarding the CSS are relatively more straightforward regarding the usefulness of monitoring wells, given the water level checks discussed in the Majority Decision and below. The SSWS, however, presents more nuanced questions regarding the obviously relevant (and broader) issue of how to assure the integrity of pipes that are buried and thus cannot be observed, inspected, or tested as easily as above-ground pipes. Intervenor Pilgrim Watch's concerns spring largely from this reality. I attempt herein to address these concerns in the course of discussing the facts and law relating to both the CSS and the SSWS, attending to the latter in somewhat greater detail. In the end I am persuaded by the combination of a large number of facts and circumstances regarding both systems, which, taken together, provide the requisite "reasonable assurance," notwithstanding the lack of any probabilistic evidence or numeric level of certainty of the nature Intervenor argues is necessary. This conclusion is based on the following facts and law:

**II. Facts**

Pilgrim's condensate storage system includes two above-ground 275,000-gallon condensate storage tanks, as well as piping, including underground piping, between these tanks and Pilgrim's reactor building auxiliary bay, where the pipes supply water to the reactor core

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[2] I note Pilgrim Watch's arguments that the scope of license renewal is not so limited as the Board Majority has viewed it. See, e.g., Pilgrim Watch Post-Hearing Findings of Fact, Conclusions of Law (June 9, 2008) at 3 [hereinafter Pilgrim Watch Proposed Findings]. While the license renewal rules are not a model of clarity and might well have been written more straightforwardly regarding the scope of license renewal, I nonetheless agree that, reading 10 C.F.R. § 54.4 in conjunction with §§ 54.21(a) and 54.29(a), only those structures and components that perform the functions listed at § 54.4(a)(1)-(3) are subject to aging management under § 54.21(a)(1). *See* LBP-08-22, Initial Decision at § II.B. And it is licensee "actions" regarding these matters that are subject to the "reasonable assurance" requirement of § 54.29(a).

isolation cooling (RCIC) and high pressure coolant injection (HPCI) pumps.[3] These pumps serve to assure adequate cooling of the reactor in the event of anything that interrupts the normal supply of water that cools the reactor, in order to prevent the release of radioactive materials to the environment.[4] The salt service water system serves to cool essential plant equipment by bringing in sea water through an underground intake pipe and ultimately discharging that water via underground discharge piping.[5]

I begin my analysis of the facts regarding these two systems with an overview of Pilgrim's aging management program for underground pipes, then organize the remainder of my discussion into consideration of the facts relating, first, to aging management of external degradation of relevant pipes and tanks, and second, to aging management of internal degradation of underground pipes and tanks, including as well review of several additional issues raised by Intervenor Pilgrim Watch.

**A. Pilgrim Aging Management Program Overview**

Pilgrim's aging management programs for buried pipes and tanks that contain or potentially contain radioactively contaminated water are (1) the Buried Piping and Tanks Inspection Program, or BPTIP; (2) the Water Chemistry Control-BWR[6] Program; (3) the Service Water Integrity Program; and (4) the One-Time Inspection Program. The BPTIP is intended to

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[3] *See* Exh. 1, Testimony of Alan cox, Brian Sullivan, Steve Woods, and William Spataro on Pilgrim Watch Contention 1 (Jan. 8, 2008) at A24, A27.

[4] *See id.* at A28.

[5] *See id.* at A31.

[6] "BWR" stands for boiling water reactor, the type of reactor that is at the Pilgrim Nuclear Power Station (hereinafter Pilgrim or PNPS).

manage the loss of material due to external degradation of buried pipes, while the other AMPs manage loss of material due to internal degradation of buried pipes.[7]

According to the testimony of Entergy and NRC Staff witnesses, these four programs are, with certain exceptions discussed below,[8] consistent with the Generic Aging Lessons Learned (GALL) Report, NUREG-1801.[9] The NRC Staff developed the GALL Report at the direction of the Commission to provide a basis for evaluating the adequacy of aging management programs for license renewal. It is based on a systematic compilation of plant aging information and an evaluation of aging management program attributes, and identifies programs that the Staff considers acceptable to manage the effects of aging on systems, structures and components within the scope of license renewal.[10] While the GALL Report is entitled to some weight as an NRC guidance document, it does not have the force of a legally binding regulation and, like any guidance document, may be challenged in an adjudicatory proceeding such as this one.[11] With this in mind, I look next at Pilgrim's programs for managing external and internal degradation of underground pipes.

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[7] Exh. 1 at A35, A91-A102; Tr. at 775-77.

[8] *See infra* text accompanying nn.64, 177-179.

[9] Exh. 1 at A72, A94, A99, A102, A130; Exh. 39, NRC Staff Testimony of Dr. James A. Davis Concerning Pilgrim Watch Contention 1 (Jan. 29, 2008), at A10, A13. The GALL Report is referenced as the technical basis document for NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants." Excerpts of it were introduced as Exhibits 7, 31, 42, 43, and 71.

[10] Exh. 1 at A73; Exh. 7, NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Vol. 1, Rev. 1, & Vol. 2, Rev. 1 (Sept. 2005) (excerpts), at 1-3.

[11] *See*, *e.g.*, *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-01-22, 54 N.R.C. 255, 264 (2001); *International Uranium (USA) Corp.* (Request for Materials License Amendment), CLI-00-1, 51 NRC 1, 19 (2000); *Curators of the University of Missouri*, CLI-95-1, 41 NRC 71, 149-50 (1995); *see also infra* n.283.

**B. Aging Management of External Degradation of Pipes**

Pilgrim's BPTIP addresses the effects of aging caused by corrosion of external surfaces of components buried in soil.[12] It has two parts: first, the use of preventive measures to inhibit the degradation of buried pipe surfaces exposed to soil, such as selection of corrosion resistant materials and/or application of protective coatings;[13] and second, the use of inspections to manage the effects of external surface corrosion on the pressure-retention capability of buried pipes and tanks.[14]

**1. Use of Corrosion-Resistant Materials**

The buried CSS piping and the SSWS inlet piping are made of stainless steel and titanium, respectively.[15] According to Entergy and NRC Staff experts, stainless steels are generally resistant to corrosion in soils,[16] and while pitting corrosion can occur on some grades of stainless steel under particular conditions (*e.g.*, high temperatures, high concentrations of chloride, and low pH levels generally less than 4.5), the CSS buried pipe is not exposed to such conditions.[17] According to the same experts, the titanium used in the SSWS inlet piping is immune to corrosion in soils, and it and its alloys are resistant to corrosion from all natural waters and steam to temperatures in excess of 600°F, and exhibit negligible corrosion in

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[12] *See* Exh. 5, Pilgrim License Renewal Application, App. B (Excerpts), at B-17 – B-18; Exh. 39 at A10; Exh. 1 at A76.

[13] *Id.* at A36.

[14] *Id*.

[15] Exh. 39 at A11, A13.

[16] Exh. 1 at A39; Tr. at 813; Exh. 39 at A13.

[17] Exh. 1 at A39.

seawater to temperatures as high as 500°F.[18] Additionally, the original CSS buried piping and SSWS buried inlet piping were covered with a coal-tar enamel coating,[19] as described below.

The SSWS discharge piping has two loops, designated as loops A and B. The pipe in each loop is made of carbon steel, with the exterior surface covered with a multi-layer coal-tar enamel or epoxy coating.[20] These coatings are designed to form a moisture- and chemical-resistant barrier that permanently bonds with the outer surface of the pipe and, if intact, creates a waterproof barrier between the soil and the pipe.[21]

**2. Application of Protective Coatings**

Pilgrim's procedures for applying coatings in the shop, before burial, include the following eight steps:

> i. The pipe is first cleaned of all dirt, grease, mill scale, or any loose debris using mechanical means such as an impact wheel or wire brush;
> ii. Following cleaning of the pipe, a layer of primer is painted onto the exterior of the cleaned pipe;
> iii. After applying the primer, a coal-tar enamel coating is applied, at a temperature calculated to ensure that the enamel bonds with the primer to prevent peeling from the pipe;
> iv. The enamel is then visually inspected for uniformity;
> v. Before the enamel cools, fiberglass wrapping is uniformly applied over the enamel to cover the entire outside surface of the enamel;
> vi. An additional layer of coal-tar enamel is applied;
> vii. The second layer of enamel is followed by an outerwrap of insulation; and
> viii. A final layer of heavy Kraft paper is wrapped around the entire pipe to complete the process.[22]

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[18] Exh. 1 at A41; Exh. 39 at A10.

[19] Exh. 1 at A46, A54; Tr. 720-21.

[20] *See* Exh. 1 at A42, A46.

[21] *Id.* at A47; *see id.* at A37-A65, Tr. 756-57.

[22] Exh. 6, Specification No. 6498-M-306, "Specification for External Surface Treatment of
(continued. . .)

The double wrapping specified for Pilgrim's buried pipe – one layer of coal-tar coating, followed by fiberglass wrapping, another layer of coal-tar, a layer of insulation, and a final layer of heavy Kraft paper – exceeds the standard industry practice for single-wrapping buried piping under normal soil conditions. The coal-tar enamel permanent coating and bonded double outer wrap used at the Pilgrim plant is specifically designed for use on submerged lines, river crossings, and similar installations that experience aggressive environments, or where trench conditions are extraordinarily severe – conditions which, according to Entergy experts, do not exist at the Pilgrim plant.[23]

Pilgrim's procedures for field installation of coatings at the joints where pipe segments are joined require cleaning by wire-brushing to remove any rust, scale, dust, or dirt, and by solvent to remove oil or grease; applying a layer of primer to the exterior of the cleaned pipe, which is then allowed to dry; and applying a 35-mil-thick coal-tar tape (consisting of a 7-mil polyethylene film backing and 28 mils of adhesive) to the primed surface.[24]

Pilgrim procedures require coatings to be inspected at every stage in the installation process, with visual inspection of the coated piping for any misapplication of the coatings followed by an electrical inspection of the pipe coating by a high-voltage "holiday" detector to identify any voids in the coating. In the field, the pipes are visually inspected upon receipt to ensure that no damage occurred during shipment. Pilgrim Construction Specification No. 6498-

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Underground Metallic Pipe for Unit No. 1 Pilgrim Station No. 600 boston Edison Co."; Exh. 1 at A46, A48; *see also* Exh. 39 at A11.

[23] Exh. 1 at A57; *see id.* at A82 – A89.

[24] *Id.* at A49; Exh. 6 at 3; *see* Tr. at 755-56, 760.

M-306, which governs the external coating process used by Entergy for the buried SSWS piping, also provides procedures for conducting field repairs on any shop-applied coatings that are found during the field inspection to be damaged.[25] After the pipes are fully joined, assembled in place, with the field joints wrapped, and before covering them with soil, the entire pipe is again tested for voids using the high voltage holiday detector to assure that field joints are properly wrapped and that the shop-applied coatings were not damaged during installation.[26]

Experience at the Pilgrim plant supports the effectiveness of the coatings used on its underground pipes. In 1999, plant personnel examined the external buried piping coatings on two forty-foot sections of SSWS discharge piping that were replaced more than 25 years after the plant had become operational. The exterior surface of the piping had been wrapped with reinforced fiberglass wrapping, coal-tar-saturated felt, and heavy Kraft paper in accordance with Specification 6498-M-306, as described above. The exterior wrappings of the pipes were found to be in good condition and no external corrosion of the pipes was observed. An examination of the piping after its wrapping was removed revealed that the outside surface of the piping was in its original condition.[27]

An aliphatic amine epoxy coating was used on the two 40-foot replacement sections of the SSWS discharge piping. A minimum of two coats was applied to each length of piping in the shop to achieve a dry thickness of at least 30 mils, and all coated areas were holiday tested

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[25] *See* Exh. 6 at 3-4.

[26] Exh. 1 at A51; *see* Exh. 41, Rebuttal Testimony and Responses to Board Questions of Dr. James A. Davis, Terence L. Chan, and Andrea T. Keim Concerning Pilgrim Watch Contention 1 (Mar. 6, 2008), at A12;Tr. at 756.

[27] Exh. 1 at A74; *see* Exh. 39 at A9; Tr. at 642.

after the curing was complete. The joints between the two forty-foot sections and the existing pipe were coated in the field.[28] According to Entergy and Staff experts, the epoxy coating used on the two forty-foot replacement pipes has excellent corrosion resistance that is equal to or superior to the double-wrapped coatings used on the original SSWS discharge piping.[29]

**3. Industry Experience with Protective Coatings**

According to several NRC publications referenced by Entergy, operating experience at nuclear plants also shows that properly applied coatings not damaged during installation will protect buried piping from external corrosion for many years.[30] Entergy expert Spataro provided specific testimony about industry experience with the coal-tar and epoxy coatings used to protect Pilgrim's buried piping from corrosion,[31] which has demonstrated that, if (1) there is a coal tar or epoxy coating on the outer surface, (2) the coating was properly applied, and (3) the coating was not damaged during installation, the protective coating will protect piping from

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[28] Exh. 1 at A53.

[29] Exh. 1 at A53; *see also* Exh. 39 at A11.

[30] These include J. I. Braverman *et al*., Brookhaven National Laboratory, "Risk-Informed Assessment of Degraded Buried Piping Systems in Nuclear Power Plants," NUREG/CR-6876 (2005), which summarizes the operating experience of buried pipes at 12 nuclear power plants; H. Ashar & G. Bagchi, Division of Engineering, Office of Nuclear Reactor Regulation, Assessment of Inservice Conditions of Safety-Related Nuclear Plant Structures, NUREG-1522 (June 1995), which reports on operating experience at six older nuclear plants licensed before 1977; and the "Operating Experience" review for buried piping and tanks in the GALL Report. The GALL Report states that "[o]perating experience shows" that a program of protective coatings and opportunistic and periodic inspections to confirm that the coatings are intact is effective in managing the "corrosion of external surfaces of buried steel piping and tanks." Exh. 1 at A70-A72; Exh. 42, NUREG-1801, Rev. 1 (Sept. 2005) Excerpt XI.M34, "Buried Piping and Tanks Inspection," at XI M-112.

[31] Exh. 1 at A66

exterior degradation.[32] Mr. Spataro indicated that the coatings Pilgrim uses form a barrier that is resistant to moisture and chemicals, and protect against external degradation as long as they remain in place.[33]

According to Mr. Spataro's experience, coal-tar and epoxy coatings in use for 25 years on a buried gas transmission line were found to be in essentially the same condition as when buried, where the coating had been properly applied and not damaged;[34] and coatings in use for 40 years on the hydroelectric dam spill gates for the St. Lawrence Seaway Power Project – coated with the same type of coal-tar used on buried pipes at Pilgrim and submerged completely or partially in a flowing river-water environment, subject not only to corrosion but also to erosion from water flow and impact damage from solid objects such as trees and ice floes – were found, after 40 years of service under such conditions, to be in substantially the original condition, still tightly adhered to the steel gates.[35]

**4. Handling Precautions and Protective Environment for Buried Pipe**

Pilgrim's procedures for actual burial of pipes provide additional assurance that protective coatings will remain in place.[36] During installation the pipe is handled with non-abrasive canvas or leather straps, or nylon belts; chains and other abrasive items are prohibited.[37] Additionally,

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[32] *Id.* at A67.

[33] *Id.* at A47; *see also id.* at A67, A71, A90.

[34] *Id.* at A68.

[35] *Id.* at A69.

[36] *Id.* at A59-A64; Tr. at 755-57.

[37] Exh. 1 at A61.

during excavation for construction of the Pilgrim plant, all trees, shrubs, and rocks over six inches were removed from the soil.[38] These two precautions serve to reduce the corrosivity of the soil surrounding the buried piping at Pilgrim. The resulting soil pH is 6.2 to 6.82 and the chloride content is 210 to 420 parts per million (ppm), which constitutes a non-aggressive soil environment.[39]

In preparation for pipe burial Pilgrim excavates the soil in layers, in order to maintain control of the soil surrounding the pipe. Once a layer of soil is removed, it is stockpiled separately from the other layers. Layers can be as small as six inches in depth. The pipe itself is placed on an approximately 6”-thick bed of sand or specially engineered fill, which consists mostly of fine aggregate sand and specified amounts of fly ash and cement, and is designed to prevent retention of water by allowing it to percolate through the soil, thus avoiding the build-up of corrosive conditions next to the buried pipe.[40] The pipe is then covered with another layer of sand or specially-engineered fill material before being covered by contaminant-free, controlled soil. During backfilling, layers are replaced in the reverse of the order in which they were removed. Generally, soils are replaced and compacted every six inches, and after twelve inches of backfill is added, the soil is tested to ensure sufficient compaction.[41]

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[38] *Id.* at A83; *see also* Exh. 41 at A10. Rocks can cause physical damage to buried structures and plants by releasing compounds during the biodegradation process that may increase soil pH. Exh. 1 at A83.

[39] *Id.* at A83, A88; *see id*. at A82-A89.

[40] *Id.* at A63, A83.

[41] *Id.* at A62-A63; *see also* Tr. at 756-57.

The Staff agrees with Entergy that it has taken sufficient precautions when burying piping to ensure that the protective coating remains in place.[42]

In addition to surrounding buried pipe with sand or special fill material, two other precautions have been taken at Pilgrim to prevent high levels of moisture in the soils adjacent to buried piping. First, Entergy installed a storm drain system at the time of construction, to prevent the buildup of water. The storm drain system runs throughout the 90-acre Pilgrim plant site and is designed to carry away excess rainwater.[43] Second, all buried pipes are buried above the water table, which ensures that the water percolates down, past the piping, and is taken away with the flow of ground water. The water table at the plant site where the CSS and SSWS piping is buried is approximately 17 feet below the surface.[44] The CSS and SSWS pipes are buried 7 to 10 feet below the surface, well above the water table.[45] In addition, the entire area above the buried piping is covered by asphalt paving.[46]

Because corrosion is significantly enhanced in the presence of an electrolyte, maintaining low moisture content in the soil better ensures a non-aggressive environment for the buried

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[42] *See* Exh. 39 at A12.

[43] Exh. 1 at A84, A85.

[44] Tr. at 757, 839.

[45] Exh. 1 at A84, A86.

[46] Tr. at 768.

pipe.[47] Thus, considering the pH and high resistivity plus the low chloride concentration and low moisture content, according to Entergy expert Spataro, "at worst the soil is mildly corrosive."[48]

Pilgrim Watch witness Dr. David Ahlfeld, professor of civil and environmental engineering and expert on groundwater flow and contaminant transport, testified that the water table at the site "is not 17 feet everywhere, I'm sure," that it varies from place to place, and that Entergy probably doesn't know the exact situation.[49] Dr. Ahlfeld added that "[i]t's probably an average of 17 feet,"[50] which is consistent with Entergy's use of the word "approximately." But Pilgrim Watch presented no evidence to suggest that the water table, which is an average of 17 feet below grade, would realistically reach as high as 10 feet below grade in any of the areas where any Pilgrim piping is buried.

Pilgrim Watch expert Arnold Gundersen, a nuclear engineer with over 35 years experience in the field, suggested that oxygen, moisture, chloride, acidity, and microbes found in the soil all, to one degree or another, corrode piping materials, and that because Pilgrim is located adjacent to Cape Cod Bay, at a low elevation near salty water, the soil surrounding the piping is not "friendly."[51] However, he provided no specific evidence to contradict the testimony or soil data Entergy provided, indicating a lack of aggressive conditions at the Pilgrim plant. Mr. Gundersen claims that precautions taken by Pilgrim to remove vegetation and place the piping

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[47] Exh. 1 at A86, A88; *see also* Tr. at 757-58.

[48] Exh. 1 at A89.

[49] Tr. at 857.

[50] Id.

[51] Exh. 13, Testimony of Arnold Gundersen Supporting Pilgrim Watch's contention 1 (Mar. 6, 2008), at A12 (pp. 23-24).

on a bed of sand are futile because "over a period of time vegetation reappears, decays and works its way down to the pipes," resulting in low pH, and soil above the sand migrates downward mixing with the sand to provide a moist environment.[52] However, because the entire area above the buried piping is covered by asphalt paving,[53] the growth of vegetation will be minimized. Moreover, as indicated above, the soil data provided by Entergy's witnesses, which Mr. Gundersen does not challenge and which show a pH from 6.2 to 8.2, a moisture content ranging from 5.5% to 8.1%, and a chloride concentration of 210 to 420 ppm, reflect a non-aggressive soil environment.[54]

**5. Inspection Program for External Surfaces of Buried Piping**

Pilgrim's BPTIP provides for periodic and opportunistic inspection of the buried piping for the purpose of confirming the continuing integrity of the coatings to protect the exterior surface of the piping from degradation.[55] The periodic and opportunistic inspections provided for by the Pilgrim license renewal BPTIP require that:

> i. Buried components will be inspected when excavated during maintenance.
> ii. Prior to entering the period of extended operation, plant operating experience will be reviewed to verify that an inspection occurred within the past ten years. If not, an inspection will be performed prior to entering the period of extended operation. [56]

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[52] *Id.* at A13 (pp. 25-26).

[53] Tr. at 768.

[54] Exh. 1 at A88.

[55] Exh. 1 at A76; *see id.* at A75-A77; Tr. at 775..

[56] Entergy witness Alan Cox testified at the evidentiary hearing that Entergy would not be relying upon any previous inspection to satisfy this requirement. Tr. 777. Thus, this pre-extended-operation inspection would occur at some point between the April 10, 2008, evidentiary hearing and the commencement of the proposed period of extended operation in 2012. *Id.*

> iii. 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 an assessment of pipe condition without excavation) occurs within this ten-year period.[57]

Thus, Pilgrim's BPTIP requires a minimum of two inspections for buried pipes subject to the BPTIP between 2002 (within ten years prior to entering the period of extended operation) and 2022 (within the first 10 years of the period of extended operation).[58] Notably, because the current operating license for Pilgrim expires in 2012 and no credit is being taken for prior opportunistic inspections, the in-scope buried piping must be inspected in the next four years, and then at least once more in the first 10 years of the period of extended operation.[59] According to Entergy experts William Spataro, an engineer and metallurgist with nearly 40 years experience in metallurgy, welding, corrosion, and forensic investigation, and Alan Cox, a nuclear engineer with 30 years experience in the nuclear industry, more frequent inspections would serve no purpose, and would in fact create the potential for damage to the protective coatings on the pipes.[60] Staff expert James Davis, a materials engineer with 39 years experience and a Ph.D. in metallurgical engineering, agrees that the BPTIP inspection regime of one within 10 years prior to the period of extended operation and at least one inspection during the first 10 years of the period of extended operation[61] is sufficient to provide reasonable assurance that

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[57] Exh. 1 at A75.

[58] Iid. at A77.

[59] Tr. at 777; Exh. 2, Rebuttal Testimony of Alan Cox, Brian Sullivan, Steve Woods, and William Spataro on Pilgrim Watch Contention 1 (Mar. 6, 2008), at A17.

[60] Exh. 1 at A76.

[61] Exh. 39 at A9.

the coatings will remain in place and protect against degradation of the outer surfaces of the buried pipe.[62]

The BPTIP is consistent with AMP XI.M34 (entitled "Buried Piping and Tanks Inspection") in the GALL Report,[63] with one exception that would permit Entergy, in situations where it would otherwise excavate buried piping solely for purposes of inspecting the piping, to instead use techniques, such as phased array ultrasonic testing (UT), that measure wall thickness without requiring excavation.[64] This UT exception, according to Dr. Davis, "uses an array of ultrasonic probes that send ultrasonic waves into the pipe at different angles to determine wall thickness" and the presence of any cracks or discontinuities, and can be done from the inside so as not to subject the piping to the risks of damage from excavation.[65]

Pilgrim Watch expert Gundersen has raised numerous challenges to the adequacy of the inspection regime provided under the BPTIP, claiming that the BPTIP is "vague and non-specific" and voluntary, and cannot be used to conclude that Entergy will examine any buried piping during the license renewal period.[66] The clear preponderance of the evidence, however,

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[62] *See* Exh. 39 at A17 ("these AMPs provide reasonable assurance that the buried piping containing or potentially containing radioactive liquid at Pilgrim will not develop leaks so great as to prevent them from performing their intended safety function…."); *see also* Exh. 41. at A17.

[63] *See* Exh. 39 at A10; Exh. 42; Exh. 45, Pilgrim License Renewal Application Excerpt – B.1.2, "Buried Piping and Tanks Inspection."

[64] Exh. 39 at A10; Exh. 45 at 1.

[65] Exh. 39 at A10.

[66] Exh. 14, Declaration of Arnold Gundersen Supporting Pilgrim Watch's Petition for Contention 1 (Jan. 26, 2008), at ¶¶ 9, 12.3.

is that license renewal AMPs are in no way voluntary,[67] given that the buried pipe AMP is a commitment made by Entergy in its license renewal application, reflected in a supplement to the Updated Final Safety Analysis Report.[68] Furthermore, implementation of the BPTIP is included in the NRC's license renewal Safety Evaluation Report on the Pilgrim plant as a commitment.[69]

Expert Gundersen suggests that the entire length of the buried pipe should be inspected.[70] According to the GALL Report, however, and consistent with experience at Pilgrim and in the industry generally, a sampling program to assess and verify the general condition of the coatings is sufficient to provide assurance that the protective coatings will remain in place without experiencing unexpected degradation.[71] In addition, according to Entergy expert Cox, the excavation that would be required to examine all underground piping poses unnecessary risk of damage to otherwise sound coatings.[72] At the hearing, Mr. Gundersen agreed that an external visual inspection of all the SSWS piping should not actually be undertaken because of the increased risk of damage to the pipes and their coatings.[73]

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[67] Exh. 2 at A7.

[68] *See* Exh. 9, Pilgrim License Renewal Application, App. A, § A.2.1.2 (Excerpts).

[69] *See* Exh. 10, NUREG-1891, "Safety Evaluation Report Related to the License Renewal of Pilgrim Nuclear Power Station" (Sept. 2007, Published Nov. 2007), App. A (Excerpts), at A-3 (Commitment 1).

[70] Exh. 14 at ¶¶ 12.4.1.2, 12.4.1.3.

[71] Exh. 1 at A77; Exh. 2 at A17.

[72] Exh. 2 at A4.

[73] Tr. at 761.

Mr. Gundersen also asserts that the time interval between inspections proposed for the BPTIP is too long.[74] Pilgrim, however, asserts that the two inspections provided for in the BPTIP between 2002 and 2022, along with further analysis in the event any degradation is identified, supported by its own and general industry experience with buried piping and coatings, provide assurance that the pipes will serve their intended functions during the period of extended operation.[75]

Regarding "opportunistic inspections," which Mr. Gundersen suggests are not included in the BPTIP,[76] Section B.1.2 of Pilgrim's Application (which concerns the BTPIP) in fact states that "buried components are inspected when excavated during maintenance."[77] Also, the GALL Report at AMP XI.M34 provides that "buried piping and tanks are opportunistically inspected whenever they are excavated during maintenance,"[78] and Pilgrim's BPTIP takes no exception to this provision.[79] Thus Pilgrim's buried piping is to be inspected whenever there is any excavation for maintenance purposes.[80]

Entergy has also developed a fleet-wide procedure, EN-DC-343, Rev. 0, "Buried Piping and Tanks Inspection and Monitoring Program" ("BPTIMP Procedure") for implementing

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[74] Exh. 14 at ¶ 12.4.5.1.

[75] Exh. 1 at A77; Exh. 2 at A17.

[76] Exh. 14 at ¶ 12.4.5.4.

[77] Exh. 32, Pilgrim License Renewal Application, App. A & B Excerpts), at A.2.1.2, B.1.2.

[78] Exh. 42.

[79] *See* Exh. 32 at B.1.2; Exh. 2 at A18.

[80] Exh. 2 at A18.

additional inspections, relating to buried pipes and tanks that if degraded could provide a pathway for radioactive contamination of groundwater, which it contends go beyond what are required in its license renewal AMPs.[81] Entergy points out that these provisions relate to an initiative of the Nuclear Energy Institute to prevent leakage and radioactive contamination of groundwater, which Entergy has voluntarily undertaken at all of its nuclear power plants, in addition to (but consolidated with) license renewal requirements.[82]

Expert Gundersen argues that Pilgrim's AMP and BPTIMP Procedure are inadequate because neither requires a baseline review.[83] Entergy and Staff witnesses contend that a baseline inspection for buried piping is not required,[84] but even so, that the installation inspections of the buried piping serve as the baseline inspections, and support an underlying assumption of the BPTIP and BPTIMP inspections that the original external pipe coatings are not degraded from their original condition.[85] Also, as NRC Staff expert Davis testified, there has been the equivalent of a baseline inspection of the buried SSWS piping in accordance with Entergy's construction Specification No. 6498-M-306[86] and post-coating visual inspection of the piping for cracks, dents, and voids in the coating using a high voltage holiday detector, followed by reinspection in the field prior to burial of the pipes using a high voltage holiday detector after

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[81] Exh. 8, Nuclear Management Manual, Procedure No. EN-DC-343, Rev. 0, "Buried Piping and Tanks Inspection and Monitoring Program; Exh. 1 at A78-A79; Exh. 2 at A5.

[82] *See* Exh. 2 at A5-A6

[83] Exh. 13 at 31; *see also* Exh. 14 at ¶12.4.1.

[84] Exh. 41 at A12; Exh. 2 at A10, A12.

[85] Exh. 2 at A11; *see also* Exh. 41 at A12.

[86] Exh. 6. *See* text accompanying nn.25, 26, *supra*.

the pipe sections have been fitted together.[87] Apart from Mr. Gundersen's claims that no baseline inspection has been done, Pilgrim Watch provided no evidence to indicate that Entergy failed to adhere to Entergy Specification No. 6498-M-306 when it coated the buried SSWS piping. Further, Pilgrim Watch failed to point to any regulatory provision that would require a baseline analysis for buried piping, and according to Dr. Davis there is no regulatory requirement that a baseline inspection be conducted.[88]

Mr. Gundersen also charges that the acceptance criteria in the BPTIMP are vague, and that the BPTIP and BPTIMP fail to provide for condition reports to follow up on deficiencies that may be identified by the inspections conducted under the BPTIP or BPTIMP.[89] In response Entergy and Staff experts emphasize that the requirements of 10 C.F.R. Part 50, Appendix B, regarding quality assurance, apply to license renewal AMPs;[90] that Appendix B.0.3 of the Application, which sets forth Pilgrim's Appendix B Corrective Action Program ("CAP"), is applicable to all of the AMPs, including the BPTIP AMP; and that the full panoply of Pilgrim's corrective action program applies to its aging management programs and activities.[91] Thus, condition reports, corrective actions, and root cause analyses are all required under the BPTIP and BPTIMP in accordance with Pilgrim's Appendix B Quality Assurance Program.[92] If

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[87] Exh. 41 at A12.

[88] Id.

[89] Exh. 14 at ¶¶ 12.4.7-12.4.10.

[90] Exh. 41 at A15; Exh. 2 at A24.

[91] Exh. 11, Pilgrim License Renewal Application, App. B, §§ B.0.3 – B.0.5; Exh. 2 at A24.

[92] Exh. 2 at A24, A26-A29.

conditions adverse to quality are detected by inspections, corrective action will be required, which would include increased inspection frequency, if needed, to establish the effectiveness of the corrective action.[93] Staff experts pointed out that NRC resident inspectors will evaluate every condition report created by Entergy in response to any condition adverse to quality.[94] Mr. Gundersen himself recognizes elsewhere in his testimony that Appendix B requires licensees to repair any degradation."[95] Thus, by regulation, a licensee aware of any piping degradation cannot ignore it.

Regarding alleged vagueness,[96] Entergy experts explain that the acceptance criteria for the BPTIP are taken from the GALL Report, and require inspection for "evidence of damaged wrapping or coating defects, such as coating perforation, holidays, or other damage," and the reporting and evaluation of "[a]ny coating and wrapping degradation" in accordance with the Pilgrim's corrective action procedures.[97]

**C. Aging Management of Internal Degradation of Underground Pipes**

**1. Aging Management of Internal Degradation of CSS Underground Pipes**

Pilgrim uses the Water Chemistry Control-BWR Program and the One-Time Inspection Program for the aging management of internal degradation of the CSS buried pipe.[98]

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[93] Exh. 2 at A17; Tr. at 649.

[94] Tr. at 649-52.

[95] Exh. 13 at 21.

[96] *See* Exh. 14 at ¶ 12.4.7.

[97] Exh. 2 at A25 (quoting GALL Report at XI M-112).

[98] Exh. 1 at A91, A101.

Furthermore, as noted *supra*, the CSS buried pipe is made of stainless steel, which is generally resistant to corrosion.[99]

**a. Water Chemistry Control-BWR Program**

The Water Chemistry Control-BWR Program (WCC Program) is designed to optimize the water chemistry in the CSS (among other plant systems) and minimize the potential for loss of material and cracking due to internal corrosion of the system.[100] The WCC Program operates by limiting the levels of contaminants in the CSS that could cause such loss of material and cracking,[101] in accordance with EPRI BWR water chemistry guidelines,[102] and as specified in the GALL Report.[103] The Staff agrees that the WCC Program is consistent with the GALL Report, § XI.M2, "Water Chemistry."[104] Under the WCC Program, water quality is continuously monitored and confirmed, and corrective actions are to be taken on a timely basis to address any water quality issues and ensure effective management of corrosion in applicable components.[105]

Pilgrim's WCC program has been confirmed as effective at managing the effects of aging on the CSS in the plant's operating experience reviews,[106] as well as by industry operating

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[99] Exh. 39 at A13.

[100] Exh. 1 at A91; Exh. 39 at A13.

[101] Exh. 1 at A92.

[102] EPRI is an acronym for the Electric Power Research Institute, which conducts research and issues guidelines on matters of interest to the electric power industry.

[103] Exh. 1 at A94.

[104] Exh. 39 at A13.

[105] Exh. 1 at A93.

[106] *See* Exh. 5 § B.1.32.2 at B-106-07.

experience as described in the GALL Report.[107] According to Staff expert Davis, from 1998 through 2004 several condition reports were issued by Pilgrim for adverse trends in parameters monitored by the WCC Program, and Pilgrim personnel took appropriate actions to return the parameters to administrative limits. Moreover, although the parameters had exceeded administrative limits set for the Pilgrim plant, they had not exceeded the EPRI acceptance limits. Pilgrim had set its own administrative limits below the EPRI acceptance limits, so that they could be exceeded for a short time and corrective actions could be taken before the EPRI acceptance limits had been exceeded.[108]

Mr. Gundersen maintains that the WCC Program is a mitigation program that does not provide detection for aging effects and that "[m]ore frequent complete inspections as part of the overall program are the only effective assurance that defects created by aging components will be uncovered."[109] However, both the GALL Report and the Application expressly identify the WCC Program as an aging management program.[110] Additionally, the One-Time Inspection Program also serves as a check on the effectiveness of the WCC.

**b. One-Time Inspection Program**

The purpose of the One-Time Inspection Program, as applied to the WCC Program and the CSS, is to "verify the effectiveness of the water chemistry control [AMPs] by confirming that unacceptable cracking, loss of material, and fouling is not occurring."[111] The One-Time

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[107] Exh. 7 § XI.M2 at XI M-12, M-13; Exh. 1 at A94.

[108] Exh. 39 at A14.

[109] Exh. 13 at A19.

[110] *See* Exh. 7 § XI.M2; Exh. 5 § B.1.32.2 at B-106-07.

Inspection Program consists of an inspection of a representative sample (based on an assessment of fabrication materials, environment, plausible aging effects, and operating experience) of the interior piping surface, which will be performed prior to the period of extended operation. The inspection locations will be chosen based on identifying those locations most susceptible to aging degradation. Pilgrim's One-Time Inspection Program comports with the NRC Staff guidance set forth in the GALL Report section for such inspection programs.[112]

**c. Additional Facts Regarding CSS Underground Piping**

Entergy takes two additional actions to ensure the continuing integrity and functioning of the CSS buried piping. First, a water level indicator in each of the two condensate storage tanks is monitored every four hours. Second, the water flow rates from the HPCI and RCIC pumps are tested on a quarterly basis, which serves to confirm adequate flow rates through the buried CSS piping.[113]

The water level in each of the two condensate storage tanks is maintained above 30 feet.[114] Corrective action is required if the water level drops below 30 feet.[115] In contrast, only about 11 feet (corresponding to 75,000 gallons) is reserved for the HPCI and RCIC.[116]

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(. . .continued)

[111] Exh. 5 § B.1.23 at B-76); *see* Exh. 1 at A100-A101.

[112] Exh. 1 at A102 (citing GALL Report § XI.M32 at XI.M-105).

[113] Exh. 1 at A106.

[114] Exh. 12, Entergy's Answer to Board Questions (Feb. 11, 2008), at 2.

[115] Exh. 1 at A111; Exh. 12 at 2; Tr. at 786-88.

[116] Exh. 1 at A112.

Consequently, there would have to be about a 20-foot drop in tank level before the capability of the HPCI and RCIC to perform their system functions using water solely from the condensate storage tanks would be impaired.[117] Such a large drop would be detected by the established monitoring frequency of every four hours.[118]

Regarding flow rates, the Pilgrim plant safety analysis requires that the HPCI system maintain a water flow rate of 4,250 gallons per minute (GPM) and 400 GPM for the RCIC system.[119] Pursuant to 10 C.F.R. § 50.55a(f)-(g) and Pilgrim's operating license technical specification surveillance requirements, Entergy undertakes quarterly in-service testing of the HPCI and RCIC systems to confirm the system capability to deliver the minimum required water flows. These quarterly tests ensure that the required water flow rates of 4,250 GPM and 400 GPM, respectively, are met,[120] and can detect a leak in the CSS system piping large enough to prevent the HPCI or RCIC systems from performing their intended function.[121] In addition to the quarterly tests, the flow rates for the HPCI and RCIC systems are confirmed during system testing once every operating cycle following each refueling outage.[122] If the flow rates are not met, Entergy is required to take corrective actions.[123]

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[117] Exh. 1 at A113.

[118] *Id.* at A114; *see* Tr. at 788.

[119] Exh. 1 at A118.

[120] *Id.* at A118.

[121] *Id.*at A120.

[122] *Id.*1 at A118.

[123] *Id.* at A119.

Finally, I note that, while the CSS is the preferred source for the HPCI and RCIC systems because it contains a higher quality of water to assure long-term cleanliness of the system, the CSS buried pipes are not seismically or safety-qualified and therefore the CSS is not the "assured source" to be relied upon in the event of an accident.[124] The water source that is relied upon to provide cooling in the event of an accident is the torus, which is seismically qualified.[125]

**2. Aging Management of Internal Degradation of SSWS Underground Pipes**

The Salt Service Water System, or SSWS, draws cooling water from Plymouth Bay and transports it to the plant through buried intake piping, and then returns the water to the bay through buried discharge piping.[126] The SSWS is intended to serve as a heat sink for the reactor building closed cooling water (RBCCW) system under both transient and accident conditions by providing a continuous supply of cooling water to the secondary sides of the RBCCW heat exchangers.[127] The SSWS is also credited as part of the assurances for safe shutdown under 10 C.F.R. Part 50, Appendix R fire protection regulations, though the actual function it serves under Appendix R – removing heat from safety equipment – is effectively the same as its other safety function (*i.e.*, serving as a heat sink for the RBCCW system).[128]

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[124] Tr. at 781-782.

[125] *See* Tr. at 781. The torus, a doughnut-shaped vessel at the bottom of the reactor containment, serves not only to provide cooling water to the reactor in the event of an accident, but also, in the event of a loss-of-coolant accident (LOCA), as the receptacle for the mixture of steam and liquid escaping the reactor. In such an accident the steam is injected into the cooler water in the torus, condensing the steam and thereby reducing the pressure.

[126] Exh. 1 at A31.

[127] Exh. 58, PNPS- FSAR § 10.7, "Salt Service Water System," at 10.7-1. The "secondary" side of a heat exchanger is the side that is cooler and receives heat from the "primary" side.

[128] Tr. at 739.

The SSWS is designed with redundancy so that no single active system component failure can prevent the system from performing its intended safety function.[129] Specifically, the SSW system consists of two discharge loops – each designed to be capable on its own of performing the system's intended safety function.[130]

Entergy witnesses testified that, "although highly unlikely" and contrary to the system's design, it is possible that the bay water being transported away from the plant in the SSWS discharge piping could become radioactively contaminated.[131] The same cannot reasonably be said of the water in the SSWS inlet piping, however, as that water is taken directly from the bay.[132] Pilgrim Watch expert Gundersen agrees that the discharge piping is the portion of the SSW system that falls within the scope of Contention 1.[133]

**a. SSWS Underground Pipe Liners**

The SSWS discharge piping consists of one 240-foot loop (Loop A) and a second 225-foot loop (Loop B) of 3/8"-thick, 22"-diameter pipe.[134] The carbon steel base metal of the pipe is supplemented internally by (1) a rubber internal liner that was installed when the pipe was manufactured, and (2) an additional cured-in-place pipe (CIPP) liner that was installed

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[129] Exh. 58 at 10.7.2.

[130] Exh. 58 at 10.7.5; 10.7.6.

[131] Exh. 1 at A32.

[132] *Id.* at A33.

[133] Exh. 13 at 4.

[134] Exh. 1 at A42; Tr. at 610-11, 619-20.

throughout the entire length of Loops A and B in 2003 and 2001, respectively.[135] In addition, prior to the CIPP installation, as noted above, forty-foot sections of Loop A and Loop B were replaced in 1999 with new carbon steel pipe sections, which were coated both internally and externally with an aliphatic amine epoxy.[136]

As originally installed, the internal liner for the SSWS discharge pipe was a rubber sleeve that was put in place as part of pipe fabrication.[137] This liner had an expected life of approximately 20 years.[138] Pilgrim monitored the integrity of the original rubber liner under the Service Water Integrity Program, which was established as part of the in-service inspection requirements for the SSWS developed in response to NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Components."[139]

As the original rubber liner approached the end of its expected life, Pilgrim undertook increasingly intensive inspections under the Service Water Integrity Program, prompted initially by a series of refueling outage inspections of the rubber liner, which, beginning in 1995, revealed some degradation of the liner. In 1995 the rubber liner was visually inspected, using a

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[135] Exh. 1 at A42-A52; Tr. at 641, 652-53.

[136] Exh. 1 at A42, A53; Tr. at 661-62.

[137] Tr. at 652; *see also* Exh. 1 at A44.

[138] Exh. 1 at A44; Tr. at 655.

[139] Exh. 1 at A44, A98.; Exh. 44, NRC Generic Letter 89.13 Re: Service Water System Problems Affecting Safety-Related Equipment (July 8, 2008). Generic Letter 89-13 was issued July 18, 1989. An NRC 'generic letter" is a document that addresses a generic issue of some safety or environmental significance, in which licensees may be, *e.g.*, requested to analyze and correct potential problems, or notified of staff technical or policy positions not previously communicated or broadly understood. *See* http://www.nrc.gov/reading-rm/doc-collections/gen-comm/; http://www.nrc.gov/reading-rm/doc-collections/gen-comm/gen-letters/ (last visited Oct. 29, 2008).

robot crawler fitted with a camera, and minor age-related degradation was found. The rubber liner was re-inspected using this same method in 1997, and additional degradation was identified. In 1999 Pilgrim undertook more intensive inspections by sending an inspector into the pipe to do both visual and ultrasonic examinations, with the intent to make any necessary replacements or repairs. In this inspection, it was discovered that a piece of the rubber liner in one of the loops had torn away from the carbon steel, leading to through-wall holes in the pipe.[140] The through-wall holes, which are depicted in a pair of photographs introduced by Pilgrim Watch at the hearing, cover a small portion of the 4”-to-6” by 4”-to-6” pipe sample featured in the photographs.[141] Some thinning near the end of the other pipe was also discovered, which was “slightly below the [minimum wall thickness].”[142] Following this discovery of degradation and small area of through-wall holes in 1999, Entergy replaced 40-foot pipe sections in each loop and made other repairs.[143]

Prior to the 1999 replacement of the two 40-foot sections, the entire rubber liner in the SSWS pipes had been in place since before Pilgrim first commenced operation in 1972,[144] thus exceeding its expected life span.[145] Entergy and NRC Staff experts agree that the corrosion

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[140] Exh. 1 at A98; Tr. 638.

[141] Exh. 67, Photographs of Corrosion on Pipes at Pilgrim Nuclear Power Station; Tr. at 737-38. The pipe sample shown in the photograph had the rubber liner component removed from it. *See* Exh. 67; Tr. at 637.

[142] Tr. at 640; *see* Tr. at 672, 727-31.

[143] Exh. 1 at A98; *see also* Tr. at 638.

[144] Tr. at 754.

[145] *Id.* at 655, 755.

that was discovered in 1999 would not have led to the failure of the SSWS pipe in the event of an earthquake.[146] Mr. Gundersen suggested that such corrosion could cause the pipe to collapse if there were a design basis event, but has not done or seen any analysis that would support this assertion.[147]

Prior to installation of the CIPP liner inside the rubber-lined SSWS Loop B discharge piping in 2001 and Loop A discharge piping in 2003, the entire rubber linings were again visually inspected, to ensure they were still in good enough shape for the installation of the CIPP. The rubber was also scraped to remove any marine matter and roughen the surface so that the rubber would bond properly with the CIPP liner.[148]

The cured-in-place "CIPP" liner is a product designed to be used in old piping as an alternative to replacing or repairing such piping.[149] Nominally ½" thick, the CIPP liner forms a rigid barrier to protect the carbon steel discharge pipe against internal corrosion. The liner material consists of a nonwoven polyester felt tube, which is saturated with a resin and catalyst system in loop A and an epoxy resin and hardener system in loop B, and which has a polyurethane or polyethylene inner membrane.[150] Based on the service conditions and the

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[146] Tr. at 670-71.

[147] *Id.* at 694-98.

[148] *Id.*at 673-76.

[149] *Id.*at 741.

[150] Exh. 1 at A43.

design of the CIPP liner, its expected life is approximately thirty-five years, according to Entergy experts.[151]

According to Entergy expert Spataro, the CIPP liners were installed without excavating the SSWS pipes. The installation was accomplished by pulling the liner, which had been dipped in wet epoxy or resin solution, through the SSWS piping and then filling the CIPP liner with hot water and pressurizing it, so that as it cured, a tight seal was made between the CIPP and the existing SSWS piping's rubber liner.[152] The liner forms a smooth, hard surface that resists moisture intrusion and abrasion, and is resistant to most chemicals and all waters.[153] According to Mr. Spataro, the CIPP liner, with its cured-in-place epoxy and polyester thermosetting resin, is superior to the rubber liner in its resistance to biofouling and other forms of degradation that might otherwise cause internal corrosion.[154]

CIPP liners such as those used at Pilgrim have been used for many years in many different applications, including power plants, public water supply systems, and waste water treatment facilities.[155] Mr. Spataro testified that, based on his professional experience with similar materials used under more aggressive conditions than at Pilgrim, he expects Pilgrim's CIPP liners to last at least thirty-five years.[156] Mr. Spataro stated that the failure mechanism for

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[151] *Id.* at A43, A98; *see also* Tr. at 655.

[152] Tr. 657-60.

[153] *Id.* at 734-35.

[154] Exh. 1 at A45.

[155] Tr. at 655, 683-84, 691-92.

[156] *Id.* at 681.

the CIPP is "flaking" caused by the surface drying resulting from a "volumetric airflow system or exposure to ultraviolet radiation"[157] – an environment that does not exist in the buried SSWS pipe at the Pilgrim plant.[158] A wet environment, such as the environment inside the SSWS discharge pipe, causes "almost no degradation at all," according to Mr. Spataro."[159]

Staff expert Davis agrees that the CIPP liners installed in loops A and B have an expected life of approximately thirty-five years,[160] and are far superior to the rubber liner.[161] Though "the rubber lining will oxidize with time and will degrade," the "epoxies are much more resistant,"[162] according to Dr. Davis, who says that epoxy liner failures of which he is aware have been "usually for mechanical reasons," and not from corrosion or related degradation.[163]

Mr. Gundersen doubts the reliability of the CIPP liners because they are applied in the field over the rubber sleeves, and questions whether they really have a 35-year life and are still bonded.[164] Mr. Gundersen suggests that some formal documented qualification determination regarding the expected lifespan of CIPP liners in the SSWS piping would be required under

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[157] *Id.* at 682.

[158] Tr. at 682.

[159] *Id.* at 683.

[160] *Id.* at 669.

[161] Exh. 39 at A11.

[162] Tr. at 669.

[163] *Id.* at 690.

[164] *Id.* at 664-668.

NRC regulations,[165] citing 10 C.F.R. Part 50, Appendix B, Section II, which concerns quality assurance requirements.[166] Mr. Gundersen also said that, based on his "experience on salt, brackish, and freshwater plants . . . in general saltwater is the worst for any component."[167]

When questioned whether he had any data regarding the impact of these various water environments upon liners like the ones being used in the Pilgrim SSWS piping, however, Mr. Gundersen admitted to having no experience with these types of liners.[168] Entergy expert Spataro, on the other hand, based on his experience testified that the specific types of liners being used in the SSWS discharge piping are "resistant to . . . all waters."[169]

Entergy witnesses did not claim to base their conclusions about the CIPP liner's expected lifespan upon specific formal documentation, but rather upon experience with comparable liners at other plants, extensive history of use of comparable liners in other industries, information from the liner manufacturer regarding limitations on its usage, and an understanding of the chemical and mechanical properties of the liner and the factors that can cause it to degrade.[170] Mr. Gundersen did not identify any specific regulatory provision(s) that would mandate

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[165] *Id.* at 703-05.

[166] Tr. at 749.

[167] *Id.* at 705.

[168] *Id.* at 666, 668, 706.

[169] Exh. 1 at A45.

[170] *See* Tr. at 655, 681-92.

determination of the liner's lifespan through the sort of formalized, application-specific process he claimed was absent.[171]

**b. Service Water Integrity Program**

Pilgrim also uses the Service Water Integrity Program for the aging management of internal degradation of its SSWS buried pipe.[172] The Service Water Integrity Program includes surveillance and control techniques to manage the effects of aging on the SSWS and structures and components serviced by the SSWS.[173] Under the program, the components of the SSWS are regularly inspected for internal loss of material and other aging effects that can degrade the 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 SSWS piping. In addition, chemical treatment using biocides, chlorine, and periodic cleaning and flushing of infrequently-used loops are part of this program.[174]

The Service Water Integrity Program will be used to monitor the newly installed CIPP liner.[175] The program is consistent with AMP XI.M20, "Open-Cycle Cooling Water System," in

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[171] Although Mr. Gundersen, as noted above, did refer to 10 C.F.R. Part 50, Appendix B, § II, as a source of this alleged regulatory requirement, NRC Staff expert Dr. Davis pointed out at the evidentiary hearing that he could not find any such requirement discussed in that regulatory provision, Tr. at 753, nor have I been made aware of any such requirement.

[172] Exh. 1 at A95-A96; *see also id.* at A44.

[173] *Id.* at A95.

[174] *Id.* at A96.

[175] *Id.* at A98; Exh. 46, Pilgrim License Renewal Application, App. B § B.1.28, "Service Water
(continued. . .)

the GALL Report,[176] with two exceptions.[177] One exception permits Entergy not to coat those portions of the SSW system that are made of corrosion-resistant materials – in this case, titanium used in the SSWS intake piping and copper alloys used for certain SSWS components.[178] The second exception would permit inspections to take place every refueling outage (*i.e*., every two years at Pilgrim), rather than both annually *and* during every refueling outage.[179]

According to NRC Staff expert Davis, the Service Water Integrity Program was generated in response to NRC Generic Letter 89-13.[180] Dr. Davis testified that the AMP includes:

> surveillance and control of biofouling; a test program to verify heat transfer capabilities; a routine inspection and maintenance program to ensure that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of safety-related systems serviced by the open-cycle cooling system; a system walk down inspection to ensure compliance with the licensing basis; and a review of maintenance, operating and training practices and procedures. [181]

The program also contains specific provisions for marine-water systems such as Pilgrim's salt service water system, which include: (1) visual inspection of the intake structure

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Integrity"; Exh. 39 at A10

[176] NUREG-1801, Vol. 2, Rev. 1 (Sep. 2005) (*see* Exh. 7).

[177] *See* Exh. 46 at 1-2.

[178] Exh. 46 at 1; Exh. 39 at A10.

[179] Exh. 46 at 1-2; Exh. 39 at A10.

[180] Exh. 39 at A10; *see* Exh. 44.

[181] Exh. 39 at A9.

during each refueling cycle by either scuba divers, dewatering the intake structure, or other comparable method to look for macroscopic biological organisms, sediment, and corrosion and to remove any accumulated fouling; (2) continuous chlorination of, or injection of effective biocides into, the service water system whenever there is a potential for microscopic biofouling; and (3) periodic flushing and flow testing at maximum design flow to check for fouling or clogging.[182]

Regarding flow testing, Entergy expert Brian Sullivan, Pilgrim's engineering director, who has 24 years experience in the nuclear industry, stated that Entergy performs monthly flow-rate testing of the seawater flow through the SSW system.[183] This is done through the RBCCW heat exchanger. The minimum required flow for the test is 4500 GPM, which ensures that there is adequate water flow through the heat exchangers and piping.[184] According to expert Sullivan, the flow rate testing confirms that a leak, should there be any, from the buried piping is not large enough to prevent the system from satisfactorily performing its intended function.[185] Mr. Sullivan further stated that, "[i]f the acceptance criteria for the flow rate test are not met, corrective action will be taken – the problem will be investigated and fixed."[186]

In addition to the preceding, there are various NRC regulatory requirements that apply to Pilgrim's SSWS piping, which will, barring alteration via regulatory or operating license

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[182] *Id.*

[183] Exh. 1 at A122.

[184] *Id.* at A123-A124.

[185] *Id.* at A124.

[186] *Id.* at A125.

amendment, remain applicable during any extended period of operation.[187] For example, as discussed in Generic Letter 89-13,[188] 10 C.F.R. Part 50, Appendix B, § XI ("Test Control"), requires that licensees establish test programs to ensure that all systems, structures, and components will function satisfactorily in accordance with their design requirements and acceptance limits.[189] Such programs must include written test procedures that "incorporate the requirements and acceptance limits contained in applicable design documents," and, as appropriate, "proof tests prior to installation, preoperational tests, and operational tests during nuclear power plant . . . operation, of structures, systems, and components." [190] They must also include "provisions for assuring that all prerequisites for the given test have been met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions."[191] Test results are to be "documented and evaluated to assure that test requirements have been satisfied."[192] According to Staff expert Andrea Keim, a materials engineer with 15 years experience in that field, including 12 years in the nuclear industry, Entergy has established a test program to meet this requirement.[193]

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[187] Exh. 40, NRC Staff Testimony of Terence L. Chan and Andrea T. Keim Concerning Pilgrim Watch Contention 1 (Jan. 29, 2008) at A16.

[188] Exh. 44.

[189] Exh. 40 at A12.

[190] 10 C.F.R. Part 50, App. B, § XI.

[191] *Id*.

[192] *Id*.

[193] Exh. 40 at A13.

Moreover, because Pilgrim's construction permit was issued prior to January 1, 1971, Pilgrim is required to implement an in-service inspection program that complies with 10 C.F.R. §§ 50.55a(g)(4)-(5) to the extent practicable.[194] Pilgrim's fourth 10-year in-service inspection program, which applies between July 1, 2005 and June 30, 2015, was submitted to the NRC by letter dated June 29, 2005.[195] According to Staff expert Terrence Chan, a nuclear and mechanical engineer with nearly 30 years experience in the nuclear power field, part of Pilgrim's in-service inspection program plan requires that the SSWS be pressure-tested in accordance with the requirements of applicable American Society of Mechanical Engineers (ASME) Code provisions, subject to certain limitations and modifications stated in 10 C.F.R. § 50.55a(b)(2).[196] According to Mr. Chan, Pilgrim's program "provides reasonable assurance of structural integrity and that significant degradation will be identified in a timely manner such that safety related systems will be able to perform their safety function."[197] According to Ms. Keim, NRC inspectors have also recently reviewed various aspects of Pilgrim's SSWS performance, including performance testing results, and did not identify any findings of significance.[198]

Pilgrim Watch challenges Entergy's representations regarding the past history of Pilgrim's Service Water Integrity program, which would continue to be used during the proposed period of

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[194] *Id.* at A14a.

[195] *Id.*

[196] Id.

[197] Id.

[198] *Id.* at A14b.

extended operation.[199] Mr. Gundersen claims that "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."[200] Mr. Gundersen wonders, "how long [were there] significant corrosion problems and how long [would] the licensee . . . have waited if it were not for the generic letter."[201] He further suggests that the replacement of the two 40-foot sections of SSWS discharge piping in 1999 provides "no indication of the condition of the remainder of these loops," and asserts that the AMP does not define inspection frequencies or other terms with sufficient specificity.[202]

According to NRC Staff expert Keim, however, the March 2006 NRC inspection of the Pilgrim SSWS to verify heat sink performance confirmed Pilgrim's conformance with the guidance found in Generic Letter 89-13 with respect to controls for selected components, and found no significant problems with the system.[203] Also, as described above, the Service Water Integrity Program was effective in detecting degradation of the internal rubber lining in the

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[199] Exh. 13 at A19 (pp.36-38).

[200] *Id*. (p. 37).

[201] Id.

[202] *Id.* (pp. 37-38).

[203] Exh. 40 at A14b; *see* Exh. 57, Letter from Clifford Anderson (NRC) to Entergy Re: Pilgrim Nuclear Power Station – NRC Integrated Inspection Report 05000293/2006002 (May 12, 2008), at 4.

original SSWS carbon steel piping by increasing inspections as the rubber liner approached its expected end of life.[204]

With regard to the CIPP liner, after it has been in service for 10 years – well before the end of its expected 35-year life – Pilgrim will undertake a complete visual examination of the CIPP, analogous to those undertaken for the original rubber lining.[205] Entergy has "gone with a ten-year frequency just to verify and assure that there are no changes in the cured-in-place liner."[206] The CIPP liner for Loop B would be subject to a complete examination in 2011, before the period of extended operation actually commences. The CIPP liner for Loop A would be subject to a complete examination in 2013, shortly after the period of extended operation commences.[207] According to Entergy expert Sullivan, if the 2011 or any subsequent inspection were to show degradation, a condition report would be written under Pilgrim's corrective action program, and corrective action would be taken as required, including increased inspection frequency, to ensure that the SSW system continued to meet its safety function and licensing basis.[208] Staff experts Chan and Davis testified that NRC resident inspectors would evaluate every condition report created by Entergy in response to a condition adverse to quality.[209]

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[204] Tr. at 636; Exh. 1 at A44, A98.

[205] Tr. at 648, 774, 776.

[206] Tr. at 648.

[207] *Id.* at 648.

[208] *Id.* at 649; Exh. 2 at A17.

[209] Tr. at 649-52.

Finally, the current ISI program for the SSW system requires a complete ultrasonic or visual examination of the CIPP when the CIPP liner reaches 20 years of service life.[210]

Pilgrim Watch and Mr. Gundersen agree that a 10-year interval for internal inspection of the whole pipe is sufficient, but argue that the 10-year period should be divided up so that each refueling outage a one-sixth portion of the pipe is examined.[211] Staff and Entergy argue that this is not necessary and that Entergy's current plans are adequate to provide reasonable assurance that the SSWS safety function will not be lost due to degradation of the CIPP liner and internal corrosion of the SSWS discharge pipe.[212]

It is clear that the only way that SSWS pipe corrosion might trigger the loss of SSWS safety function would be a total collapse of both discharge pipes so that the flow path was completely blocked.[213] According to Entergy experts, this is not a credible failure scenario, and they are not aware of any historical information suggesting that such a failure might occur.[214] For such a failure to occur, the ½"-thick CIPP liner would have to be degraded such that it no longer protected the carbon steel pipe from the seawater, in a large enough area to lead to collapse. However, as noted above, according to Entergy witness Spataro the CIPP liner is not

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[210] Exh. 1 at A98.

[211] Tr. at 722; Pilgrim Watch Proposed Findings at 65.

[212] *See* Entergy's Reply to Pilgrim Watch's Proposed Post-Hearing Findings of Fact and Conclusions of Law on Contention 1 (June 23, 2008) [hereinafter Entergy Reply Findings] at 20; NRC Staff's Response to Pilgrim Watch's Proposed Findings of Fact and Conclusions of Law (June 23, 2008) [hereinafter Staff Response Findings] at 19.

[213] *See*, *e.g.*, Tr. at 610.

[214] Tr. at 610, 612; Exh. 12 at 6.

subject to degradation and failure in seawater,[215] and any wearing or erosion of the CIPP liner would be at such a slow rate that it would take many years for it to erode.[216] Further, according to Entergy and Staff witnesses, even if corrosion of the pipe were to occur, such corrosion would typically be localized and very unlikely to threaten the integrity of the pipe such that it would collapse.[217]

**D. Additional Issues Raised by Intervenor**

**1. Cathodic Protection**

Pilgrim Watch and Mr. Gundersen claim, referring to the GALL Report at § XI.M28, that in order to reduce corrosion rates and the likelihood of leaks Entergy can and should backfit the SSW system and CSS buried pipes with cathodic protection.[218] According to Entergy and NRC Staff experts, however, the cathodic protection program contained in the GALL Report is simply one of two *alternative* methods that the Report recommends for protecting buried piping against external corrosion.[219] Entergy has chosen to utilize the other of the two alternative GALL AMPs – which relies upon visual inspections rather than cathodic protection – and Pilgrim's external corrosion management program thus complies with the GALL Report without utilizing cathodic

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[215] Tr. at 685-88.

[216] *Id.* at 687.

[217] *Id.* at 727-31.

[218] Exh. 14 at ¶¶12.4.11, 18.2; Exh. 13 at 53; Tr. at 761-63; *see also* Exh. 71, GALL Report § XIM.28. According to the GALL Report, "cathodic protection imposes a current from an anode onto the pipe or tank to stop corrosion from occurring at defects in the coating." Exh. 71.

[219] Tr. at 768-772.

protection.[220] According to Staff expert Davis, the author of the BPTIP AMP in the GALL Report, the risks associated with a cathodic protection system causing an unscheduled plant shutdown led to the alternative to cathodic protection that is described in § XI.M34.[221] According to Dr. Davis, caution must be exercised when backfitting cathodic protection to an existing plant in order to avoid stray current corrosion – a process that, if not properly guarded against, could create a through-wall hole in a nearby pipe "in a matter of weeks."[222]

**2. Tritium Discovery at Pilgrim**

Pilgrim Watch asserts that tritium discovered in the groundwater at Pilgrim indicates the presence of leaks in Pilgrim's buried piping or at least the possibility that such leaks are occurring.[223] Expert Gundersen admits, however, that the precise source of the tritium is currently unknown.[224] It is possible that the tritium could be coming from the SSWS, but because it is only a possibility and not a certainty that the SSWS could become contaminated with radioactivity, it is more likely that the presence of tritium in the groundwater indicates some level of leakage in another system that contains radioactive water by design.

**3. Relevance of Small Leaks**

Pilgrim Watch has argued that small leaks could indicate a problem that could lead to SSWS discharge piping failure that would prevent that piping from performing its intended safety

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[220] *Id.*

[221] *Id.* at 769-72.

[222] *Id.* at 771.

[223] *See, e.g.*, Exh. 14 at ¶¶ 16-17.

[224] Exh. 14 at ¶16.

functions.[225] The NRC Staff argues, however, that, so long as cooling water is able to leave the plant and take safety-system heat with it, this is all that is significant for license renewal purposes.[226] Staff agrees that even minor leakage from the SSWS buried discharge piping would require correction under NRC's corrective action requirements, which apply to all operating reactors, but argues that this is a current operating issue, not a license renewal issue, and so is not material to the instant license renewal proceedings.[227]

Pilgrim Watch expert Gundersen also suggests that small leaks in the buried SSWS discharge piping have the potential to grow into bigger leaks that could challenge the ability of the piping to perform its heat removal function.[228] According to Mr. Gundersen's prefiled testimony, "[l]eaks not only increase in flow, but in fact the rate of expansion for leaks actually accelerates once a pinhole has been created in the pipe or tank wall."[229] According to Staff corrosion expert Davis, however, leaks in coated buried pipes generally do not expand

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[225] *See, e.g.*, Exh. 13 at A6, A16.

[226] *See* NRC Staff Proposed Findings of Fact and Conclusions of Law and Order in the Form of an Initial Decision (June 9, 2008) [hereinafter Staff Proposed Findings] at 35.

[227] *Id.* (citing 10 C.F.R. Part 50, App. B, § XVI ("Corrective Action")).

[228] Exh. 14 at ¶¶ 16-17. Pilgrim Watch also contends in its Statement of Position that functions of all buried pipes include prevention of radioactive contamination of groundwater and protection against the site becoming a "legacy site" in the future due to such contamination. Pilgrim Watch Presents Statements of Position, Direct Testimony and Exhibits Under 10 CFR 2.1207 [Modified Per Request ASLB Order of February 21, 2008, section c, page 2] (Mar. 3, 2008) [hereinafter Pilgrim Watch Statement] at 90. While clearly these are legitimate functions of buried piping that contains, or may contain, radioactive water, this does not mean that these functions fall within the relatively narrow range of functions that are relevant for purposes of license renewal. As was noted in LBP-06-23, 64 NRC at 310, radioactive contamination of groundwater *per se* is not material to the issues in this renewal proceeding.

[229] Exh. 14 at ¶ 16.

substantially beyond the portion of the pipe where the pipe's coating has failed.[230] Also, according to Entergy expert Spataro, in the case of the SSWS buried piping degradation that occurred in the past at Pilgrim and that was reflected in the photographs introduced at the evidentiary hearing, there did not appear to be substantial lateral expansion of the holes.[231]

Pilgrim Watch puts forth another theory of how small leaks could cause license-renewal-relevant problems in the buried SSWS piping. This theory proposes that a hole in buried piping could lead to matter *entering* the pipe and causing the piping to become blocked, thereby preventing the piping from performing its intended safety function.[232] However, Mr. Gundersen provided no explanation as to how this "Venturi" effect would realistically lead to major blockage in the 22"-diameter SSWS buried piping.[233] It is also not clear that Mr. Gundersen had the SSWS piping in mind when putting forth his Venturi effect blockage theory, given that his prefiled testimony regarding this effect did not specifically discuss the SSWS piping.[234] Moreover, he conceded at the hearing that he had not conducted any analysis to determine whether, given pressure characteristics and other relevant factors, it was possible for material to enter the Pilgrim piping through a hole.[235] Mr. Gundersen also did not question the ability of

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[230] Tr. at 729.

[231] *Id.* at 726.

[232] Exh. 14 at ¶17.2; Exh. 13 at 17-18.

[233] *See* Tr. at 610.

[234] *See* Exh. 14 at ¶17.2; Exh. 13 at 17-18.

[235] Tr. at 809. He relied on an event at the Millstone plant as the real-life basis for his postulated scenario, but admitted that Millstone was indeed able to achieve and maintain safe shutdown. Tr. at 825. In addition, Mr. Gundersen testified that he would expect that the contaminants involved in the Millstone event would not be the same as the material that, in his postulated (continued. . .)

SSWS pipe-pressure testing (which, as discussed above, is part of Pilgrim's in-service inspection program) to determine whether blockage was occurring in the SSWS buried piping due to Venturi-effect-related material or otherwise. Finally, again, because of the redundancy of the SSW system, blockage would need to occur in *both* SSWS discharge loops at the same time – and go undetected in both despite any pressure testing and inspections – in order for the intended safety functions of the SSW system to be compromised.

Mr. Gundersen also suggested that, even if small leaks do not grow into large ones, they could undermine the structural soundness of the SSWS piping and thus lead to failure in a design basis earthquake – *i.e.*, "[t]he hole or holes act as stress risers and increase the likelihood of gross failure under the stress of accident conditions."[236] According to Mr. Gundersen, the only design basis event of significant concern to him with respect to this "stress riser" theory would be a design basis earthquake.[237] He believes that the through-holes discovered in 1999 raise concern that the SSWS pipes could fail in the event of such an earthquake, but has not conducted any analysis to determine the likelihood of this.[238] He stated that his failure scenario was based upon analyses that people who have worked for him have

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(. . .continued)

scenario, would potentially enter the CSS buried piping at Pilgrim. Tr. at 811. Finally, when Entergy's experts testified that Pilgrim could still achieve and maintain safe shutdown if faced with his postulated scenario, Mr. Gundersen agreed that their testimony was accurate. Tr. at 825-27.

[236] Exh. 14 at ¶¶17.3, 17.3.1; *see* Exh. 13 at A10 (pp. 19-20).

[237] Tr. at 718.

[238] *Id.* at 694-95.

done in the past, but he did not provide any specifics regarding this research, and indicated that this research would not have looked at holes of the size that are depicted in the photographs.[239]

According to Entergy experts Spataro and Cox, in their experience holes in buried piping have not led to overall structural weakness of the piping (*e.g.*, due to thinning of areas of the piping that have not developed through-wall holes).[240] In addition, Staff expert Chan indicated that, in his experience, Staff analysis of degraded piping has not revealed an inability of the degraded piping to withstand design-basis seismic events.[241] Moreover, Mr. Gundersen acknowledged that the lateral progression of any degradation would be less than degradation through a pipe.[242]

Pilgrim Watch also contended in its Initial Statement of Position that a concept known as "leak before break" applies to the buried piping at Pilgrim.[243] Pilgrim Watch did not, however, provide any actual evidence to explain this "leak before break" concept, or to show that the concept applies to the buried SSWS discharge piping at Pilgrim. To the contrary, NRC Staff expert Davis stated that the "leak before break" concept is not applicable to the SSW system, as it applies only to "high energy piping" in pressurized water reactors.[244]

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[239] *Id.* at 696.

[240] *See id.* at 727-28, 737-38.

[241] *Id.* at 730-31.

[242] Tr. at 732.

[243] Pilgrim Watch Statement at 19.

[244] Exh. 41 at A6.

Likewise, regarding Pilgrim Watch's claims that failure to address flow-accelerated corrosion (FAC) is a deficiency in Entergy's buried pipes and tanks AMPs,[245] according to NRC Staff expert Davis FAC "has never been observed in service water piping or buried condensate storage piping," is a concern only in "high-energy piping systems," and neither the CSS nor the SSWS buried discharge piping qualify as such.[246] Pilgrim Watch, meanwhile, provides no evidence linking the FAC phenomenon specifically to the buried SSWS discharge piping.

**4. Rates of Aging and Corrosion**

Pilgrim Watch has also argued, and presented the testimony of expert Gundersen, to the effect that the buried piping at Pilgrim, as well as that piping's "wraps and coatings," would exhibit so-called "bathtub curve" behavior, rather than linear aging behavior, and would fall within the "wear out phase" of the bathtub curve during the proposed period of extended operation.[247] Mr. Gundersen did not attempt to explain specifically why this would be true for any particular buried pipe or pipe coating, but rather suggested that "[t]his adjudication process must flush out the precise age of each part of the pipes, wraps and coatings and provide documents from the manufacturer certifying their life expectancy."[248]

NRC Staff expert Davis testified that the very purpose of Pilgrim's BPTIP "is to prevent [the wear out phase] of the bathtub curve from occurring,"[249] and Entergy does not appear to

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[245] Pilgrim Watch Statement at 32-33.

[246] Exh. 41 at A5.

[247] Exh. 13 at 22.

[248] Id.

[249] Exh. 41 at A9.

make any claim that aging of its SSWS buried discharge piping would be "linear." Further, Mr. Gundersen's bathtub curve analysis is limited to generalizations about unspecified pipes and coatings, rather than specific analysis of the actual pipes and coatings being used at Pilgrim. Moreover, as discussed above, Mr. Gundersen admits having no experience with the CIPP liners that are the current interior coating mechanism for the SSWS buried discharge piping.

**5. Leakage Events at Other Plants**

Pilgrim Watch claims that several occurrences at other nuclear plants support its claims that the Pilgrim buried pipe and tank AMPs are insufficient.[250] These include a reference to a pipe leak at the Byron Nuclear Power Station as well as discoveries of radioactivity in the groundwater at additional plant sites. Pilgrim Watch did not, however, provide any evidence to show that the fact of a leak at Byron reveals any material information about the risk of leaks in the Pilgrim buried SSWS discharge piping. Indeed, according to testimony from Entergy experts, "(1) the piping at Byron was not buried and (2) the piping was not wrapped."[251]

**6. Monitoring Wells**

Finally, I note Pilgrim Watch expert Ahlfeld's testimony that leakage of non-radioactive contents of the SSWS buried discharge piping could be detected via monitoring wells.[252] It appears that the potential exists that Entergy could add to its AMPs with respect to the SSWS

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[250] *See, e.g.,* Pilgrim Watch Statement at 22-23; Exh. 14 at ¶15; Exh. 20, Liquid Radioactive Release Lessons Learned Task Force Final Report Excertps (Sept. 1, 2006); Exh. 25, NRC Preliminary Notification of Even or Unusual Occurrence, PNO-III-07-21, "Both Units at byron Shut Down Due to Leak in Pipe" (Oct. 23, 2007) and Union of Concerned Scientists, "Help Wanted: Dutch Boy at Byron" (Oct. 25, 2007); Exh. 36, Event Notification Report, No. 43832, Palisades (Dec. 10, 2007).

[251] Exh. 2 at A34.

[252] Tr. at 763, 766.

buried discharge piping by utilizing monitoring wells to check for increased concentration of such things as chloride in the Pilgrim groundwater, the presence of which might indicate that the saltwater in the SSWS piping may be leaking. However, as Entergy points out, the SSWS discharge piping runs near the intake embayment and into the discharge canal, both of which contain salt water.[253] Therefore, it would be difficult to discern whether salt levels in a monitoring well were attributable to a leak rather than the influences of the adjacent water bodies.[254] In addition, the SSWS discharge lines are each over 200 feet long, and attempting to use monitoring wells to detect leakage from this span would be difficult and inefficient. In contrast, the monthly SSWS flow-rate tests check the water flow through the SSWS buried piping, and serve as a check on the water that flows through the discharge pipes.[255]

Nor would a monitoring well be more effective than the condensate storage tank water level monitoring program in detecting a leak in the CSS buried piping. As noted above, this monitoring is performed every four hours, which is substantially more frequent than would be a sampling program for monitoring wells, as suggested by Pilgrim Watch expert Ahlfeld.[256] The water level check would directly and quickly detect any leak significant enough to impair the intended functions of the CSS,[257] whereas, depending on the location of a leak, it might take considerable time for radioactive water to reach, and be detectible in, a monitoring well.

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[253] Entergy Reply at R35.

[254] Exh. 1 at A127.

[255] *Id.* at A127, A129.

[256] Exh. 1 at A129; *see id.* at A116.

[257] *Id.* at A116; *see also id.* at A121, A129.

## II. Application of Relevant Law to Facts

### A. "Reasonable Assurance" Standard

Before applying relevant license renewal law to the preceding facts, I note that the parties are in disagreement on the proper interpretation of the words, "reasonable assurance," as used at 10 C.F.R. § 54.29, in this license renewal proceeding. Under § 54.29(a), an applicant must demonstrate that "[a]ctions have been identified and have been or will be taken with respect to" its aging management program(s) and any required "time-limited aging analyses" (not at issue herein) such that "there is *reasonable assurance* that the activities authorized by the renewed license will continue to be conducted in accordance with the [current licensing basis]."[258]

Pilgrim Watch argues that the term, "reasonable assurance," should be interpreted to require the Applicant to "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."[259] Intervenor also argues that there must be a "95% Level of Confidence," and a "95 percent probability,"[260] citing case law including the 1993 Supreme Court decision, *Daubert v. Merrell Dow Pharmaceuticals*, in support of its argument, and referring to a transcript of a meeting of the

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[258] 10 C.F.R. §54.29(a) (emphasis added).

[259] Pilgrim Watch Proposed Findings at 68.

[260] *Id.* at 69.

Advisory Committee on Reactor Safeguards (ACRS) in which a "95 percent confidence" criterion for "reasonable assurance" is discussed.[261]

NRC Staff points out, regarding the reasonable assurance standard of § 54.29(a), that "[a]lthough reasonable assurance appears in many areas of the Commission case law and regulations, it is not specifically defined in either the Atomic Energy Act or the Commission's regulations,"[262] and that Pilgrim Watch has cited no Commission rule or case law to support its view.[263] Staff cites case law authority for the proposition that "reasonable assurance" does not mean zero risk or absolute certainty,[264] and that, with respect to reasonable assurance of adequate protection of public health and safety, it is a determination to be made on a case-by-case basis.[265] Staff argues that reasonable assurance is "based upon technical judgment, not application of a mechanical verbal formula, a set of objective standards, or a specific confidence

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[261] *Id.* at 69-70 (citing *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579, 592 (1993); Exh. 17, Transcript of Sept 6, 2001, ACRS Meeting). Pilgrim Watch also cites the Texas Supreme Court's decision in *Merrell Dow Pharmaceuticals, Inc., v. Havner*, 953 S.W.2d 706, 723-24 (Tex. 1997), and the unreported decision of the District of Columbia Superior Court in *United States v. Chase*, 2005 WL 757259, (Jan. 10, 2005 D.C. Super). Pilgrim Watch Proposed Findings at 69.

[262] Staff Proposed Findings at 14.

[263] *Id.* at 15 n.50.

[264] *Id.* at 14 (citing *Nader v. Ray*, 363 F. Supp. 946, 954 (D.D.C. 1973); *North Anna Envtl. Coalition v. NRC*, 533 F.2d 655, 667 (D.C. Cir. 1975) (rejecting the argument that reasonable assurance requires proof beyond a reasonable doubt and noting that the licensing board equated "reasonable assurance" with "a clear preponderance of the evidence")).

[265] *Id.* (citing *Union of Concerned Scientists v. NRC*, 880 F.2d 552, 558 (D.C. Cir. 1989) (stating that "adequate protection" may be given content through case-by-case applications of technical judgment and that Congress neither defined nor commanded the Commission to define adequate protection); Revision of Backfitting Process for Power Reactors, 53 Fed. Reg. 20,603, 20,605 (June 6, 1988) (stating that like "adequate protection," "reasonable assurance" is a determination based upon full consideration of all relevant information)).

interval,"[266] noting that the Commission "has explicitly stated that reasonable assurance does not denote a specific statistical parameter," and urging that the standard is a "flexible" one that "does not require focus on extreme values or precise quantification of parameters to a high degree of confidence."[267] The "touchstone," Staff contends, of "reasonable assurance of adequate protection of public health and safety" is "compliance with the Commission's regulations."[268] Moreover, according to Staff, an "adequate aging management program" is one that "monitors the performance and condition of [structures and components] subject to aging mechanisms in a manner that allows for the timely identification and correction of degraded conditions."[269]

Entergy makes some of the same arguments as those of the NRC Staff,[270] and also argues that "reasonable assurance" requires that it prove its case by the "preponderance of the

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[266] *Id.* at 14-15 (citing *Union of Concerned Scientists*, 880 F.2d at 558; *AmerGen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), LBP-07-17, 66 NRC 327, 340 (2007)).

[267] *Id.* at 15 (citing Disposal of High-Level Radioactive Wastes in a Proposed Geologic Repository at Yucca Mountain, Nevada, 66 Fed. Reg. 55,732, 55,739-40 (Nov. 2, 2001)).

[268] *Id.* (citing *Oyster Creek*, LBP-07-17, 66 NRC at 340, Maine Yankee Atomic Power Co. (Maine Yankee Atomic Power Station), ALAB-161, 6 AEC 1003, 1009 (1973)). Staff argues that we should, as the Licensing Board did in the *Oyster Creek* case with similar arguments, find Pilgrim Watch's arguments to the contrary to be "without merit and without any basis in Commission regulations or case law." *Id.* at 15 n.50 (citing *Oyster Creek*, LBP-07-17, 66 NRC at 340 n.18).

[269] *Id*. at 15 (citing 60 Fed. Reg. 22,461, 22,469 (May 8, 1995).

[270] Entergy's Proposed Findings of Fact and Conclusions of Law on Pilgrim Watch Contention 1 (June 9, 2008) [hereinafter Entergy Proposed Findings] at 10.

evidence" standard common to NRC proceedings, which has been interpreted as requiring "only that the record underlying a finding makes it slightly more likely than not."[271]

Based on relevant legal authority, I conclude, as Staff and Entergy argue, that the "reasonable assurance" standard of 10 C.F.R. § 54.29(a) must be determined on a case-by-case basis. Pilgrim Watch's arguments to the contrary are not supported by any law of which I am aware.[272] On the other hand, while the preponderance of the evidence standard obviously applies in this proceeding,[273] this standard in this or any license renewal proceeding means only that there must be a preponderance of the evidence that there *is* the required "reasonable assurance" – it does not define what level or degree of "assurance" constitutes a "reasonable" level of assurance. And while I do not find Intervenor's argument on this to be supported by law, it does not follow that "reasonable assurance" necessarily means only a 51% level of

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[271] *Id.* at 9 (citing *Advanced Medical Systems, Inc.* (One Factory Row, Geneva, Ohio 44041), CLI-94-6, 39 N.R.C. 285, 302 & n.22 (1994); *Oyster Creek*, LBP-07-17, 66 NRC at 340, 371; *Commonwealth Edison Co.* (Zion Station, Units 1 and 2), ALAB-616, 12 NRC 419, 421 (1980)); *Inquiry into Three Mile Island Unit 2 Leak Rate Data Falsification*, LBP-87-15, 25 N.R.C. 671, 690 (1987)).

[272] I note that the *Daubert* decision – in which the Court dealt with the question of the appropriate standard for the admission of expert testimony, held that the prior standard of "general acceptance" was "not a necessary precondition to the admissibility of scientific evidence under the Federal Rules of Evidence," and placed on trial judges the "task of ensuring that an expert's testimony both rests on a reliable foundation and is relevant," 509 U.S. at 597 – nowhere contains any reference to a "95% probability" or a "95% level of certainty" or "confidence." Nor do the other cases cited by Pilgrim Watch support its argument, dealing rather with, *e.g.*, how statistical evidence can play into proving causation. *See Havner*, 953 S.W.2d at 715.

[273] *See*, *e.g.*, *Duke Energy Corp.* (Catawba Nuclear Station, Units 1 and 2), LBP-05-10, 61 NRC 241 (2005); *Connecticut Yankee Atomic Power Co.* (Haddam Neck Plant), LBP-03-18, 58 NRC 262 (2003); *Pacific Gas & Electric Co.* (Diablo Canyon Nuclear Power Plant, Units 1 and 2), ALAB-763, 19 NRC 571, 577, *review declined*, CLI-84-14, 20 NRC 285 (1984). Intervenor does not dispute the appropriateness of this standard. *See supra* text accompanying n.259.

certainty or assurance that "the activities authorized by the renewed license will continue to be conducted in accordance with the [current licensing basis]."

Indeed, to use numeric references in a case in which there is no evidence from any party regarding any mathematical probabilities – and in which, as Intervenor has argued, it may be unlikely that such mathematical probabilities could be determined with a high degree of confidence in light of the absence of experience with reactors 40 to 60 years old[274] – is not particularly helpful in this proceeding. I am not persuaded, however, by Intervenor's argument to the effect that this uncertainty somehow suggests that "reasonable assurance" cannot be determined in a license renewal case.

I note Intervenor's reference to certain language of the Commission in the *Turkey Point* case, to the effect that applicants for license renewal must "demonstrate how their programs *will be effective* in managing the effect of aging during the period of extended operations," and "identify any additional actions . . . that *will need to be taken* to manage adequately the detrimental effects of aging."[275] I do not, however, interpret this as requiring the "95% level of certainty" argued by Intervenor. I also note, regarding additional case law cited by Intervenor, namely, *North Anna Envir'l. Coalition v. NRC*,[276] that the U.S. Court of Appeals for the D.C. Circuit in that case rejected an argument that the "reasonable assurance" standard (in a construction permit case) should be interpreted to require proof "beyond a reasonable doubt." The Court cited the U.S. Supreme Court's finding, in *Power Reactor Dev. Co. v. Int'l Union of*

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[274] *See* Pilgrim Watch Proposed Findings at 10, 40.

[275] *See* Pilgrim Watch Proposed Findings at 69; *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 8 (2001) (emphasis added).

[276] 533 F.2d 655 (D.C. Cir. 1976); *see* Pilgrim Watch Proposed Findings at 68.

*Elec., Radio and Machine Workers*,[277] of an argument that "reasonable assurance" should require a "compelling reasons" standard, to be without merit.[278] The D.C. Circuit stated that "[n]either the Atomic Energy Act nor the regulations require totally risk-free siting,"[279] noting that such "absolute positions and arguments . . . have been rejected by the courts."[280]

As the D.C. Circuit observed a year earlier, "[a]bsolute or perfect assurances are not required by AEA, and neither present technology nor public policy admit of such a standard."[281] Although a 95% level of certainty or confidence is not the same as absolute perfection, and although there has been technological progress since 1975, the same general observation would still seem to be pertinent in this proceeding. I would observe further that it is not unusual in NRC proceedings for there to be some tension between what different parties would find to be a "reasonable" degree of certainty. This is not to negate any point of view, and care must be taken to assure that all parties' views are heard and considered, which I have tried to do in this proceeding.

As a neutral adjudicator, I view my responsibility herein as determining, by a preponderance of the evidence, whether there is a level of assurance that reasonably and

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[277] 367 U.S. 396 (1961).

[278] *See* 533 F.2d at 667; *see also* 367 U.S. at 414. The Court in *North Anna* noted that the Licensing Board in that case in fact "equated 'reasonable assurance' with 'a clear preponderance of the evidence' standard," and found that the evidence in the case "met even . . . [the] beyond a reasonable doubt [standard]," but did not find that either was required. 533 F.2d at 667-68.

[279] 533 F.2d at 665.

[280] *Id.* (citing 367 U.S. at 414; *Nader v. NRC*, 513 F.2d 1045, 1050 (1975); comparing *Citizens for Safe Power v. NRC*, 524 F.2d 1291, 1301 and n.15 (1975)).

[281] *Citizens for Safe Power*, 524 F.2d at 1297.

clearly convinces me, taking all relevant facts and circumstances into account, that activities authorized under Pilgrim's renewed license will in fact continue to be conducted in accordance with its current licensing basis. Of course, as the D.C. Circuit has also pointed out, "an agency or commission must articulate with clarity and precision its findings and the reasons for its decisions,"[282] and in my role as a member of the Licensing Board in this proceeding, I endeavor herein to fulfill this duty, in a manner that reasonably addresses the concerns that Pilgrim Watch has raised.[283]

**B. Conclusions Regarding Condensate Storage System**

Based on the facts discussed above at sections II.B and II.C.1, I conclude that there is reasonable assurance that activities related to the condensate storage system buried pipes will continue to be conducted in accordance with Pilgrim's current licensing basis, without the need for monitoring wells. I, like my colleagues in their Majority Decision, base this conclusion primarily on the water level monitoring that is done in the condensate storage tanks every four hours, as discussed in section II.C.1.c above. Because of the required minimum 30-foot water level in the condensate storage tanks and the reservation of only 11 feet of this water for the HPCI and RCIC, there would have to be a 20-foot drop in tank water level before the capability

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[282] *Nader v. NRC*, 513 F.2d at 1051.

[283] I note at this point Intervenor's questioning of deference to the GALL Report in certain particulars. *See* Pilgrim Watch Proposed Findings at 42, 57. (I also note its own reliance on the Report on some points. *See*, *e.g.*, *id.* at 10.) The GALL Report, as a document developed to assist in compliance with the license renewal rules, is entitled to "special weight" in this license renewal proceeding. *Private Fuel Storage*, 54 NRC at 264; *see also supra* n.11. Therefore, reliance by Entergy and the Staff on particular portions of it may be in order, in the absence of a rule, or persuasive evidence, to the contrary. I have noted above in section II of this Opinion a number of instances in which parties rely on the GALL Report. I have also, however, tried herein to indicate as fully as possible the factual, technological, and logical bases for the findings and conclusions I draw from the evidence in this proceeding, separate and apart from whether or not Entergy has acted in compliance with the GALL Report.

of the HPCI and RCIC to perform their system functions using water solely from the condensate storage tanks would be impaired. In these circumstances, the water level monitoring of the tanks would obviously provide a much quicker and more accurate indication of any leak than monitoring wells could provide. Moreover, if there were a seismic event, water would be available as a back-up from the torus. These facts, taken together with the facts regarding Pilgrim's Water Chemistry Control program, use of appropriately-handled stainless steel pipes with appropriately-applied durable coatings, and inspections as described above at section II.B, provide reasonable assurance that activities related to the condensate storage system buried pipes will continue to be conducted in accordance with Pilgrim's current licensing basis, and that the use of monitoring wells would not make this any more likely.

**C. Conclusions Regarding Salt Service Water System**

I likewise conclude that Entergy has proven by a preponderance of the evidence that the salt service water system underground discharge pipes meet all relevant license renewal safety requirements, such that there is reasonable assurance that related activities will continue to be conducted in accordance with Pilgrim's current licensing basis, without the need of monitoring wells.

Specifically, based on the facts as discussed in section II.B above, I find the preponderance of the evidence to be (1) that the external double-wrapped coal-tar coating on the SSWS discharge pipes, which was specifically designed for use on submerged lines, river crossings, and similar installations with aggressive environments,[284] is durable and was appropriately applied and tested; (2) that the pipes were appropriately handled and buried in a manner geared to ensure an appropriate soil environment; and (3) that Pilgrim's inspection

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[284] *See supra* text accompanying n.23.

program for the external surfaces of buried piping strikes an appropriate balance between inspecting pipes effectively and avoiding such frequent inspections that they might create the potential for damage to the protective coating on the pipes. I have in reaching this conclusion taken into account Pilgrim Watch's arguments and evidence, including Dr. Ahlfeld's testimony about the water table in the area, and Mr. Gundersen's testimony about the soil environment and corrosion of pipes. I conclude, however, that Pilgrim Watch's evidence in these regards neither equals nor matches in detail, specificity or depth, the evidence presented by Entergy and supported by the NRC Staff with regard to aging management of external degradation of underground pipes.

In addition, based on the facts stated in detail in section II.C.2 above, regarding protection against internal degradation of pipes, I find the preponderance of the evidence to be (1) that, based on its design, characteristics, installation, and durability, as credibly described by Entergy witnesses and as supported by experience in a number of industries in aggressive environments, the cured-in-place (CIPP) pipe liners in these pipes are very unlikely to degrade to an extent that any holes would develop in the pipes;[285] (2) that the Service Water Integrity Program has been successfully implemented at Pilgrim to manage SSW system degradation due to internal corrosion, so as to assure its ability to fulfill its intended function, and will continue to manage the system effectively during the extended term of the license (including

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[285] I note that after the hearing Pilgrim Watch sought to introduce additional evidence concerning the installation of the CIPP liners that it contended showed problems with that installation, but, as noted in the Board's order denying its motion, *see* Licensing Board Order (Ruling on Pilgrim Watch Motions Regarding Testimony and Proposed Additional Evidence Relating to Pilgrim Watch Contention 1) (June 4, 2008) at 6 (unpublished), in addition to noting certain "'challenges' the contractor dealt with in placing the liner," it also described how the contractor "addressed these challenges so as to reach 'favorable results' that were tested to 'confirm compliance with physical property specifications.'"

through flow-rate testing, which serves as a check on water flowing through the discharge pipes, and which would likely be a much better indicator of any leak large enough to compromise the safety function of the discharge pipes than would monitoring wells); (3) that, even if any degradation resulted in corrosion that led to holes developing in the pipes, it would be very unlikely that any such holes would spread laterally on the pipe very far from any area of liner degradation, or that there would be enough holes of sufficient size to cause either of these large, 22”-diameter pipes to collapse; and (4) that, even in the very unlikely event of holes developing in one pipe to an extent sufficient to cause collapse, it would be extremely unlikely for holes also to develop in the other pipe to an extent sufficient to lead to collapse of both pipes. Protecting against this possibility, even in a design-basis earthquake, is required of Pilgrim as part of its current licensing basis, and the clear preponderance of the evidence is that it will be no less able to accomplish this in the license renewal period than in its current license term.

Moreover, the testing that Pilgrim will be required to undertake, as discussed above,[286] as well as the required in-service inspection, which are in addition to inspections required under the Service Water Integrity Program,[287] will provide additional assurances. I do not find that Pilgrim Watch’s challenges to the inspection programs, through Mr. Gundersen, negate or outweigh the evidence presented by Entergy and the Staff regarding these programs, under all the circumstances and facts presented in this proceeding.

Nor do I find Pilgrim Watch’s evidence concerning cathodic protection, tritium discovery at Pilgrim, small leaks and their significance, rates of aging and corrosion, or leakage events at

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[286] *See supra* text accompanying nn.187-193.

[287] *See supra* text accompanying nn.194-198.

other plants to counter this conclusion. As noted above,[288] (1) there are some safety concerns associated with cathodic protection such that the GALL Report, credibly, permits an alternative approach; (2) it is more likely that the tritium at the Pilgrim plant is coming from another source than the SSWS discharge pipes, and while further checking into and correction of this is certainly in order,[289] I do not find that it raises sufficient doubt to counter the preceding findings and conclusions regarding the SSWS discharge pipes; (3) nor, for the reasons stated above in sections II.D.3, 4, and 5, do I find Mr. Gundersen's theories about small leaks, rates of aging and corrosion, or leakage events at other plants, counter the preceding findings and conclusions.[290]

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[288] *See supra* sections II.D.1-5.

[289] *See supra* text accompanying n.227.

[290] I note that Pilgrim Watch has also raised questions about Pilgrim's possible use of counterfeit or substandard pipes, referring to a 1990 GAO report, Exh. 28, Report to the Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives, "Nuclear Safety and Health – Counterfeit and Substandard Products Are a Governmentwide Concern," GAO/RCED-91-6 (Oct. 1990), suggesting that "Entergy has not established 'whether or not the . . . SSW[S] . . . piping has counterfeit and/or substandard pipe fittings and flanges.'" Pilgrim Watch Proposed Findings at 18. Entergy and Staff, however, point out that the NRC issued a Generic Letter "requiring licensees to take actions 'to avoid using counterfeit and fraudulently marked products using the methods identified in the generic letter.'" Entergy Reply at 21; Exh. 41 at A7 (citing Generic Letter 89-02, "Actions to Improve the Detection of Counterfeit and Fraudulently Marked Products). Entergy also suggests that the issue is one resolved under the plant's current licensing basis and not a license renewal issue. Entergy Reply to Pilgrim Watch at 21.

Pilgrim Watch suggests that Entergy should have placed some documentation of its response to Generic Letter 89-02 into the record, or that the Board should have required its production. Pilgrim Watch Proposed Findings at 31. As Entergy argues, however, it provided its response to the generic letter to Intervenor in discovery. Entergy Reply to Pilgrim Watch at 21. Thus Intervenor could have produced the document and challenged it and its contents with specificity, but failed to do so. In light of this, I find that the preponderance of the evidence on this issue lies in favor of Entergy.

Finally, I am mindful of Dr. Ahlfeld's testimony that monitoring wells might detect increased amounts of chloride in ground water, indicating a possible leak before it becomes large enough to pose a risk of the discharge pipes failing to fulfill their safety purpose. As Entergy points out, however, since the pipes run near bodies of salt water, it would likely be difficult to discern whether any chloride levels were attributable to a leak rather than the influences of the adjacent water bodies.[291] While it might well be a good idea for Entergy to install more monitoring wells to check for radioactive liquids in the ground water, as argued by Pilgrim Watch and suggested by the towns of Plymouth and Duxbury,[292] I do not find this to be required under relevant license renewal law and rules, and the preponderance of the evidence is that monitoring wells would not serve a useful purpose from a license renewal standpoint, taking all of the facts and circumstances as described above into account.

Pilgrim Watch would have the Licensing Board interpret the rules and law relating to license renewal more broadly than has been done in this proceeding, but absent good authority to do so, this would contravene the ethical responsibility a judge has to comply with the law as it exists.[293] Intervenor also urges the Board to delve more deeply into certain facts than the parties have done in presenting their evidence. While this might be permitted as to issues before a licensing board, I do not find that any such additional action on the part of the Board is called for in this proceeding, absent a remand or other similar reason, given all the facts presented to and considered by the Board, as recounted and discussed above.

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[291] *See supra* section II.D.6.

[292] *See* Tr. at 863, 865.

[293] *See* ABA Model Code of Judicial Conduct (Feb. 2007), Rules 1.1, 2.2 and comments thereto.

In sum, I conclude, based on close consideration the facts, and by a clear preponderance of the evidence from which these facts are gleaned, that Entergy's processes for coating and lining the SSWS buried discharge piping, its precautions in handling and burying the pipe and in providing a non-aggressive soil environment for the pipe, its previous inspections and testing and its planned future inspections and testing of this buried piping, provide reasonable assurance that activities related to this piping will continue to be conducted in accordance with the Pilgrim plant's current licensing basis.

**D. Conclusion on Contention 1**

In conclusion, I like my colleagues also resolve Pilgrim Watch Contention 1 in favor of Entergy. I recognize that Pilgrim Watch would like to see more frequent and more extensive inspections of all of the buried piping at the Pilgrim plant, as well as monitoring wells. But the question at this point in this proceeding is simply whether relevant Pilgrim aging management programs for the buried pipes, as Entergy has formulated them and implements them, are adequate to provide reasonable assurance that related activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis.[294] Once a determination is made on this issue, the Board's inquiry ends.[295] I hope that aspects of this proceeding, along with the contents of this Opinion, which arise out of issues that Intervenor brought forward in the proceeding with admirable persistence and resourcefulness, will provide

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[294] *See* 10 C.F.R. §§ 54.21(a)(3), 54.29(a).

[295] *See* 60 Fed. Reg. at 22,490 ("The Commission does not intend to impose requirements on a licensee that go beyond what is necessary to adequately manage aging effects."). It should also be noted, however, that the NRC's corrective action requirements, including those that address leakage, along with all other requirements relating to operating reactors, require correction of any problems on an ongoing basis. And any person may file a petition for an enforcement action under 10 C.F.R. § 2.206, or (as Intervenor is aware, having filed one) a petition for rulemaking under § 2.802, to address any perceived problems that may present themselves.

some assurances to Pilgrim Watch and the towns of Plymouth and Duxbury regarding these matters.

Rockville, Maryland
October 31, 2008[296]

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[296] Copies of this Concurring Opinion were sent this date by email to all participants and counsel.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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| In the Matter of | ) | |
| | ) | |
| ENTERGY NUCLEAR GENERATION CO. | ) | |
| AND | ) | |
| ENTERGY NUCLEAR OPERATIONS, INC. | ) | Docket No. 50-293-LR |
| | ) | |
| (Pilgrim Nuclear Power Station) | ) | |

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing CONCURRING OPINION OF ADMINISTRATIVE JUDGE ANN MARSHALL YOUNG TO INITIAL DECISION ISSUED OCTOBER 30, 2008 (LBP-08-22) have been served upon the following persons by U.S. mail, first class, or through NRC internal mail.

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Docket No. 50-293-LR
CONCURRING OPINION OF ADMINISTRATIVE JUDGE ANN MARSHALL YOUNG
TO INITIAL DECISION ISSUED OCTOBER 30, 2008 (LBP-08-22)

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Office of the Secretary of the Commission

Dated at Rockville, Maryland
this 31st day of October 2008