RAS 13760

June 8, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board Panel

In the Matter of	)	
	)	
Entergy Nuclear Generation Company and	)	Docket No. 50-293-LR
Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-848-02-LR
	)	
(Pilgrim Nuclear Power Station)	)	

ENTERGY'S MOTION FOR SUMMARY DISPOSITION OF PILGRIM WATCH CONTENTION 1

Pursuant to 10 C.F.R. § 2.1205 and the schedule set forth in the December 20, 2006 Order[1] of the Atomic Safety and Licensing Board ("Licensing Board" or "Board"), Applicants Entergy Nuclear Generation Company and Entergy Nuclear Operations, Inc. (collectively "Entergy") seek summary disposition of Pilgrim Watch Contention 1. Entergy moves for summary disposition of the contention on the grounds that no genuine issue as to any material fact exists and, thus, Entergy is entitled to a decision as a matter of law. 10 C.F.R. § 2.710(d)(2). This Motion is supported by (1) a Statement of Material Facts as to which Entergy asserts that there is no genuine dispute; and (2) a Declaration by Alan Cox, the Technical Manager, License Renewal with Entergy Nuclear.[2]

---

1 Order (Establishing Schedule for Proceeding and Addressing Related Matters) (Dec. 20, 2006) ("Scheduling Order").

2 Declaration of Alan Cox in Support of Entergy's Motion for Summary Disposition of Pilgrim Watch Contention 1 (June 5, 2007) ("Cox Decl.").

Template=SECY-041

SECY-02

I. PROCEDURAL BACKGROUND

On May 25, 2006, Pilgrim Watch filed its petition to intervene[3] seeking the admission of five contentions. On October 16, 2006, the Licensing Board admitted two of Pilgrim Watch's contentions, including an amended version of Pilgrim Watch Contention 1, into the PNPS license renewal proceeding.[4] Pilgrim Watch Contention 1, as amended by the Board, 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.

LBP-06-23, 64 N.R.C. at 315 (footnote omitted). On December 20, 2006, the Licensing Board issued the Scheduling Order, which provides that motions for summary disposition be filed no later than June 11, 2007. Scheduling Order at 5.

II. STATEMENT OF THE ISSUE

In admitting the amended Pilgrim Watch Contention 3, the Licensing Board stated that Pilgrim Watch Contention 1

> raises factual issues from two perspectives: First, it can be viewed, in its most direct form, as a challenge to the adequacy of the proposed interval of inspection. Second, it can be viewed, in its pointing out of the of lack of monitoring for leaks that would be indicative of pipe or tank failure, as a challenge to the adequacy of a plan which merely satisfies the minimum requirements of regulatory guidance which, in and of itself, appears to contemplate some plant-specific elements. With regard to the first perspective, it is unclear at this point whether or not this proposed periodicity is sufficient for this plant, and with regard to the second, it is likewise premature to say whether or not monitoring for leaks is properly part of an aging management plan designed to prevent leaks.

---

3 Request for Hearing and Petition to Intervene by Pilgrim Watch (May 25, 2006) ("Pilgrim Watch Pet.").

4 Memorandum and Order (Ruling on Standing and Contentions of Petitioners Massachusetts Attorney General and Pilgrim Watch), LBP-06-23, 64 N.R.C. 257 (2006).

64 N.R.C. at 312 n.255 (emphasis in original).

With respect to the sufficiency of the PNPS aging management programs ("AMP"), Pilgrim Watch contends that, for buried pipes and tanks, the AMPs provide for inadequate inspection and monitoring to detect potential leakage from underground pipes and tanks that could migrate off-site, particularly for small leaks that might otherwise go undetected. Pilgrim Watch Pet. at 11-14. According to Pilgrim Watch, the only way to detect and protect against such leaks is to install a suitable array of monitoring wells. Id. at 13-14. Among other arguments, Pilgrim Watch bases its claims about the alleged inadequacy of the AMPs on leakage events that have occurred at other nuclear power plants, Pilgrim Watch Pet. at 6-8 and Exhibit A, and further concludes that PNPS should enhance its monitoring program because of those events. Pilgrim Watch. Pet. at 14-15.

As will be demonstrated, the claims raised by Pilgrim Watch Contention 1 lack merit and are refuted by the Declaration provided in support of this Motion. There are no material facts in dispute that warrant holding a hearing on this contention, and Entergy is entitled to a decision as a matter of law in its favor.

III. ENTERGY IS ENTITLED TO SUMMARY DISPOSITION ON PILGRIM WATCH CONTENTION 1.

A. Legal Standards for Summary Disposition

Entergy has previously set forth in detail the legal standards for summary disposition in its Motion for Summary Disposition of Pilgrim Watch Contention 3 at pages 4-6 (May 17, 2007). Entergy incorporates by reference those standards here.

B. There is No Factual Dispute Requiring Litigation

1. Overview of Pilgrim Watch Contention 1 and Its Lack of Validity

Contention 1 alleges that PNPS AMPs fail to provide adequate inspection and monitoring for leaks of systems and components that may contain radioactive water. Pilgrim Watch Pet. at 4. Contention 1, however, provides no basis to dispute the adequacy of the AMPs for underground pipes and tanks and, moreover, raises issues beyond the scope of this proceeding. Pilgrim Watch fundamentally misunderstands the purpose and scope of the AMPs for buried pipes and tanks implemented under 10 C.F.R. Part 54. The purpose of the AMPs for buried pipes and tanks is not to prevent the radioactive contamination of the soil or groundwater, which is an "everday operational issue,"[5] but to manage the aging effects of critical plant functions that prevent and mitigate design basis accidents or other functions of principal importance to plant safety. Moreover Pilgrim Watch simply ignores the fact that the specific program challenged in Contention 1 solely concerns the exterior surfaces of buried pipes and tanks and that wholly separate programs are designed to protect and ensure the integrity of the interior surfaces of underground pipes and tanks. Cox Decl. at ¶¶ 25-27, 32, 34.

Only the condensate storage system and possibly the salt service water system ("SSW") at PNPS are within the scope of license renewal and have buried components containing radioactive water.[6] As will be discussed below, the attempted comparisons made by Pilgrim Watch between PNPS and leakage events at other nuclear power plants, Pilgrim Watch Pet. at 6-8 and Exhibit A, have no relevance to the PNPS condensate storage system or SSW buried pipes. In any event, the radioactive water leakage at other nuclear plants provides no indication of any

---

5 Dominion Nuclear Connecticut, Inc. (Millstone Nuclear Power Station, Units 2 and 3), CLI-06-04, 63 N.R.C. 32, 37 (2006) (holding that the possible release of excessive radioactivity into the environment is an "'everyday operational issue'" and not within the scope of license renewal) (quoting Dominion Nuclear Connecticut, Inc. (Millstone Nuclear Power Station, Units 2 and 3), CLI-04-36, 60 N.R.C. 631, 637-38 (2004), quoting Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 N.R.C. 3, 7 (2001)).

6 Neither the PNPS condensate system or the SSW system contain buried tanks. Cox Decl. at ¶ 19 n.3.

susceptibility to radioactive leakage at PNPS or of any asserted deficiency in the AMPs established to support PNPS license renewal. Cox Decl. at ¶¶ 41-44.

Lastly, installing a monitoring system to detect the leakage of radioactive liquid from buried piping and tanks in order to protect groundwater is not within the scope of license renewal. Pilgrim Watch is in effect seeking to raise a continuing licensing basis ("CLB") issue. However, the Commission has expressly declined to extend license renewal to potential ground water contamination issues because that is part of the ongoing regulatory process. See, e.g., Final Rule, Nuclear Power Plant License Renewal; Revisions, 60 Fed. Reg. 22,461, 22,464, 22,481-82 (May 8, 1995); Union of Concerned Scientists; Denial of Petition for Rulemaking, 66 Fed. Reg. 65,141 (Dec. 18, 2001); Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4) CLI-01-17, 54 N.R.C 3, 15-17 (2001).

In short, Pilgrim Watch has failed to dispute "facts that might affect the outcome of the suit under the governing law," and its remaining "irrelevant or unnecessary" claims should "not be counted." Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 248 (1986). Consequently, Contention 1 lacks any genuine factual dispute and is ripe for summary disposition.

2. Overview of Function and Purpose of License Renewal Aging Management Programs

Pursuant to 10 C.F.R. Part 54, PNPS has established AMPs to ensure that the effects of aging during the extended license renewal term are managed for the systems, structures, and components that are within the scope of license renewal. Cox Decl. at ¶ 7. The purpose of the AMPs identified in the PNPS License Renewal Application is to manage the effects of aging so that the intended function(s) of the systems, structures, and components within the scope of license renewal will be maintained consistent with the CLB for the period of extended operation in accordance with 10 C.F.R. § 54.21(a)(3). Cox Decl. at ¶ 7. Thus, the potential effects of aging define the issues for consideration in license renewal proceedings. Millstone, CLI-04-36, 60 N.R.C. at 637. In other words, with the exception of the detrimental effects of aging and a few other issues related to safety only during the period of extended operation, the existing regulatory processes are deemed adequate to ensure that the licensing bases of currently-operating plants provide and maintain an adequate level of safety. Cox Decl. at ¶ 8; 60 Fed. Reg. at 22,464, 22,481-82. Consequently, license renewal does not focus on everyday operational issues, because these issues are addressed by ongoing agency oversight, review, and enforcement. Cox Decl. at ¶ 7; Millstone, CLI-06-04, 63 N.R.C. at 37.

Moreover, the license renewal rule is focused on plant systems structures and components that are of "principal importance" to the safety of the plant.[7] In this respect, 10 C.F.R. § 54.4 specifies and limits plant systems, structure, and components functions that are within the scope of license renewal to those that are important for plant safety. Cox Decl. at ¶ 8. These functions are:

- (1) critical plant safety-related functions relied upon to remain functional during and following design-basis events in order to maintain to (i) the integrity of the reactor coolant pressure boundary; (ii) the capability to shut down the reactor and maintain it in a safe shut-down condition; or (iii) the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 (i.e., 25 rem at the exclusion area boundary following a postulated fission product release);
- (2) non-safety-related functions whose failure could prevent the satisfactory accomplishment of any of the above critical safety-related functions; and

---

[7] 66 Fed. Reg. at 65,142; 60 Fed. Reg.at 22,465 .

- (3) systems, structures, and components relied on in safety analyses or plant evaluations to perform functions or to demonstrate compliance with various design basis and beyond design basis requirements established by the Commission, *e.g.*, anticipated transients without scram, and station blackout.

10 C.F.R. § 54.4(a)(1) – (3). Of these systems, structures and components that fall within the scope of 10 C.F.R. § 54.4, 10 C.F.R. § 54.21(a)(1) defines the systems, structures, and components that are subject to aging management review as those that (i) perform an intended function, as described in § 54.4, without moving parts or without a change in configuration or properties; and (ii) that are not subject to replacement based on a qualified life or specified time period.

Thus, in license renewal, the focus is to maintain critical plant functions that may be subject to aging mechanisms in the extended period of operation. License renewal is not focused on everyday operational issues, which are effectively addressed by ongoing agency oversight, review, and enforcement. Cox Decl. at ¶¶ 7, 9; Millstone, CLI-06-04, 63 N.R.C. at 37.

3. The Condensate Storage System is the Only In-scope System with Buried Pipes and Tanks that Contains Radioactive Water.

The license renewal scoping criteria provided in 10 C.F.R. § 54.4 provide the plant systems, structures and components that are within the scope of license renewal and the functions of the systems, structures and components that are intended to be ensured by AMPs. Cox Decl. at ¶ 8. Only six systems at PNPS that have buried piping or tanks meet the scoping criteria of 10 C.F.R. § 54.4: (1) standby gas treatment; (2) salt service water ("SSW"); (3) fuel oil; (4) station blackout diesel generator; (5) fire protection; and (6) condensate storage. Cox Decl. at ¶ 10. None of the remaining systems at PNPS that contain buried piping or tank components have functions that meet the 10 C.F.R. § 54.4 scoping criteria. Cox Decl. at ¶ 10.

The only system within the license renewal scope with buried pipes and tanks that contains radioactive liquid is the condensate storage system. Cox Decl. at ¶ 11. The condensate storage system provides for station makeup needs and accepts condensate discharges to maintain appropriate condenser water level. Cox Decl. at ¶ 14. It is possible, but unlikely, that the SSW could contain radioactivity as a result of leakage from the radioactive systems for which it is the ultimate heat sink. Cox Decl. at ¶ 12. The SSW cools the reactor building closed cooling system, which in turn cools systems that contain radioactive liquid. Cox Decl. at ¶ 12. However, the interfacing reactor building closed cooling system is monitored for radioactivity by radiation detectors, and thus it is highly unlikely that the SSW would become radioactively contaminated. Cox Decl. at ¶ 12.

The remaining systems at PNPS that have buried piping or tanks and meet the scoping criteria of 10 C.F.R. § 54.4 – the fuel oil system, the station blackout diesel generator system, the fire protection system, and the standby gas treatment system – neither contain radioactive water or other corrosive liquid nor interact with systems containing radioactively contaminated water. Cox Decl. at ¶ 13. Thus, with respect to Pilgrim Watch Contention 1, the buried pipes and tanks for those systems are not at issue.

The objective of the AMPs with respect to the condensate storage system buried piping is to preserve its capability to provide a source of water to the reactor core isolation cooling ("RCIC") and high pressure coolant injection ("HPCI") pumps so as to avoid the loss of plant safety functions. Cox Decl. at ¶ 14. Buried piping in the condensate storage system consists of stainless steel piping from the condensate storage tanks to the RCIC and HPCI. Cox Decl. at ¶ 14. The condensate storage system falls within the scope of 10 C.F.R. § 54.4(a)(1) because it supplies water to the suction of the RCIC and HPCI pumps, which is performed by safety-related piping and valves that interface with RCIC and HPCI. Cox Decl. at ¶ 14. Similarly, the condensate storage system falls within 10 C.F.R. § 54.4(a)(3)because it provides a source of water to the HPCI and RCIC systems, which are credited in the 10 C.F.R. 50 Appendix R analysis for safe shutdown for fire protection. Cox Decl. at ¶ 14.[8]

The objective of the AMPs with respect to the SSW is to preserve its capability to provide cooling for plant systems. Cox Decl. at ¶ 15. The SSW functions as the ultimate heat sink for the reactor building closed cooling water and turbine building closed cooling water systems during plant operations. Cox Decl. at ¶ 15. The buried piping in the SSW consists of titanium and rubber-lined carbon steel and falls within 10 C.F.R. § 54.4(a)(1) because it cools essential safety-related equipment in the reactor building. Cox Decl. at ¶ 15. Similarly, the SSW falls within 10 C.F.R. § 54.4(a)(3) because it is credited for cooling plant systems in the 10 C.F.R. Part 50 Appendix R safe shutdown analysis for fire protection (10 C.F.R. § 50.48).[9]

In summary, the following table details the buried tanks and pipes in systems that contain or may contain radioactive water within the scope of license renewal:

System	Intended function	Buried Material	Internal Environment	Potentially Radioactive
Condensate Storage	10CFR54.4(a)(1), (a)(2) and (a)(3)	Stainless steel	Treated water	Yes
Salt Service Water	10CFR54.4(a)(1), (a)(2) and (a)(3)	Carbon steel, Titanium	Raw water	Highly unlikely

[8] Regarding 10 C.F.R. § 54.4(a)(2), the condensate storage system helps to maintain the integrity of non-safety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function. Cox Decl. at ¶ 14.

[9] Regarding 10 C.F.R. § 54.4(a)(2), the SSW maintains the integrity of non-safety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

Cox Decl. at ¶ 16.

4. PNPS Aging Management Program for Buried Pipes and Tanks

PNPS implements a range of programs to manage the effects of aging on buried piping and tanks that are within the scope of license renewal and subject to aging management review. These include the Buried Piping and Tanks Inspection Program ("BPTIP"), the Water Chemistry Control-BWR Program, the Service Water Integrity Program, and the One-Time Inspection Program. Cox Decl. at ¶ 17. The objective of the AMPs as applied to buried pipes and tanks is to maintain the pressure boundary of the buried pipes and tanks to ensure that the systems containing the buried pipes and tanks can perform their system intended functions in accordance with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3). Cox Decl. at ¶ 17.

a. BPTIP

The BPTIP manages the effects of aging on the external surfaces of components buried in soil. Cox Decl. at ¶ 18. The BPTIP includes (1) preventive measures, such as protective coatings applied to external surfaces, to inhibit the corrosion of external surfaces of buried pipes and tanks; and (2) inspections to ensure that the protective coatings are being maintained. Cox Decl. at ¶ 18. The BPTIP preventive measures are in accordance with standard industry practice for installing external coatings and wrappings. Cox Decl. at ¶ 19. Industry operating experience has shown that properly applied coatings will prevent the aging of components buried in the soil for extended periods of time, unless there is unusually aggressive soil chemistry (which is not the case at PNPS), or the coatings are damaged during installation or maintenance. Cox Decl. at ¶

20. This operating experience has been confirmed by NUREG-1801[10] in the XI.M34 Operating Experience review. Cox Decl. at ¶ 20. PNPS operating experience with excavating of buried piping for maintenance or modification activities has also confirmed the effectiveness of properly applied coatings. Cox Decl. at ¶¶ 20-21.

The BPTIP provides for periodic and opportunistic inspections of buried pipes and tanks within the scope of license renewal. Cox Decl. at ¶ 23. Pursuant to the BPTIP, buried components will be inspected when excavated during maintenance. Cox Decl. at ¶ 23. Prior to entering the period of extended operation, plant operating experience will be reviewed to verify that an inspection of buried pipes and tanks within the scope of license renewal has occurred within the past ten years. Cox Decl. at ¶ 23. If not, an inspection will be performed prior to entering the period of extended operation. Cox Decl. at ¶ 23. Further, 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. Cox Decl. at ¶ 23. The purpose of these inspections is to ensure that the protective coatings are being maintained in place to protect against corrosion of the external surfaces of the buried components. Cox Decl. at ¶ 23.

PNPS has replaced and relined SSW buried piping (which, as discussed infra, is very unlikely to contain radioactive water) in order to prevent the internal corrosion of the pipes from the raw water environment. Cox Decl. at ¶¶ 19 n. 4, 26. When replacing the SSW pipes, PNPS examined external buried piping coatings, which consisted of reinforced fiberglass wrapping and

[10] NUREG 1801, Generic Aging Lessons Learned (GALL) Report, Vol. 2, Rev. 1 (Sept. 2005) ("GALL Report").

coal tar saturated felt and heavy Kraft paper in accordance with the PNPS specification for the external wrapping of pipes. Cox Decl. at ¶ 21. The exterior wrappings of the pipes were found to be in good condition and no external corrosion of the pipes was observed. Cox Decl. at ¶ 21.

According to NUREG-1801, plant-specific operating experience is relevant in considering the effectiveness of AMPs. Cox Decl. at ¶ 22. The importance of the information contained in the GALL Report cannot be overlooked. The Gall Report is the technical basis document for NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants." The GALL Report identifies AMPs that have been determined to be acceptable programs to manage the aging effects of systems, structures and components within the scope of license renewal as required by 10 C.F.R. Part 54. 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. The GALL Report is an authoritative document based on a systematic compilation of plant aging information and evaluation of program attributes for managing the aging effects of systems, structures and components for license renewal. NUREG-1801 at 1-3. PNPS's operating experience demonstrates the sufficiency of the external coatings of buried pipes and tanks. Cox Decl. at ¶ 22. This operating experience, when combined with the opportunistic and periodic inspections provided for by the PNPS BPTIP, demonstrates that PNPS will ensure that the aging of the exterior surfaces of buried pipes and tanks is appropriately managed in accordance with 10 C.F.R. Part 54, so that the buried pipes and tanks will perform their intended functions. Cox Decl. at ¶ 22. If coatings on components are maintained, the coatings will prevent the soil from adversely affecting the exterior surface of buried components such that they can continue to perform their intended functions. Cox Decl. at ¶ 24.

b. Water Chemistry Control-BWR Program

The Water Chemistry Control-BWR Program optimizes the water chemistry in the condensate storage system to minimize the potential for loss of material and cracking due to internal corrosion of the system by limiting contaminants in the system. Cox Decl. at ¶ 25. This existing program has been confirmed to be effective at managing the aging effects of the condensate storage system as documented by the operating experience review. Cox Decl. at ¶ 25. The Program uses Electric Power Research Institute BWR water chemistry guidelines, described in NUREG-1801, which include chemistry recommendations for the condensate storage tanks. Cox Decl. at ¶ 25. The Program's effectiveness has also been confirmed by industry operating experience as described in NUREG-1801. Cox Decl. at ¶ 25.

c. The Service Water Integrity Program

The Service Water Integrity Program includes surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the SSW system or structures and components serviced by the SSW system. Cox Decl. at ¶ 26. Under the Program, the components of the SSW system are routinely inspected for internal erosion and corrosion and other aging mechanisms that can degrade the SSW system. Cox Decl. at ¶ 26. The inspection program includes provisions for visual inspections, eddy current testing of heat exchanger tubes, ultrasonic testing, radiography testing and heat transfer capability testing. Cox Decl. at ¶ 26. This Program has been successfully implemented at PNPS to identify SSW degradation from loss of material due to internal corrosion prior to the loss of its intended function. Cox Decl. at ¶ 26.

d. One-Time Inspection Program

The One-Time Inspection Program is a new program, which includes activities to confirm the absence of significant aging effects for the internal surfaces of piping and is performed by a visual inspection of the interior piping surface prior to the period of extended operation. Cox Decl. at ¶ 27. It may be satisfied by an opportunity inspection. Cox Decl. at ¶ 27. With respect to the condensate storage system buried piping and tanks, the One-Time Inspection Program will ensure the effectiveness of the Water Chemistry Control-BWR, which minimizes the potential for loss of material and cracking due to internal corrosion of the condensate storage system. Cox Decl. at ¶ 27.

5. Response to the Issues Raised in Pilgrim Watch Contention 1

Pilgrim Watch raises a whole host of claims alleging that the PNPS AMPs for buried pipes and tanks provide for inadequate inspection and monitoring to detect potential leakage from underground pipes and tanks that could migrate off-site, particularly for small leaks that might otherwise go undetected. Pilgrim Watch Pet. at 11-14. According to Pilgrim Watch, the only way to detect and protect against such leaks is to install a suitable array of monitoring wells. Id. at 13-14. Pilgrim Watch's claims have no merit. Pilgrim Watch fundamentally misunderstands the purpose and scope of the AMPs for buried pipes and tanks and ignores the fact that the specific program challenged in Contention 1 solely concerns the exterior surfaces of buried pipes and tanks, and that wholly separate programs are designed for pipe and tank interior surfaces. Cox Decl. at ¶ 28.

a. Protecting groundwater from radioactive leakage is not a license renewal intended function

The objective of the AMPs as applied to buried pipes and tanks is to maintain the pressure boundary of the buried pipes and tanks in order to ensure that systems containing these components can perform their intended functions that are within the scope of license renewal in accordance with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3). Cox Decl. at ¶ 30. The AMPs accomplish this objective by managing potential degradation due to aging of both the exterior surfaces and the interior surfaces of buried pipes and tanks in order to ensure the general integrity of the buried pipes and tanks to perform their intended functions. Cox Decl. at ¶¶ 30, 32. In accordance with the provisions of 10 C.F.R. § 54.4 and 10 C.F.R. § 54.21(a)(3), the purpose of the AMPs is not, as claimed by Pilgrim Watch, to protect the groundwater from radioactive contamination. Cox Decl. at ¶ 30.

Simply stated, the prevention of leakage of radioactive liquid from buried piping and tanks to protect groundwater from radioactive contamination, as sought by Pilgrim Watch, is not a license renewal intended function as defined by § 54.4. Cox Decl. at ¶¶ 9, 30. Pilgrim Watch's claim of inadequate monitoring is, thus, "irrelevant or unnecessary" and should "not be counted" as a genuine factual dispute. Anderson, 477 U.S. at 248. One of the intended functions specified in 10 C.F.R. § 54.4 to be accounted for in AMPs is the "capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 . . . ." 10 C.F.R. § 54.4(a)(1)(iii). Cox Decl. at ¶ 9. In other words, the systems, structures, and components within the scope of license renewal are those relied upon to prevent or mitigate the consequences of an accident that could result in potential offsite exposures that would exceed the 25 rem TEDE limit, or 300 rem thyroid limit, at the exclusion area boundary following a postulated fission product release proscribed in 10 C.F.R. §§ 50.34(a)(1), 50.67(b)(2), and 100.11.[11] Cox Decl. at ¶ 9. Leakage of radioactive liquid from buried piping and tanks is not a design basis event that could cause accident consequences comparable to those referred to in §§ 50.34(a)(1), 50.67(b)(2) or 100.11. Consequently, preventing such leakage is not a safety-related function or other critical plant function that has to be maintained under the license renewal rules. Cox Decl. at ¶ 9.

Moreover, the existing regulatory process maintains the performance of the condensate storage system and other buried pipes and tanks that may contain radioactively contaminated water in order to keep any exposures to radiation below applicable regulatory limits for normal operations.[12] Cox Decl. at ¶ 31. In denying a petition for rulemaking from the Union of Concerned Scientists,[13] the Commission held that the potential aging degradation of liquid and gaseous radioactive waste management systems was <u>not</u> within the scope of license renewal (1) because such degradation and resulting radioactive leakage was not a licensing basis event

---

[11] 10 C.F.R. § 50.34(a)(1)(ii)(D)(1) requires an evaluation demonstrating that "an individual located at any point on the boundary of the exclusion area for any 2 hour period following the onset of the postulated fission product release, would not receive a radiation dose in excess of 25 rem total effective dose equivalent (TEDE)" (footnote omitted). 10 C.F.R. 50.67(b)(2) provides, among other things, that the NRC may not issue a license amendment unless the applicant's analysis demonstrates that "[a]n individual located at any point on the boundary of the exclusion area for any 2-hour period following the onset of the postulated fission product release, would not receive a radiation dose in excess of 0.25 Sv (25 rem) total effective dose equivalent (TEDE)" (footnote omitted). 10 C.F.R. § 100.11 provides, among other things, that the exclusion area should be set such that "an individual located at any point on its boundary for two hours immediately following onset of the postulated fission product release would not receive a total radiation dose to the whole body in excess of 25 rem or a total radiation dose in excess of 300 rem to the thyroid from iodine exposure" (footnotes omitted).

[12] Licensees must comply with 10 C.F.R. Part 20 for general protection against ionizing radiation and its underlying requirement to maintain occupational and public doses of radiation as low as reasonably achievable ("ALARA"). The Commission issued 10 C.F.R. § 50.34a and 10 C.F.R. 50.36a in 1970, and Appendix I to 10 C.F.R. Part 50 in 1975, to enhance the regulatory framework for 10 C.F.R. Part 20 for assuring that the radioactivity in effluents are ALARA. <u>See</u> Union of Concerned Scientists; Denial of Petition for Rulemaking, 66 Fed. Reg. 65,141, 65,143 (Dec. 18, 2001).

[13] See 66 Fed. Reg. 65,141.

covered under license renewal, and (2) because the existing regulatory process provides the means for protecting the public from such radiation exposures. Cox Decl. at ¶ 31.

Here, Pilgrim Watch raises the same fatally flawed claim. Pilgrim Watch erroneously asserts that the AMPs do not provide adequate inspection of underground pipes and tanks to ensure that there is not a "potential leak of radioactive water from corroded components that could be migrating off-site." Pilgrim Watch Pet. at 11-12 (emphasis added). Pilgrim Watch's focus on offsite mitigation demonstrates that Pilgrim Watch is concerned with protection of groundwater from radioactive contamination, and not with the safety functions that are to be maintained by the AMPs. Pilgrim Watch goes on to claim that the "Aging Management Program at Pilgrim does not provide adequate monitoring to ensure that leaks from systems and components such as underground pipes and tanks are detected," and that the "only effective way to monitor" for such leaks "would be to have on-site monitoring wells" that would be "sampled regularly." Pilgrim Watch Pet. at 13 (emphasis added). Again, ongoing radiological monitoring to detect radioactive leakage and protect ground water from radioactive contamination is an operational program that is beyond the scope of license renewal. Everyday operational issues such as radiological monitoring are not addressed in license renewal proceedings because the Commission has determined that such matters are appropriately handled by its regulations governing plant operations. Cox Decl. at ¶ 35; Millstone, CLI-06-04, 63 N.R.C. at 37 (holding that the possible release of excessive radioactivity into the environment is an "'everyday operational issue'" and not within the scope of license renewal).

That Pilgrim Watch is impermissibly raising everyday operational issues is demonstrated on pages 14-15 of the Petition. There, Pilgrim Watch argues in support of its claimed need for monitoring wells that "[c]urrent regulations already require the Applicant to have in place an effective program for monitoring radiation on-site and off-site," citing to 10 C.F.R. § 20.1302 and 10 C.F.R. Part 50 Appendix A. Pilgrim Watch Pet. at 14 & n.6. However, as made clear by the Commission in Millstone and by its denial of the UCS petition, both discussed above, such radiological monitoring is an everyday operational issue that is not within the scope of license renewal.

In short, the claims raised by Pilgrim Watch in Contention 1 are not within the scope of license renewal under 10 C.F.R. Part 54 because they concern the detection and prevention of radioactive leakage in order to protect ground water from radioactive contamination. Such concerns fall within the realm of existing regulatory processes for protecting the public from such radiation exposures and do not concern licensing basis events covered under license renewal. Rather, the regulatory purpose of license renewal AMPs is to ensure, in accordance with the requirements of 10 C.F.R. Part 54, the performance of critical plant safety functions of principal importance to plant safety. As set forth below, the PNPS AMPs for buried pipes and tanks fully meet the requirements of the licensing renewal regulations.

b. The PNPS AMPs adequately assure the integrity of buried components

As previously stated, the objective of the AMPs as applied to buried pipes and tanks is to maintain the pressure boundary of the buried pipes and tanks in order to ensure that systems containing these components can perform their system intended functions in accordance with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3). Cox Decl. at ¶ 30. The AMPs accomplish this objective by managing potential degradation due to aging of both the exterior surfaces and the interior surfaces of buried pipes and tanks in order to ensure the integrity of the buried pipes and tanks to perform their intended functions. Cox Decl. at ¶¶ 30, 32.

PNPS implements a range of programs to manage the effects of aging on buried piping and tanks that are within the scope of the aging management program: the BPTIP, the Water Chemistry Control-BWR Program, Service Water Integrity Program, and the One-Time Inspection Program. Cox Decl. at ¶ 33. In this respect, Pilgrim Watch Contention 1 ignores the fact that the specific program challenged in the Contention – the BPTIP – solely concerns the exterior surfaces of buried pipes. Cox Decl. at ¶ 32. Wholly separate AMPs are established for assuring the lack of degradation of the interior surfaces of the buried pipes and tanks. Cox Decl. at ¶ 32. Together, these programs ensure the integrity of the buried pipes and tanks to perform their intended license renewal functions. Cox Decl. at ¶¶ 30, 32.

The BPTIP employs preventive measures, such as protective coatings applied to the external surfaces, to mitigate the corrosion of external surfaces of buried pipes and tanks exposed to soil, and inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components. Cox Decl. at ¶ 34. The BPTIP applies to the condensate storage system buried piping, which is made of stainless steel, and the SSW, which is made of rubber-lined carbon steel and titanium.

As previously discussed, prior to entering the period of extended operation, plant operating experience will be reviewed to verify that an inspection of the external surfaces of buried pipes and tanks within the scope of license renewal has occurred within the past ten years. Cox Decl. at ¶ 23. If not, an inspection will be performed prior to entering the period of extended operation. Cox Decl. at ¶ 23. Further, 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. Cox Decl. at ¶ 23. Thus, at least one inspection of buried pipes and tanks will occur before entering the period of extended operation, and at least one will occur within the first ten years of extended operation. The purpose of these inspections is to ensure that the protective coatings are being maintained in place to protect against corrosion of the external surfaces of the buried components. Cox Decl. at ¶ 23.

Pilgrim Watch provides no basis to challenge the sufficiency of this interval of inspection for ensuring the protective coatings remain intact and protect the exterior surface of the buried pipe from degradation. Indeed, as discussed in the GALL Report, the NRC has determined that industry operating experience demonstrates that an AMP for the exterior surfaces of buried pipes and tanks consisting of protective coatings, such as those used at PNPS, and opportunistic and periodic inspections, such as those in the PNPS AMP for buried pipes and tanks, is effective in managing the corrosion of external surfaces of buried pipes and tanks. Cox Decl. at ¶ 22. Moreover, the PNPS operating experience demonstrates that the protective coatings protective coatings used on buried pipes and tanks at PNPS provide sufficient protection. Cox Decl. at ¶¶ 21-22. As discussed further below, the operating experience at other nuclear plant is not relevant to PNPS. The operating experience and the opportunistic and periodic inspections provided for by the PNPS BPTIP, which ensure that protective coatings are being maintained in place, provide for appropriate aging management of the exterior surfaces of buried pipes and tanks to ensure their intended function in accordance with 10 C.F.R. Part 54. Cox Decl. at ¶ 22.

Moreover, wholly separate AMPs are established for assuring the lack of degradation of the interior surfaces of the buried pipes and tanks. Cox Decl. at ¶ 32. The Water Chemistry Control-BWR Program optimizes the water chemistry in the condensate storage system to minimize the potential for loss of material and cracking due to internal corrosion of the system by limiting the levels of contaminants in condensate storage system that could cause loss of material and cracking, thus further ensuring that the pressure boundary is maintained. Cox Decl. at ¶ 33. As described above, the effectiveness of this program is confirmed by both industry and PNPS operating experience. Cox Decl. at ¶ 32. The One-Time Inspection Program will ensure the effectiveness of the Water Chemistry Control-BWR Program. Cox Decl. at ¶ 33. In addition, the Service Water Integrity Program provides for routine surveillance and other control techniques to manage and minimize the effects of internal erosion and corrosion and other aging mechanisms that can degrade the SSW system, which is a proven program that has been successfully implemented at PNPS. Cox Decl. at ¶ 26.

In summary, the BPTIP will provide adequate aging management for the external surfaces of buried components without the installation of monitoring wells. Cox Decl. at ¶ 41. In addition, aging management programs for the internal surfaces of these components will protect the inside surfaces such that leakage will not occur. Cox Decl. at ¶ 41. This has been confirmed by current operating experience in the nuclear industry and by relevant operating experience at PNPS and has been determined to be an acceptable aging management program for the period of extended operation. Cox Decl. at ¶ 41.

c. Leakage events at other nuclear power plants cited by Pilgrim Watch are not relevant to the AMPs for the challenged PNPS buried components

Pilgrim Watch erroneously attempts to compare PNPS with other nuclear power plants by citing to leakage events that have occurred elsewhere, emphasizing three events at Braidwood, Palo Verde and Dresden nuclear plants. Pilgrim Watch Pet. at 6-8 & Exhibit A. Contrary to Pilgrim Watch's generalized claims, the examples cited by Pilgrim Watch are not applicable to PNPS. There is simply no relevant comparison to be made between PNPS and the leakage events at the other nuclear plants cited by Pilgrim Watch.

In the first place, five of the events referenced in Pilgrim Watch's supporting documents concerned leakage from spent fuel pools. Cox Decl. at ¶ 37. These included leakage from spent fuel pools at three pressurized water plants ("PWR"), a spent fuel pool at a national laboratory reactor, and a cask handling pool at a fuel fabrication facility. Cox Decl. at ¶ 37. Pilgrim is a boiling water reactor ("BWR") and, unlike the spent fuel pools at PWRs which are typically partially below grade, the spent fuel pool at Pilgrim is above grade. Cox Decl. at ¶ 37. The spent fuel pool at Pilgrim is elevated within the reactor building, well above the floor of the building, which makes a leak readily detectable by plant personnel. Cox Decl. at ¶ 37. Therefore, any leaks would not be related to the buried pipe and tank aging management program, since the spent fuel pool at Pilgrim is not buried. Cox Decl. at ¶ 37.

With respect to the three events on which Pilgrim Watch focuses, the Palo Verde and Braidwood events had nothing to do with the leakage from buried components that were in contact with a soil environment and had experienced aging as a result of this environment. Cox Decl. at ¶ 38.[14] The leakage event at the Dresden facility came from condensate storage system buried piping that supplies water to the RCIC and HPCI systems. Cox Decl. at ¶ 39. However, Dresden designates this piping as non-safety-related, whereas PNPS has designated this same piping as safety-related. Cox Decl. at ¶ 39. In addition, the condensate storage system piping at PNPS is made of stainless steel, which is resistant to corrosion even in a soil environment, whereas at Dresden the piping was made of aluminum. Cox Decl. at ¶ 39. The operational review for PNPS showed no degradation or occurrences of leakage of radioactively contaminated

[14] The Palo Verde event involved tritium found in a water sample from a test hole caused by gaseous releases from an evaporator system, condensed by rain, and then either absorbed into the ground or transported into the storm drain system. Cox Decl. at ¶ 38. The Braidwood event was caused by leakage through vacuum breaker valves on a line that periodically transported liquid radioactive effluent discharges, and liquid leaked through the internals

water from the buried stainless steel piping for the PNPS condensate storage system. Cox Decl. at ¶ 40. Thus, the non-safety related, aluminum condensate storage piping which caused the Dresden leakage event is not comparable to the safety-related, stainless steel condensate storage system piping used at PNPS. Cox Decl. at ¶¶ 39-40.

In short, none of the industry events cited by Pilgrim Watch are analogous or relevant to the buried piping containing radioactively contaminated water at PNPS. Cox Decl. at ¶ 40.

d. Other arguments raised by Pilgrim Watch have no merit

Pilgrim Watch raises a series of other arguments, none of which are meritorious. Pilgrim Watch mistakenly seeks to rely on the standard bathtub curve to claim that, as nuclear power plants age, they are more likely to experience corrosion related leaks. Pilgrim Watch Pet. at 9-10. As discussed above, corrosion related leaks are not the focus of the AMPs. Cox Decl. at ¶ 42.

Pilgrim Watch also relies upon a book by Bellenger to contend that corrosion can be induced by low energy radionuclides. Pilgrim Watch Pet. at 10-11. Pilgrim Watch's reliance thereon is misplaced. A brief review reflects that this book is concerned with the corrosion effects of tritiated water in facilities that use or produce tritiated water, such as facilities specially designed for tritium production and recycling, and has no relevance here. Cox Decl. at ¶ 43. In any event, the PNPS Water Chemistry Control-BWR program ensures that the condensate storage system is not susceptible to internally caused corrosion. Cox Decl. at ¶ 25. The Service Water Integrity Program ensures that the components of the SSW system are routinely inspected

---

of the valves, which are not addressed by the BPTIP. Cox Decl. at ¶ 38. There are no vacuum breaker valves at PNPS. Cox Decl. at ¶ 38.

for internal erosion and corrosion and other aging mechanisms that can degrade the SSW system. Cox Decl. at ¶ 26.

Pilgrim Watch further argues that PNPS might be "vulnerable to undetected leaks in its underground pipes and tanks because of nonconforming pipe fittings and flanges." Pilgrim Watch. Pet. at 11. This argument is baseless. First, this is a current design and licensing basis issue, not an aging management issue, and is not relevant to PNPS license renewal. Cox Decl. at ¶ 44. Second, the GAO Report cited in the Contention makes only a general reference to PNPS and provides no detail specific to PNPS. Cox Decl. at ¶ 44. Further, PNPS's previous owner and operator identified, located and remediated, as appropriate, any counterfeit and substandard pipe fittings and flanges at PNPS, pursuant to NRC Bulletin 88-05. Cox Decl. at ¶ 44. Therefore, PNPS responded to this issue under the NRC's ongoing oversight, review, and enforcement of operational issues, as contemplated by the NRC license renewal rules.

* * *

In summary, Pilgrim Watch Contention 1 has failed to raise a genuine dispute of material fact. Installing a monitoring system to detect the leakage of radioactive liquid from buried piping and tanks is not within the scope of license renewal. Even if it were, Pilgrim Watch has provided no basis to dispute the adequacy of the PNPS AMPs for underground pipes and tanks containing radioactive water within the scope of license renewal. The PNPS AMP for external pipe and tank surfaces comports with NRC guidance and industry experience as articulated in the GALL Report. The integrity of the external coatings of PNPS buried pipes and tanks has been proven by PNPS operating experience. The PNPS AMPs for the internal surfaces of buried pipes and tanks, which Pilgrim Watch does not challenge, will prevent leakage by ensuring that internal pipe and tank surfaces do not corrode. Pilgrim Watch's attempted comparisons to events at other nuclear plants have no merit. Pilgrim Watch Contention 1, therefore, has nothing to commend it, and Entergy's Motion for Summary Disposition should be granted.

IV. CONCLUSION

For the reasons set forth above, the Board should grant Entergy's Motion for Summary Disposition of Pilgrim Watch Contention 1.

V. CERTIFICATION

In accordance with 10 C.F.R. §2.323(b) and the Scheduling Order, counsel for Entergy conferred with the parties in a sincere effort to resolve the matters at issue in the instant Motion prior to the filing of the Motion, but was unsuccessful in doing so.

Respectfully Submitted,

Paul Gaukler

David R. Lewis
Paul A. Gaukler
PILLSBURY WINTHROP SHAW PITTMAN LLP
2300 N Street, N.W.
Washington, DC 20037-1128
Tel. (202) 663-8000

Counsel for Entergy

Dated: June 8, 2007

400575716

June 8, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Entergy Nuclear Generation Company and	)	Docket No. 50-293-LR
Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-848-02-LR
	)	
(Pilgrim Nuclear Power Station)	)	

STATEMENT OF MATERIAL FACTS

Entergy hereby submits, in support of its Motion for Summary Disposition of Pilgrim Watch Contention 1, this Statement of Material Facts as to which Entergy contends that there is no genuine dispute.

A. General

1. The purpose of the aging management programs ("AMP") identified in the PNPS license renewal application is to manage the effects of aging so that the intended function(s) of systems, structures, and components will be maintained consistent with the current licensing basis ("CLB") for the period of extended operation in accordance with 10 C.F.R. § 54.21(a)(3). Cox Decl. at ¶ 7.

2. 10 C.F.R. §§ 54.4(a)(1)-(3) define both the safety-related and non-safety-related systems, structures and components that are within the scope of license renewal and the functions of the systems, structures and components that are intended to be ensured by AMPs. Cox Decl. at ¶ 8.

3. 10 C.F.R. § 54.21(a)(1) defines the systems, structures, and components that are subject to aging management review as those that (i) perform an intended function, as described in § 54.4, without moving parts or without a change in configuration or properties; and (ii) are not subject to replacement based on a qualified life or specified time period. Cox Decl. at ¶ 8.

4. Leakage of radioactive liquid from buried piping and tanks is not a design basis event that could cause accident consequences comparable to those referred to in §§ 50.34(a)(1), 50.67(b)(2) or 100.11. Cox Decl. at ¶ 9.

5. Preventing radioactive liquid leakage from buried pipes and tanks is not an intended safety function or other license renewal intended function that is to be ensured by AMPs implemented under the license renewal rules. Cox Decl. at ¶ 9.

B. PNPS Buried Pipes and Tanks within the Scope of License Renewal with the Potential for Containing Radioactive Liquids

6. The following systems are the only systems at PNPS with buried pipes and/or tanks that meet the scoping criteria of 10 C.F.R. § 54.4: (1) standby gas treatment; (2) salt service water; (3) fuel oil; (4) station blackout diesel generator; (5) fire protection; and (6) condensate storage. Cox Decl. at ¶ 10.

7. The condensate storage system is the only system at PNPS within the license renewal scoping criteria of 10 C.F.R. § 54.4 with buried pipes or tanks that contain radioactive liquid. Cox Decl. at ¶ 11.

8. Radioactive contamination of the salt service water ("SSW") system, which is designed to contain only non-radioactive water but cools systems that contain radioactive liquid, is highly unlikely. Cox Decl. at ¶ 12.

9. The buried pipes and tanks for the fuel oil system, the station blackout diesel generator system and the fire protection system do not contain radioactive materials, nor do they interact with any systems that contain radioactivity. Cox Decl. at ¶ 13.

10. The piping in the standby gas treatment system would, during accident conditions, contain radioactively contaminated gas, but does not contain radioactively contaminated water. Cox Decl. at ¶ 13.

11. The condensate storage system provides for station makeup needs and accepts condensate discharges to maintain appropriate condenser water level. Cox Decl. at ¶ 14.

12. The condensate storage system buried piping is made of stainless steel and runs from the condensate storage tanks to the reactor core isolation cooling ("RCIC") and high pressure coolant injection ("HPCI") pumps. Cox Decl. at ¶ 14.

13. The AMPs related to the condensate storage system buried piping are intended to preserve its capability to provide a source of water to the HPCI and RCIC systems so as to avoid the loss of plant safety functions. Cox Decl. at ¶ 14.

14. The SSW functions as the ultimate heat sink for the reactor building closed cooling water and turbine building closed cooling water systems during plant operations. Cox Decl. at ¶ 15.

15. The buried piping in the SSW is made of titanium and carbon steel and consists of piping from the intake structure as well as two discharge loops. Cox Decl. at ¶ 15. Both the titanium and carbon steel piping have external coatings and the carbon steel piping is lined internally with cured-in-place rubber pipe linings to protect against corrosion. Cox Decl. at ¶ 19, n.4, & ¶ 26.

16. The following table summarizes the details of the buried tanks and pipes in systems that contain, or potentially contain, radioactive water within the scope of license renewal under 10 C.F.R. Part 54.

System	Intended function	Buried Material	Internal Environment	Potentially Radioactive
Condensate Storage	10CFR54.4(a)(1), (a)(2) and (a)(3)	Stainless steel	Treated water	Yes
Salt Service Water	10CFR54.4(a)(1), (a)(2) and (a)(3)	Carbon steel, Titanium	Raw water	Highly unlikely

Cox Decl. at ¶ 16.

C. PNPS AMPs for In-Scope Buried Pipes and Tanks that Contain or May Contain Radioactively Contaminated Water

17. PNPS implements the Buried Piping and Tanks Inspection Program, the Water Chemistry Control-BWR Program, the Service Water Integrity Program, and the One-Time Inspection Program to manage the effects of aging on buried piping and tanks that are within the scope of license renewal and subject to aging management review. Cox Decl. at ¶ 17.

18. The objective of the AMPs as applied to buried pipes and tanks is to maintain the pressure boundary of the buried pipes and tanks so as to ensure that the systems containing the buried pipes and tanks can perform their system intended functions in accordance with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3). Cox Decl. at ¶ 17.

19. The Buried Piping and Tanks Inspection Program ("BPTIP") manages the effects of aging on the external surfaces of buried components through preventive measures to inhibit the corrosion of external surfaces of buried pipes and tanks exposed to soil, such as protective coatings applied to the external surfaces, and periodic and opportunistic inspections to manage the effects of external surface corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components. Cox Decl. at ¶¶ 18, 22-23.

20. The preventive measures employed at PNPS for buried pipes are in accordance with standard industry practice for installing external coatings and wrappings. Cox Decl. at ¶ 19.

21. Industry operating experience has shown that properly applied coatings will prevent the exterior degradation of components buried in the soil for extended periods of time absent unusually aggressive soil chemistry (which is not the case at PNPS) or damage during installation and maintenance. Cox Decl. at ¶ 20.

22. The effectiveness of properly applied coatings to prevent exterior degradation of buried piping is confirmed by operating experience at PNPS. PNPS examined external coatings on buried SSW buried piping and found the coatings to be in good condition with no external corrosion of the piping. Cox Decl. at ¶¶ 20-21.

23. Operating experience at PNPS demonstrates the sufficiency of the protection provided by the protective coatings used on buried pipes and tanks at PNPS. Cox Decl. at ¶¶ 22, 40.

24. The periodic and opportunistic inspection part of the PNPS BPTIP provides that (1) buried components will be inspected when excavated during maintenance; (2) an inspection will be performed prior to entering the period of extended operation, unless plant operating experience shows that an inspection occurred within the ten year period prior to extended operations; and (3) a focused inspection will be performed within the first 10 years of the period of extended operation, unless an opportunistic inspection occurs within this ten-year period. Cox Decl. at ¶ 23.

25. The purpose of the periodic and opportunistic inspections under the PNPS BPTIP is to ensure that the protective coatings are being maintained in place to protect against corrosion of the external surfaces of the buried components. If coatings on buried components are

maintained, the coatings will prevent the soil from adversely affecting the exterior surface of the components such that they can continue to perform their intended function. Cox Decl. at ¶¶ 23-24.

26. Based on the PNPS plant-specific operating experience, the periodicity of periodic and opportunistic inspections under the PNPS BPTIP is sufficient to ensure that the protective coatings are being maintained in place to protect against corrosion of the external surfaces of the buried components and to maintain the intended functions of the buried components. Cox Decl. at ¶ 23.

27. The Water Chemistry Control-BWR Program optimizes the water chemistry in the condensate storage system to minimize the potential for loss of material and cracking due to internal corrosion of the system by limiting the levels of contaminants in the condensate storage system that could cause loss of material and cracking. Cox Decl. at ¶ 25.

28. The Water Chemistry Control-BWR Program is based on Electric Power Research Institute BWR water chemistry guidelines. The effectiveness of the Program is confirmed by industry and PNPS operating experience. Cox Decl. at ¶ 25.

29. Under the Service Water Integrity Program, the components of the SSW system are routinely inspected for internal erosion and corrosion and other aging mechanisms that can degrade the SSW system. This Program has been successfully implemented at PNPS to identify SSW degradation from loss of material due to internal corrosion prior to the loss of its intended function. Cox Decl. at ¶ 26.

30. The One-Time Inspection Program confirms the absence of significant aging effects for the internal surfaces of piping though a visual inspection of a representative sample of the interior piping surface which will be performed prior to the period of extended operation.

The One-Time Inspection Program will be implemented to ensure the effectiveness of the Water Chemistry Control-BWR Program. Cox Decl. at ¶ 27.

III. RESPONSE TO THE ISSUES RAISED IN PILGRIM WATCH CONTENTION 1

31. The purpose of AMPs implemented under 10 C.F.R. Part 54 is to ensure that the intended functions of in-scope systems and components, as identified in the scoping criteria of 10 C.F.R. § 54.4, are maintained for the period of extended operation. Cox Decl. at ¶ 29.

32. The objective of AMPs as applied to buried pipes and tanks is to maintain the pressure boundary of the buried pipes and tanks so as to ensure that systems containing these components can perform their system intended functions in accordance with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3). Cox Decl. at ¶¶ 30, 33, 35.

33. The purpose of the AMPs is not to monitor or detect radioactive leaks from underground pipes and tanks that do not affect intended license renewal functions of the systems or to protect groundwater from contamination. Cox Decl. at ¶¶ 30, 33, 35.

34. The BPTIP AMP solely concerns the exterior surfaces of buried pipes. Cox Decl. at ¶ 32.

35. Wholly separate programs are established for managing potential degradation of the interior surfaces of the buried pipes and tanks, including the Water Chemistry Control-BWR Program, the Service Water Integrity Program, and the One-Time Inspection Program. Cox Decl. at ¶¶ 25-27, 32-34.

36. The objective of the BPTIP, the Water Chemistry Control-BWR Program, the Service Water Integrity Program, and the One-Time Inspection Program as applied to buried

pipes and tanks is to maintain the pressure boundary of the buried pipes and tanks so as to ensure that the systems containing the components can perform their intended functions in accordance with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3), and not to prevent or detect small radioactive leaks that do not affect system functions or to protect groundwater from radioactive contamination. Cox Decl. at ¶ 33.

37. Pilgrim is a boiling water reactor ("BWR"), and its spent fuel pool is above grade within the reactor building, which makes a leak from the spent fuel pool readily detectable by plant personnel and unrelated to AMPs for buried pipes and tanks. Cox Decl. at ¶ 37.

38. The radioactive leakage events at Palo Verde, Braidwood, and Byron had nothing to do with the leakage of buried components that were in contact with a soil environment and had experienced aging as a result of this environment. Cox Decl. at ¶ 38 & note 8.

39. The Palo Verde event identified in March 2006 involved tritium found in a water sample from a test hole caused by gaseous releases from an evaporator system prior to the mid 1990s which had been condensed by rain, and the resulting water runoff on the site was absorbed into the ground and also ran into the storm drain system. Cox Decl. at ¶ 38.

40. The Braidwood and Byron events were caused by leakage through vacuum breaker valves on a line that periodically transported liquid radioactive effluent discharges. The PNPS buried piping containing radioactively contaminated water includes no vacuum breaker valves or similar valves that discharge to the environment. Cox Decl. at ¶ 38 & note 8.

41. The leakage event at the Dresden facility concerned leakage from the non-safety-related condensate storage system buried aluminum piping that supplies the RCIC and HPCI

systems. At PNPS, the condensate storage system is safety-related, and its piping is made of corrosion resistant stainless steel. Cox Decl. at ¶ 39.

42. None of the reported industry events of radioactive leakage are identified as having conditions that are analogous or relevant to the configuration or design of the buried piping containing radioactively contaminated water at PNPS. Cox Decl. at ¶¶ 37-40 & note 9.

43. The operating experience review conducted for the PNPS license renewal application identified no occurrences of degraded buried piping containing radioactively contaminated water. Cox Decl. at ¶ 40.

44. NRC Bulletin 88-05 alerted utilities to potential counterfeit and substandard pipe fittings and flanges, and the previous PNPS owner and operator identified, located and remediated, as appropriate, any counterfeit and substandard pipe fittings and flanges at PNPS. Cox Decl. at ¶ 44.

Respectfully Submitted,

Paul Gaukler

David R. Lewis
Paul A. Gaukler
PILLSBURY WINTHROP SHAW PITTMAN LLP
2300 N Street, N.W.
Washington, DC 20037-1128
Tel. (202) 663-8000

Counsel for Entergy

Dated: June 8, 2007

40057773

COPY

June 5, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Entergy Nuclear Generation Company and	)	Docket No. 50-293-LR
Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-848-02-LR
	)	
(Pilgrim Nuclear Power Station)	)	

DECLARATION OF ALAN COX IN SUPPORT OF ENTERGY'S MOTION FOR SUMMARY DISPOSITION OF PILGRIM WATCH CONTENTION 1

Alan Cox states as follows under penalties of perjury:

I. INTRODUCTION

1. I am the Technical Manager, License Renewal with Entergy Nuclear ("Entergy"). In that capacity, I was responsible for the integrated plant assessment and license renewal application development for the Pilgrim Nuclear Power Station ("PNPS") license renewal project.

2. My professional and educational experience is summarized in the Curriculum Vitae attached as Exhibit 1 to this Declaration. I hold a Bachelors degree in nuclear engineering from the University of Oklahoma and a Masters of Business Administration from the University of Arkansas at Little Rock. I have 30 years of experience in the nuclear power industry, having served in various positions related to engineering and operations of nuclear power plants. I have held reactor operator and senior reactor operator licenses issued by the NRC for the operation of Arkansas Nuclear One, Unit 1. I have been licensed as a registered professional engineer in the State of Arkansas.

3. Since 2001, I have worked full-time on license renewal supporting the integrated plant assessment and license renewal application development for Entergy license renewal projects, as well as projects for other utilities. I am a member of the Nuclear Energy Institute ("NEI") License Renewal Task Force and have been a representative on the NEI License Renewal Mechanical Working Group and the NEI License Renewal Electrical Working Group. As a member of the Entergy license renewal team, I have participated in the development of seven license renewal applications. In addition, I have participated in industry peer reviews of eleven additional license renewal applications.

4. In my capacity as Technical Manager, License Renewal, I am knowledgeable of the aging management programs that are described in the PNPS license renewal application. I have been the manager of the technical staff responsible for preparing the license renewal application. In that capacity, I have reviewed and provided input to aging management reviews and aging management program development for the PNPS.

5. I am familiar with Pilgrim Watch Contention 1, which was raised by Pilgrim Watch in the NRC licensing proceeding for the PNPS license renewal. As admitted into the proceeding by the Atomic Safety and Licensing Board, Pilgrim Watch Contention 1 asserts that "[t]he 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."

6. My Declaration addresses claims raised by Pilgrim Watch in Pilgrim Watch Contention 1 concerning the adequacy of the PNPS aging management program for buried pipes and tanks. I will demonstrate that the PNPS buried piping and tanks aging management program

is in accordance with the requirements of 10 C.F.R. Part 54 and that there is no factual basis for the many claims raised by Pilgrim Watch in Contention 1 concerning that program.

II. BACKGROUND

A. Function and Purpose of License Renewal Aging Management Programs

7. 10 C.F.R. Part 54 governs the health and safety matters that must be considered in a license renewal proceeding. 10 C.F.R. §§ 54.21 and 54.29(a) focus on the management of the effects of aging on certain systems, structures and components defined in the rules, and the review of time-limited aging analyses. PNPS has identified aging management programs ("AMPs") to ensure that the effects of aging during the extended license renewal term are managed for the systems, structures, and components that are within the scope of license renewal. The purpose of the AMPs identified in the PNPS license renewal application is to manage the effects of aging so that the intended function(s) of systems, structures, and components will be maintained consistent with the current licensing basis ("CLB") for the period of extended operation in accordance with 10 C.F.R. § 54.21(a)(3). Thus, the potential effects of aging define the issues for consideration in license renewal proceedings. In other words, with the exception of the detrimental effects of aging and a few other issues related to safety only during the period of extended operation, the existing regulatory processes are adequate to ensure that the licensing bases of currently-operating plants provide and maintain an adequate level of safety. Consequently, license renewal does not focus on everyday operational issues (e.g., operational programs such as those controlling the release of radioactive material into the environment), because these issues are addressed by ongoing agency oversight, review, and enforcement.

8. The scoping criteria for license renewal set forth in 10 C.F.R. § 54.4 dictate the plant systems, structure and components that are within the scope of 10 C.F.R. Part 54. This provision reads in full as follows:

> (a) Plant systems, structures, and components within the scope of this part are—
>
> (1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions—
> (i) The integrity of the reactor coolant pressure boundary;
> (ii) The capability to shut down the reactor and maintain it in a safe shut-down condition; or
> (iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of this chapter, as applicable.
> (2) All non-safety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1) (i), (ii), or (iii) of this section.
> (3) All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).
>
> (b) The intended functions that these systems, structures, and components must be shown to fulfill in § 54.21 are those functions that are the bases for including them within the scope of licensee renewal as specified in paragraphs (a) (1)-(3) of this section.

Thus, 10 C.F.R. §§ 54.4(a)(1)-(3) define both the safety-related and non-safety-related systems, structures and components that are within the scope of license renewal and the functions of the systems, structures and components that are intended to be ensured by AMPs. Of these systems, structures and components that fall within the scope of 10 C.F.R. § 54.4, 10 C.F.R. § 54.21(a)(1) defines the systems, structures, and components that are subject to aging management review as those that (i) perform an intended function, as described in § 54.4, without moving parts or without a change in configuration or properties; and (ii) are not subject to replacement based on a qualified life or specified time period.

9. As indicated above, safety-related systems, structures and components relied on to "mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in 10 C.F.R. §§ 50.34(a)(1), 50.67(b)(2), and 100.11" are within the scope of the license renewal rules. 10 C.F.R. § 54.4(a)(1)(iii). This provision brings within scope those safety-related systems, structures and components that are relied on to prevent or mitigate the consequences of an accident that could result in potential offsite exposures comparable to 25 rem (or 300 rem to the thyroid from iodine) following a postulated fission product release. Thus, this provision pertains to systems, structures and components that have been classified as safety-related because they are credited with mitigating design basis accidents. It does not encompass non-safety-related components, such as the liquid radioactive waste system, which the Commission specifically declined to include within the scope of the license renewal rule.[1] Leakage of radioactive liquid from buried piping and tanks is not a design basis event that could cause accident consequences comparable to those referred to in §§ 50.34(a)(1), 50.67(b)(2) or 100.11. Consequently, preventing radioactive leakage from buried pipes and tanks is not an intended safety function or other license renewal intended function that is to be ensured by AMPs implemented under the license renewal rules.

B. PNPS Buried Pipes and Tanks within the Scope of License Renewal with the Potential for Containing Radioactive Liquids

10. For PNPS, the relevant systems with buried piping or tanks that meet the scoping criteria of 10 C.F.R. § 54.4 are (1) standby gas treatment; (2) salt service water; (3) fuel oil; (4)

---

[1] Union of Concerned Scientists; Denial of Petition for Rulemaking, 66 Fed. Reg. 65,141 (Dec. 18, 2001).

station blackout diesel generator; (5) fire protection; and (6) condensate storage. None of the remaining systems at PNPS that contain buried piping or tank components have functions that meet the 10 C.F.R. § 54.4 scoping criteria.

11. The only system within the license renewal scope with buried pipes or tanks that contain radioactive liquid is the condensate storage system. In a boiling water reactor facility, such as PNPS, the condensate system contains radioactively contaminated water.

12. The salt service water ("SSW") system is designed to contain only raw, non-radioactive cooling water. Because the SSW cools the reactor building closed cooling water system which in turn cools systems that contain radioactive liquid, possible but unlikely cross-contamination could result in some buried components in the SSW system containing radioactive material. However, the interfacing reactor building closed cooling water system is monitored for radioactivity by radiation detectors. Additionally, a water chemistry control program based on EPRI guidelines is in place for the reactor building closed cooling water system to protect against corrosion and cracking that could cause leakage of radioactivity into the SSW system. Thus, radioactive contamination of the SSW is highly unlikely.

13. The buried pipes and tanks for the fuel oil system, the station blackout diesel generator system and the fire protection system do not contain radioactive materials. Nor do they interact with any systems that contain radioactivity. The standby gas treatment system would, during accident conditions, remove particulates and radioactively contaminated gases from the reactor building's contaminated ventilation exhaust system air stream. However, the standby gas treatment system is a gas system and does not contain radioactively contaminated water, which is the subject of Pilgrim Watch Contention 1.

14. The purpose of the condensate storage system is to provide for station makeup needs and to accept condensate discharges to maintain appropriate condenser water level. PNPS LRA at Section 2.3.4.1, p. 2.3-116. Buried piping in the condensate storage system is made of stainless steel and runs from the condensate storage tanks to the reactor core isolation cooling ("RCIC") and high pressure coolant injection ("HPCI") pumps.

- Regarding 10 C.F.R. § 54.4(a)(1), the condensate storage system supplies water to the suction of the RCIC and HPCI pumps, which is performed by safety-related piping and valves that interface with RCIC and HPCI.
- Regarding 10 C.F.R. § 54.4(a)(2), the condensate storage system helps to maintain the integrity of non-safety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.
- Regarding 10 C.F.R. § 54.4(a)(3), the condensate storage system provides a source of water to the HPCI and RCIC systems, which are credited in the 10 C.F.R. 50 Appendix R analysis for safe shutdown for fire protection.

Thus, the objective of the AMPs with respect to the condensate storage system is to preserve its capability to provide a source of water to the HPCI and RCIC systems so as to avoid the loss of plant safety functions.

15. The purpose of the SSW system is to function as the ultimate heat sink for the reactor building closed cooling water and turbine building closed cooling water systems during plant operations. PNPS LRA at Section 2.3.3.2, p. 2.3-32. The buried piping in the SSW is made of titanium and carbon steel and consists of piping from the intake structure as well as two discharge loops. The intended functions of the SSW as they relate to the 10 C.F.R. § 54.4 scoping criteria are as follows:

- Regarding the intended safety functions specified in 10 C.F.R. § 54.4(a)(1), the SSW provides cooling to the reactor building closed cooling water system, which cools essential equipment in the reactor building.
- Regarding 10 C.F.R. § 54.4(a)(2), the SSW maintains the integrity of non-safety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.
- Regarding 10 C.F.R. § 54.4(a)(3), the SSW is credited in the 10 C.F.R. Part 50 Appendix R analysis for safe shutdown for fire protection (10 C.F.R. § 50.48).

Thus, the objective of the AMPs with respect to the SSW is to preserve its capability to provide cooling for plant systems.

16. The following table summarizes the details of the buried tanks and pipes in systems that contain, or potentially contain, radioactive water within the scope of license renewal under 10 C.F.R. Part 54.

System	Intended function	Buried Material	Internal Environment	Potentially Radioactive
Condensate Storage	10CFR54.4(a)(1), (a)(2) and (a)(3)	Stainless steel	Treated water	Yes
Salt Service Water	10CFR54.4(a)(1), (a)(2) and (a)(3)	Carbon steel, Titanium	Raw water	Highly unlikely

C. PNPS Aging Management Programs for In-Scope Buried Pipes and Tanks

17. PNPS implements several programs to manage the effects of aging on buried piping and tanks that are within the scope of license renewal and subject to aging management review. The objective of the aging management programs as applied to buried pipes and tanks is to maintain the pressure boundary of the buried pipes and tanks so as to ensure that the systems containing the buried pipes and tanks can perform their system intended functions in accordance

with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3). The programs include the Buried Piping and Tanks Inspection Program, the Water Chemistry Control-BWR Program, the Service Water Integrity Program, and the One-Time Inspection Program.

18. The Buried Piping and Tanks Inspection Program ("BPTIP") manages the effects of aging on the external surfaces of buried components. The program manages the potential loss of material[2] from the external surfaces of components buried in soil. It includes (a) preventive measures to inhibit the corrosion of external surfaces of buried pipes and tanks exposed to soil, such as protective coatings applied to the external surfaces, and (b) inspections to manage the effects of external surface corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components. See PNPS LRA at Appendix B, Section B.1.2, p. B-17-18. The BPTIP ensures that protective coatings, when applied, remain intact such that the piping is protected from the soil environment.

19. The preventive measures employed at PNPS for buried pipes[3] in the condensate storage and SSW systems are in accordance with standard industry practice for installing external coatings and wrappings. The original PNPS specification for buried steel piping called for a shop coating of double wrap type coating, which consisted of a primer, coal tar epoxy, fibrous glass mat, and bonded asbestos felt wrap. Field coating, which is applied to field-fabricated piping connections, is a 35 millimeter cold-applied tape coating consisting of a 7 millimeter polyethylene film backing and 28 millimeters of adhesive. The subject buried pipes at PNPS are protected by such coatings, or by additional protective design features.[4]

---

[2] Loss of material is the effect of aging caused by corrosion.

[3] The condensate storage and SSW systems both contain buried pipes but neither contains any buried tanks.

[4] In the SSW system, the buried carbon steel piping has either been replaced or relined to prevent internal corrosion of the piping from the raw water environment. The SSW inlet piping was replaced in

20. Industry operating experience has shown that properly applied coatings will prevent the aging of components buried in the soil for extended periods of time and that exterior degradation will be prevented unless there is unusually aggressive soil chemistry (which is not the case at PNPS) or the coatings are damaged during installation or maintenance. This operating experience is reflected and confirmed by the "Operating Experience" review for buried piping and tanks in § XI.M34 of NUREG-1801 which 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."[5] The effectiveness of properly applied coatings has also been confirmed by operating experience at PNPS during the excavation of buried piping for maintenance and modification activities.

21. PNPS has had the opportunity to examine external buried piping coatings on two forty foot sections of SSW discharge piping (one from each discharge loop) that were replaced in 1999. The exterior surface of the piping was wrapped with reinforced fiberglass wrapping and coal tar saturated felt and heavy Kraft paper in accordance with the PNPS specification for the

---

1995 and 1997 with titanium piping wrapped with the same external coating as the original carbon steel pipe. Portions of the SSW discharge piping were replaced in 1999 with carbon steel pipe coated internally and externally with an epoxy coating. Furthermore, both carbon steel discharge loops of the SSW have subsequently been lined internally with cured-in-place rubber pipe linings. These new materials and coatings have superior corrosion resistance compared to the original materials and coatings.

[5] NUREG 1801, Generic Aging Lessons Learned ("GALL") Report, Vol. 2, Rev. 1 at XI M-112 (excerpts attached as Exhibit 2 to this Declaration.). 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." The GALL Report identifies AMPs that have been determined to be acceptable programs to manage the aging effects of systems, structures and components within the scope of license renewal as required by 10 C.F.R. Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." 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. The GALL report is based on a systematic compilation of plant aging information and evaluation of program attributes for managing the aging effects of systems, structure and components for license renewal. NUREG 1801 at 1-3.

external wrapping of pipes. The exterior wrappings of the pipes were found to be in good condition and no external corrosion of the pipes was observed. PNPS examined the removed piping after its wrapping was removed and found the outside surface of the piping in good condition.[6]

22. As reflected in NUREG-1801 in the XI.M34 Operating Experience review at XI M-112, the NRC has determined that operating experience shows that an AMP for the exterior surfaces of buried pipes and tanks consisting of protective coatings (such as those used at PNPS) and opportunistic and periodic inspections (such as those set forth in the PNPS AMP for buried pipes and tanks) is effective in managing the corrosion of external surfaces of buried pipes and tanks. NUREG-1801 does state that the plant-specific operating experience is relevant in considering the effectiveness of such a program. Here, the PNPS operating experience demonstrates the sufficiency of the protection provided by the protective coatings used on buried pipes and tanks at PNPS, which, combined with the opportunistic and periodic inspections provided for by the PNPS BPTIP to ensure that protective coatings are being maintained in place, provides for appropriate aging management of the exterior surfaces of buried pipes and tanks to ensure their intended function in accordance with 10 C.F.R. Part 54.

23. The periodic and opportunistic inspection part of the PNPS BPTIP provides for inspections as follows:

- Buried components will be inspected when excavated during maintenance.

---

[6] The inlet SSW carbon steel piping that was replaced with titanium piping in order to prevent interior corrosion was never removed from the ground so the exterior coatings and surface of the original carbon steel SSW inlet piping were not examined.

- 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.
- In addition, 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.

The purpose of these inspections is to ensure that the protective coatings are being maintained in place to protect against corrosion of the external surfaces of the buried components. Based on the PNPS plant-specific operating experience, the periodicity of these inspections is sufficient to accomplish this purpose and to maintain the intended functions of the components.

24. As stated, the PNPS BPTIP is consistent with NUREG-1801, Section XI.M34 Buried Piping and Tanks Inspection which provides the NRC Staff's guidance on aging management programs for the external surfaces of buried pipes and tanks.[7] If coatings on components are maintained, the coatings will prevent the soil from adversely affecting the exterior surface of the component such that it can continue to perform its intended function.

25. The Water Chemistry Control-BWR Program optimizes the water chemistry in the condensate storage system (among other plant systems) to minimize the potential for loss of material and cracking due to internal corrosion of the system. This is accomplished by limiting the levels of contaminants in the condensate storage system that could cause loss of material and

---

[7] The license renewal application does identify an exception to the NUREG-1801 program. The exception is merely to allow the use of a more effective means of assessing the condition of buried piping without the need for excavation, should an acceptable technology become available. This exception was taken to allow the potential use of such a technique in lieu of excavating piping in order to provide a more effective assessment of overall piping condition while eliminating the potential for damaging the protective coating on the piping during excavation.

cracking. This is an existing program at PNPS that has been confirmed to be effective at managing the aging effects of the condensate storage system as documented by the operating experience review. See PNPS LRA at Appendix B, Section B.1.32.2, p. B-106-07. The program uses Electric Power Research Institute BWR water chemistry guidelines, as specified in NUREG-1801, which include chemistry recommendations for condensate storage tanks. The program's effectiveness has also been confirmed by industry operating experience as described in NUREG-1801. NUREG-1801 at XI M-12, M-13.

26. The Service Water Integrity Program includes surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the SSW system or structures and components serviced by the SSW system. Under the program, the components of the SSW system are routinely inspected for internal erosion and corrosion and other aging mechanisms that can degrade the SSW system. The inspection program includes provisions for visual inspections, eddy current testing of heat exchanger tubes, ultrasonic testing, radiography testing and heat transfer capability testing. This program has been effective in detecting previous degradation of the internal rubber lining in the original SSW carbon steel piping. As a result, the inlet pipes were replaced with titanium pipe, and portions of the discharge pipes were replaced with carbon steel piping coated internally and externally with an epoxy coating, and the entire lengths of the discharge pipes were internally lined with cured-in-place pipe linings. Thus, this program has been successfully implemented at PNPS to identify SSW degradation from loss of material due to internal corrosion prior to the loss of its intended function. See PNPS LRA at Appendix B, Section B.1.28, p. B-92-93.

27. The One-Time Inspection Program is a program which includes activities to confirm the absence of significant aging effects for the internal surfaces of piping. In

accordance, with NUREG-1801, the One-time Inspection Program is an inspection of a representative sample (based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience) of the interior piping surface which will be performed prior to the period of extended operation. NUREG-1801 at XI M-105. The inspection locations will be chosen based on identifying potentially susceptible locations for aging degradation. NUREG-1801 at XI M-105. The One-Time Inspection Program will, among other actions, "verify the effectiveness of the water chemistry control [AMPs] by confirming that unacceptable cracking, loss of material, and fouling is not occurring." PNPS LRA at Appendix B, Section B.1.23, p. B-76. Therefore, the One-Time Inspection Program will ensure the effectiveness of the Water Chemistry Control-BWR Program, which minimizes the potential for loss of material due to internal corrosion of the condensate storage system.

III. RESPONSE TO THE ISSUES RAISED IN PILGRIM WATCH CONTENTION 1

28. Pilgrim Watch claims that the PNPS aging management program for buried pipes and tanks provides for inadequate inspection and monitoring to detect potential leakage from underground pipes and tanks that could migrate off-site, particularly for small leaks that might otherwise go undetected. Pilgrim Watch Pet. at 11-14. According to Pilgrim Watch, the only way to detect and protect against such leaks is to install a suitable array of monitoring wells. Id. at 13-14. As described below, the claims raised by Pilgrim Watch (1) are based on a fundamental misunderstanding of the purpose and scope of the aging management program for buried piping implemented pursuant to the requirements of 10 C.F.R. § 54, and (2) ignore the fact that the specific program challenged in the Contention concerns solely the exterior surfaces of buried pipes and tanks and that wholly separate programs are specified for pipe and tank interior surfaces.

29. The NRC regulations make abundantly clear that the purpose of an aging management program implemented under 10 C.F.R. Part 54 is to ensure that the intended functions of in-scope systems and components, as identified in the scoping criteria of 10 C.F.R. § 54.4, are maintained for the period of extended operation. Specifically, the NRC requires that, for each structure and component subject to aging management under 10 C.F.R. Part 54, the application shall "demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the [current licensing basis] for the period of extended operation." 10 C.F.R. § 54.21(a)(3) (emphasis added).

30. Consequently, in accordance with this overall function of the purpose of the aging management program, the objective of aging management programs as applied to buried pipes and tanks is to maintain the pressure boundary of the buried pipes and tanks so as to ensure that systems containing these components can perform their system intended functions in accordance with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3). The program does this by monitoring and confirming the general quality and condition of the external protective coatings on the sample of components that are inspected so as to ensure the general integrity of the buried pipes and tanks to perform their intended functions. The purpose of the program is not to monitor or detect small radioactive leaks that do not affect intended license renewal functions of the systems or to protect groundwater from radioactive contamination, as sought by Pilgrim Watch.

31. In this respect, the existing regulatory process maintains the performance of the condensate storage system and other plant systems containing radioactively contaminated water through the license renewal period in order to keep any exposures to radiation below regulatory limits for normal operations. See Union of Concerned Scientists; Denial of Petition for Rulemaking, 66 Fed. Reg. 65,141. There, the Commission denied a petition for rulemaking to

include potential aging degradation of liquid and gaseous radioactive waste management systems within the scope of license renewal because such degradation was not a licensing basis event covered under license renewal and because the existing regulatory process provides the means for protecting the public from such radiation exposures.

32. Also, the Contention ignores the fact that the specific program challenged in the Contention – the BPTIP – concerns solely the exterior surfaces of buried pipes. Wholly separate programs are established for managing potential degradation of the interior surfaces of the buried pipes and tanks. In particular, for the condensate system, an established water chemistry program is in place, in accordance with well established industry guidelines and practice, to minimize the potential for loss of material and cracking due to <u>internal</u> corrosion of the system. As described above, the effectiveness of this program is confirmed by both industry and PNPS operating experience.

33. Pilgrim Watch specifically asserts that the AMP does not provide adequate inspection of underground pipes and tanks to ensure that there is not a "potential leak of radioactive water from corroded components that could be migrating off-site." Pilgrim Watch Pet. at 11-12. Pilgrim Watch's focus on offsite mitigation demonstrates that Pilgrim Watch is concerned with protection of groundwater, and not with the safety functions maintained by the AMPs. In any event, Pilgrim Watch's assertion is demonstrably wrong. PNPS implements a range of programs to manage the effects of aging on buried piping containing radioactively contaminated water (no buried tanks at PNPS contain radioactively contaminated water). As discussed above, these programs include the BPTIP, the Water Chemistry Control-BWR Program, the Service Water Integrity Program, and the One-Time Inspection Program. The objective of these programs as applied to buried pipes and tanks is to maintain the pressure

boundary of the buried pipes and tanks so as to ensure that the systems containing the components can perform their intended functions in accordance with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3), and not to prevent or detect small radioactive leaks that do not affect system functions or to protect groundwater from radioactive contamination, as claimed by Pilgrim Watch.

34. As described above, the BPTIP manages the effects of aging on the external surfaces of buried components (and thus helps to maintain the pressure boundary) through (1) preventive measures, such as protective coatings applied to the external surfaces, to mitigate the corrosion of external surfaces of buried pipes and tanks exposed to soil, and (2) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components. The BPTIP ensures that protective coatings, when applied, remain intact such that the piping is protected from the soil environment. The Water Chemistry Control-BWR Program optimizes the water chemistry in the condensate storage system to minimize the potential for loss of material and cracking on internal surfaces of the system. This is accomplished by limiting the levels of contaminants in condensate storage system that could cause loss of material and cracking, thus further ensuring that the pressure boundary is maintained. The Service Water Integrity Program provides for routine surveillance and other control techniques to manage and minimize the effects of internal erosion and corrosion and other aging mechanisms that can degrade the SSW system. Related to the condensate storage system, the One-Time Inspection Program will provide additional confirmation of the effectiveness of the Water Chemistry Control-BWR Program.

35. Likewise, Pilgrim Watch's claim that monitoring wells need to be installed at Pilgrim because the AMP does not provide adequate monitoring to ensure that radioactive leaks

from underground pipes and tanks are detected, Pilgrim Watch Pet. at 13-14, is misplaced. The monitoring of radioactive leaks from underground pipes and tanks is not a function of the AMP. The Commission has made clear that such leakage is an everyday operational issue beyond the scope of license renewal. See Union of Concerned Scientists; Denial of Petition for Rulemaking, 66 Fed. Reg. 65,141. Rather, as stated, the objective of the aging management programs as applied to buried pipes and tanks is to maintain the pressure boundary of the buried pipes and tanks so as to ensure that the systems containing the components can perform their intended functions in accordance with 10 C.F.R. §§ 54.4(a)(1), (a)(2) or (a)(3). The PNPS program is sufficient in this respect as already discussed.

36. As support for Contention 1, Pilgrim Watch cites events that have occurred at other nuclear power plants, Pilgrim Watch Pet. at 6, that are inapplicable to the PNPS configuration and design. Specifically, Pilgrim Watch identified several nuclear industry events where radioactively contaminated water has leaked into the ground, specifically emphasizing three events at the Braidwood, Palo Verde and Dresden nuclear plants. Pilgrim Watch Pet. at 6-8, & Exhibit A. Further, Pilgrim Watch claims that PNPS should improve its current inspection and monitoring program because of the leaks that have occurred at other nuclear power plants. Pilgrim Watch Pet. at 14-15.

37. Pilgrim Watch's cited examples are not applicable to PNPS. At the outset, five of the events referenced in Pilgrim Watch's supporting documents concerned leakage from spent fuel pools. These included leakage from spent fuel pools at three pressurized water plants ("PWR"), from a spent fuel pool at a national laboratory reactor, and from a cask handling pool at a fuel fabrication facility. Pilgrim is a boiling water reactor ("BWR") and, unlike the spent fuel pools at PWRs which are typically partially below grade, the spent fuel pool at Pilgrim,

typical of many BWRs, is above grade. The spent fuel pool at Pilgrim is within the reactor building, above the floor of the building, which makes a leak readily detectable by plant personnel. See PNPS Updated Safety Analysis Report ("UFSAR"), §§ 10.3.7, 12.2.2.1; see also Application at 2.4-3. Thus, any leaks from the Pilgrim spent fuel pool would be readily detected. Furthermore, any leaks would not be related to the AMPs for buried pipes and tanks, since the spent fuel pool at Pilgrim is above grade.

38. With respect to the three events focused on by Pilgrim Watch, the Palo Verde and Braidwood events had nothing to do with the leakage of buried components that were in contact with a soil environment and had experienced aging as a result of this environment. See Liquid Radioactive Release Lessons Learned Task Force ("LRRLTF") Final Report (Sept. 1, 2006), which was commissioned by the NRC to review the history of unplanned, unmonitored releases of radioactive liquids into the environment, including those at Palo Verde and Braidwood (excerpts attached as Exhibit 3 to this Declaration). The Palo Verde event identified in March 2006 involved tritium found in a water sample from a test hole. The utility determined the cause was gaseous releases from an evaporator system prior to the mid 1990s which had been condensed by rain, and the resulting water runoff on the site was absorbed into the ground and also ran into the storm drain system. LRRLTF Final Report at 6. The Braidwood event was caused by leakage through vacuum breaker valves on a line that periodically transported liquid radioactive effluent discharges. The leakage was through the internals of the valves rather than through the valve bodies or the connecting piping which are the components addressed by the BPTIP. LRRLTF Final Report at 3.[8] The PNPS buried piping containing radioactively

[8] The leak at the Byron plant referenced in the materials attached to Pilgrim Watch Contention 1 also involved leaking vacuum breaker valves – the same as the leakage event at Braidwood. LRRLTF Final Report at 4.

contaminated water includes no vacuum breaker valves or similar valves that discharge to the environment.

39. The only instance of leakage from buried piping identified in Pilgrim Watch's Contention 1 was the event that occurred at the Dresden facility. This event concerned leakage from the condensate storage system buried piping that supplies the RCIC and HPCI systems. At Dresden, this piping is designated as non-safety-related and was made from aluminum. LRRLTF Report at 26. At PNPS, this same piping is safety-related and is made of stainless steel which is resistant to corrosion even in a soil environment. Thus, only one of the operating events cited by Pilgrim Watch in the Petition for Hearing involved leakage from buried piping. None involved the specific materials used in the Pilgrim condensate storage system buried piping.

40. The operating experience review conducted for the PNPS license renewal application identified no occurrences of degraded buried piping containing radioactively contaminated water. The review found no occurrences of leaks or degraded coatings on the external surfaces of any buried stainless steel piping for the condensate system, which is the only buried piping system at PNPS subject to license renewal aging management that contains radioactively contaminated water. Furthermore, the degradation experienced by the SSW system, which is highly unlikely to contain radioactively contaminated water, occurred with respect to the interior surfaces of the original carbon steel piping, which has either subsequently been replaced or relined. Examination of the exterior surfaces of the SSW showed the wrappings to be in good condition with no external corrosion of the pipes. In short, none of the industry events cited by Pilgrim Watch identify conditions that are analogous or relevant to the

configuration or design of the buried piping containing radioactively contaminated water at PNPS.[9]

41. In summary, PNPS has confirmed that the BPTIP will provide adequate aging management of the systems that contain buried components without the installation of monitoring wells. In addition, aging management programs for the internal surfaces of these components will protect the inside surfaces such that leakage will not occur. This has been confirmed by current operating experience in the nuclear industry and at PNPS and has been determined to be an acceptable aging management program for the period of extended operation.

42. Pilgrim Watch raises some other claims in Contention 1 which I will briefly address. First, Pilgrim Watch mistakenly seeks to rely on the standard bathtub curve to claim that, as nuclear power plants age, they are more likely to experience corrosion related leaks. Pilgrim Watch Pet. at 9-10. As stated, corrosion related leaks are not the focus of the AMP. Furthermore, the whole purpose of 10 C.F.R. Part 54 is to ensure that appropriate aging management programs are in place to appropriately manage the aging effects of nuclear power plant systems and components.

43. Pilgrim Watch also mistakenly relies upon a book by Bellanger to contend that corrosion can be induced by low energy radionuclides. Pilgrim Watch Pet. at 10-11. A brief review reflects that this book is concerned with the corrosion effects of tritiated water in facilities that use or produce tritiated water, such as facilities specially designed for tritium production and recycling, and has no relevance here. As previously discussed, the water chemistry program for

---

[9] Likewise, the other industry events referenced in the LRRLTF Final Report are not identified as having conditions that are analogous or relevant to the configuration or design of the buried piping containing radioactively contaminated water at PNPS, i.e., wrapped safety-related stainless steel piping.

the condensate system is based on well established industry guidelines to minimize corrosion for BWRs which has been proven effective by extensive industry operating experience. Similarly, as previously discussed, a program is in place at PNPS which has proven effective for managing and minimizing corrosion of the SSW system.

44. Pilgrim Watch erroneously argues that PNPS might be "vulnerable to undetected leaks in its underground pipes and tanks because of nonconforming pipe fittings and flanges." Pilgrim Watch. Pet. at 11. As an initial matter, this is an everyday operational issue, and not an aging management issue, and hence is irrelevant here. Furthermore, the GAO report cited in the Contention makes only a general reference to PNPS, listing PNPS as one of several plants that may have received counterfeit or substandard parts including pipe fittings and flanges, and provides no detail specific to PNPS.[10] Moreover, NRC Bulletin 88-05 (referred to in GAO/RCED-91-6 at 41) alerted utilities about potential counterfeit and substandard pipe fittings and flanges, and Boston Edison, the previous PNPS owner and operator, identified, located and remediated, as appropriate, any counterfeit and substandard pipe fittings and flanges at PNPS. See Boston Edison Company, "Response to NRC Bulletin 88-05 and Supplements 1 & 2, Nonconforming Materials" (Sept. 1988). Therefore, PNPS responded to this issue under the NRC's ongoing oversight, review, and enforcement of operational issues as contemplated by the NRC license renewal rules.

IV. CONCLUSION AND SUMMARY

45. My testimony in this declaration demonstrates that the PNPS buried pipe and tanks aging management program is in accordance with the requirements of 10 C.F.R. Part 54

[10] See United States Government Accounting Office, Report No. GAO/RCED-91-6, "Nuclear Safety and Health: Counterfeit and Substandard Products Are a Government-wide Concern" (Oct. 1990) at Table 2.1, pp. 15-16.

and that there is no factual basis for the many claims raised by Pilgrim Watch in Contention 1 concerning that program.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 5, 2007.

Alan Cox

EXHIBIT 1

Entergy

RESUME

Alan B. Cox

EDUCATION

B.S., Nuclear Engineering, University of Oklahoma, 1977
M.B.A., University of Arkansas at Little Rock, 1999

EXPERIENCE

June 2001 - Present

Entergy License Renewal Team – Manager, License Renewal
Project manager and technical lead for license renewal services supporting both Entergy and non-Entergy license renewal projects. Entergy representative on various license renewal related industry groups.

1996-2001

Entergy Operations – Supervisor, Design Engineering
Responsible for NSSS systems including supervision of engineers responsible for ANO-1 license renewal project. Served as member of expert panel responsible for review of license renewal application. Also provided design engineering support for plant modifications, corrective action tasks, major projects and plant operations associated with Arkansas Nuclear One.

1993-1996

Entergy Operations – Senior Staff Engineer
Provided design engineering support for plant modifications, corrective action tasks, major projects and plant operations associated with Arkansas Nuclear One. Principal mechanical engineering reviewer for improved Technical Specifications for ANO-1.

1990-1993

Entergy Operations – Technical Assistant to Plant Manager
Provided technical support associated with management of Arkansas Nuclear One, Unit 1. Served as Entergy representative on the B&W Owners Group steering committee.

1986-1989

Arkansas Power & Light Company – Manager, Operations
Responsible for the day to day operations of Arkansas Nuclear One, Unit 1.

1977-1986

Arkansas Power & Light Company – Engineer
At Arkansas Nuclear One, served in various capacities associated with the operation of Unit 1 and the startup and operation of Unit 2. Included assignments in plant performance monitoring, outage planning and scheduling, reactor engineering, and operations technical support. Qualified as shift technical advisor for both units of Arkansas Nuclear One.

CERTIFICATIONS

- Professional Engineer; Registered in Arkansas (currently inactive)
- Previously held RO and SRO licenses at Arkansas Nuclear One, Unit 1

PROFESSIONAL AFFILIATIONS

- Member, American Nuclear Society (ANS)

EXHIBIT 2

NUREG-1801, Vol.1, Rev. 1

Generic Aging Lessons Learned (GALL) Report

Summary

Manuscript Completed: September 2005
Date Published: September 2005

Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

INTRODUCTION

NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," is referenced as a technical basis document in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR). The GALL Report identifies aging management programs (AMP) that were determined to be acceptable to manage aging effects of systems, structures and components (SSC) in the scope of license renewal, as required by 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

The GALL Report is comprised of two volumes. Volume 1 summarizes the aging management reviews that are discussed in Volume 2. Volume 2 lists generic aging management reviews (AMRs) of SSCs that may be in the scope of license renewal applications (LRAs) and identifies GALL AMPs that are acceptable to manage the aging effects.

If an LRA references the GALL Report as the approach used to manage aging effect(s), the NRC staff will use the GALL Report as a basis for the LRA assessment consistent with guidance specified in the SRP-LR.

BACKGROUND

Revision 0 of the GALL Report

By letter dated March 3, 1999, the Nuclear Energy Institute (NEI) documented the industry's views on how existing plant programs and activities should be credited for license renewal. The issue can be summarized as follows: To what extent should the staff review existing programs relied on for license renewal in determining whether an applicant has demonstrated reasonable assurance that such programs will be effective in managing the effects of aging on the functionality of structures and components during the period of extended operation? In a staff paper, SECY-99-148, "Credit for Existing Programs for License Renewal," dated June 3, 1999, the staff described options for crediting existing programs and recommended one option that the staff believed would improve the efficiency of the license renewal process.

By staff requirements memorandum (SRM), dated August 27, 1999, the Commission approved the staff's recommendation and directed the staff to focus the staff review guidance in the Standard Review Plan for License Renewal (SRP-LR) on areas where existing programs should be augmented for license renewal. The staff would develop a "Generic Aging Lessons Learned (GALL)" report to document the staff's evaluation of generic existing programs. The GALL Report would document the staff's basis for determining which existing programs are adequate without modification and which existing programs should be augmented for license renewal. The GALL Report would be referenced in the SRP-LR as a basis for determining the adequacy of existing programs.

This report builds on a previous report, NUREG/CR-6490, "Nuclear Power Plant Generic Aging Lessons Learned (GALL)," which is a systematic compilation of plant aging information. This report extends the information in NUREG/CR-6490 to provide an evaluation of the adequacy of aging management programs for license renewal. The NUREG/CR-6490 report was based on information in over 500 documents: Nuclear Plant Aging Research (NPAR) program reports sponsored by the Office of Nuclear Regulatory Research, Nuclear Management and Resources Council (NUMARC, now NEI) industry reports addressing license renewal for major structures and components, licensee event reports (LERs), information notices, generic letters, and bulletins. The staff has also considered information contained in the reports provided by the Union of Concerned Scientists (UCS) in a letter dated May 5, 2000.

Following the general format of NUREG-0800 for major plant sections except for refueling water, chilled water, residual heat removal, condenser circulating water, and condensate storage system in pressurized water reactor (PWR) and boiling water reactor (BWR) power plants, the staff has reviewed the aging effects on components and structures, identified the relevant existing programs, and evaluated program attributes to manage aging effects for license renewal. This report was prepared with the technical assistance of Argonne National Laboratory and Brookhaven National Laboratory. As directed in the SRM, this report has the benefit of the experience of the staff members who conducted the review of the initial license renewal applications. Also, as directed in the SRM, the staff has sought stakeholders' participation in the development of this report. The staff held many public meetings and workshops to solicit input from the public. The staff also requested comments from the public on the draft improved license renewal guidance documents, including the GALL Report, in the Federal Register Notice, Vol. 65, No. 170, August 31, 2000. The staff's analysis of stakeholder comments is documented in NUREG-1739. These documents can be found on-line at: http://www.nrc.gov/reading-rm/doc-collections/.

Revision 1 of the GALL Report

The GALL Report has been referenced in numerous license renewal applications (LRA) as a basis for aging management reviews to satisfy the regulatory criteria contained in 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," Section 54.21, "Contents of application – technical information." Based on lessons learned from these reviews, and other public input, including industry comments, the NRC staff proposed changes to the GALL Report to make the GALL Report more efficient. A preliminary version of Revision 1 of the GALL Report was posted on the NRC public web page on September 30, 2004. The draft revisions of GALL Vol. 1 and Vol. 2 were further refined and issued for public comment on January 31, 2005. In addition, the staff also held public meetings with stakeholders to facilitate dialog and to discuss comments. The staff subsequently took into consideration comments received (see NUREG-1832) and incorporated its dispositions into the September 2005 version of the GALL Report.

OVERVIEW OF THE GALL REPORT EVALUATION PROCESS

The results of the GALL effort are presented in a table format in the GALL Report, Volume 2. The table column headings are: Item, Structure and/or Component; Material, Environment; Aging Effect/Mechanism; Aging Management Program (AMP); and Further Evaluation. The staff's evaluation of the adequacy of each generic aging management program in managing certain aging effects for particular structures and components is based on its review of the following 10 program elements in each aging management program:

AMP Element	Description
1. Scope of the program	The scope of the program should include the specific structures and components subject to an aging management review.
2. Preventive actions	Preventive actions should mitigate or prevent the applicable aging effects.
3. Parameters monitored or inspected	Parameters monitored or inspected should be linked to the effects of aging on the intended functions of the particular

AMP Element	Description
	structure and component.
4. Detection of aging effects	Detection of aging effects should occur before there is a loss of any structure and component intended function. This includes aspects such as method or technique (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection and timing of new/one-time inspections to ensure timely detection of aging effects.
5. Monitoring and trending	Monitoring and trending should provide for prediction of the extent of the effects of aging and timely corrective or mitigative actions.
6. Acceptance criteria	Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the particular structure and component intended functions are maintained under all current licensing basis (CLB) design conditions during the period of extended operation.
7. Corrective actions	Corrective actions, including root cause determination and prevention of recurrence, should be timely.
8. Confirmation process	The confirmation process should ensure that preventive actions are adequate and appropriate corrective actions have been completed and are effective.
9. Administrative controls	Administrative controls should provide a formal review and approval process.
10. Operating experience	Operating experience involving the aging management program, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support a determination that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation.

If, on the basis of its evaluation, the staff determined that a program is adequate to manage certain aging effects for a particular structure or component without change, the "Further Evaluation" entry would indicate that no further evaluation is recommended for license renewal.

Chapter XI of the GALL Report, Volume 2, contains the staff's evaluation of generic aging management programs that are relied on in the GALL Report, such as the ASME Section XI inservice inspection, water chemistry, or structures monitoring program.

APPLICATION OF THE GALL REPORT

The GALL Report is a technical basis document to the SRP-LR, which provides the staff with guidance in reviewing a license renewal application. The GALL Report should be treated in the same manner as an approved topical report that is generically applicable. An applicant may reference the GALL Report in a license renewal application to demonstrate that the programs at the applicant's facility correspond to those reviewed and approved in the GALL Report.

If an applicant takes credit for a program in GALL, it is incumbent on the applicant to ensure that the plant program contains all the elements of the referenced GALL program. In addition, the conditions at the plant must be bounded by the conditions for which the GALL program was evaluated. The above verifications must be documented on-site in an auditable form. The applicant must include a certification in the license renewal application that the verifications have been completed.

The GALL Report contains one acceptable way to manage aging effects for license renewal. An applicant may propose alternatives for staff review in its plant-specific license renewal application. Use of the GALL Report is not required, but its use should facilitate both preparation of a license renewal application by an applicant and timely, uniform review by the NRC staff.

In addition, the GALL Report does not address scoping of structures and components for license renewal. Scoping is plant specific, and the results depend on the plant design and current licensing basis. The inclusion of a certain structure or component in the GALL Report does not mean that this particular structure or component is within the scope of license renewal for all plants. Conversely, the omission of a certain structure or component in the GALL Report does not mean that this particular structure or component is not within the scope of license renewal for any plants.

The GALL Report contains an evaluation of a large number of structures and components that may be in the scope of a typical LRA. The evaluation results documented in the GALL Report indicate that many existing, typical generic aging management programs are adequate to manage aging effects for particular structures or components for license renewal without change. The GALL Report also contains recommendations on specific areas for which generic existing programs should be augmented (require further evaluation) for license renewal and documents the technical basis for each such determination. In addition, the GALL Report identifies certain SSCs that may or may not be subject to particular aging effects, and for which industry groups are developing generic aging management programs or investigating whether aging management is warranted. To the extent the ultimate generic resolution of such an issue will need NRC review and approval for plant-specific implementation, as indicated in a plant-specific FSAR supplement, and reflected in the SER associated with a particular LR application, an amendment pursuant to 10 CFR 50.90 will be necessary.

In the GALL Report, Volume 1, Tables 1 through 6 are summaries of the aging management review. These tables contain the same information as Tables 3.1-1 to 3.6-1, respectively, in the SRP-LR. These tables also include additional seventh and eighth columns that identify the related generic item and unique item associated with each structure and/or component (i.e., each row in the AMR tables contained in Volume 2 of the GALL Report). A locator for the plant systems evaluated in Volume 2 is also provided in the Appendix of Volume 1.

The Appendix of Volume 2 of the GALL Report addresses quality assurance (QA) for aging management programs. Those aspects of the aging management review process that affect the quality of safety-related structures, systems, and components are subject to the QA requirements of Appendix B to 10 CFR Part 50. For nonsafety-related structures and components subject to an aging management review, the existing 10 CFR Part 50, Appendix B, QA program may be used by an applicant to address the elements of the corrective actions, confirmation process, and administrative controls for an aging management program for license renewal.

The GALL Report provides a technical basis for crediting existing plant programs and recommending areas for program augmentation and further evaluation. The incorporation of the GALL Report information into the SRP-LR, as directed by the Commission, should improve the efficiency of the license renewal process and better focus staff resources.

NUREG-1801, Vol. 2, Rev. 1

Generic Aging Lessons Learned (GALL) Report

Tabulation of Results

Manuscript Completed: September 2005
Date Published: September 2005

Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

XI.M2 WATER CHEMISTRY

Program Description

The main objective of this program is to mitigate damage caused by corrosion and stress corrosion cracking (SCC). The water chemistry program for boiling water reactors (BWRs) relies on monitoring and control of reactor water chemistry based on industry guidelines such as the boiling water reactor vessel and internals project (BWRVIP)-29 (Electric Power Research Institute [EPRI] TR-103515) or later revisions. The BWRVIP-29 has three sets of guidelines: one for primary water, one for condensate and feedwater, and one for control rod drive (CRD) mechanism cooling water. The water chemistry program for pressurized water reactors (PWRs) relies on monitoring and control of reactor water chemistry based on industry guidelines for primary water and secondary water chemistry such as EPRI TR-105714, Rev. 3 and TR-102134, Rev. 3 or later revisions.

The water chemistry programs are generally effective in removing impurities from intermediate and high flow areas. The Generic Aging Lessons Learned (GALL) report identifies those circumstances in which the water chemistry program is to be augmented to manage the effects of aging for license renewal. For example, the water chemistry program may not be effective in low flow or stagnant flow areas. Accordingly, in certain cases as identified in the GALL Report, verification of the effectiveness of the chemistry control program is undertaken to ensure that significant degradation is not occurring and the component's intended function will be maintained during the extended period of operation. As discussed in the GALL Report for these specific cases, an acceptable verification program is a one-time inspection of selected components at susceptible locations in the system.

Evaluation and Technical Basis

1. ***Scope of Program:*** The program includes periodic monitoring and control of known detrimental contaminants such as chlorides, fluorides (PWRs only), dissolved oxygen, and sulfate concentrations below the levels known to result in loss of material or cracking. Water chemistry control is in accordance with industry guidelines such as BWRVIP-29 (EPRI TR-103515) for water chemistry in BWRs, EPRI TR-105714 for primary water chemistry in PWRs, and EPRI TR-102134 for secondary water chemistry in PWRs.

2. ***Preventive Actions:*** The program includes specifications for chemical species, sampling and analysis frequencies, and corrective actions for control of reactor water chemistry. System water chemistry is controlled to minimize contaminant concentration and mitigate loss of material due to general, crevice and pitting corrosion and cracking caused by SCC. For BWRs, maintaining high water purity reduces susceptibility to SCC.

3. ***Parameters Monitored/Inspected:*** The concentration of corrosive impurities listed in the EPRI guidelines discussed above, which include chlorides, fluorides (PWRs only), sulfates, dissolved oxygen, and hydrogen peroxide, are monitored to mitigate degradation of structural materials. Water quality (pH and conductivity) is also maintained in accordance with the guidance. Chemical species and water quality are monitored by in-process methods or through sampling. The chemical integrity of the samples is maintained and verified to ensure that the method of sampling and storage will not cause a change in the concentration of the chemical species in the samples.

BWR Water Chemistry: The guidelines in BWRVIP-29 (EPRI TR-103515) for BWR reactor water recommend that the concentration of chlorides, sulfates, and dissolved oxygen are monitored and kept below the recommended levels to mitigate corrosion. The two impurities, chlorides and sulfates, determine the coolant conductivity; dissolved oxygen, hydrogen peroxide, and hydrogen determine electrochemical potential (ECP). The EPRI guidelines recommend that the coolant conductivity and ECP are also monitored and kept below the recommended levels to mitigate SCC and corrosion in BWR plants. The EPRI guidelines in BWRVIP-29 (TR-103515) for BWR feedwater, condensate, and control rod drive water recommend that conductivity, dissolved oxygen level, and concentrations of iron and copper (feedwater only) are monitored and kept below the recommended levels to mitigate SCC. The EPRI guidelines in BWRVIP-29 (TR-103515) also include recommendations for controlling water chemistry in auxiliary systems: torus/pressure suppression chamber, condensate storage tank, and spent fuel pool.

PWR Primary Water Chemistry: The EPRI guidelines (EPRI TR-105714), for PWR primary water chemistry recommend that the concentration of chlorides, fluorides, sulfates, lithium, and dissolved oxygen and hydrogen are monitored and kept below the recommended levels to mitigate SCC of austenitic stainless steel, Alloy 600, and Alloy 690 components. TR-105714 provides guidelines for chemistry control in PWR auxiliary systems such as the boric acid storage tank, refueling water storage tank, spent fuel pool, letdown purification systems, and volume control tank.

PWR Secondary Water Chemistry: The EPRI guidelines (EPRI TR-102134), for PWR secondary water chemistry recommend monitoring and control of chemistry parameters (e.g., pH level, cation conductivity, sodium, chloride, sulfate, lead, dissolved oxygen, iron, copper, and hydrazine) to mitigate steam generator tube degradation caused by denting, intergranular attack (IGA), outer diameter stress corrosion cracking (ODSCC), or crevice and pitting corrosion. The monitoring and control of these parameters, especially the pH level, also mitigates general (for steel components), crevice, and pitting corrosion of the steam generator shell and the balance of plant materials of construction (e.g., steel, stainless steel, and copper).

4. ***Detection of Aging Effects:*** This is a mitigation program and does not provide for detection of any aging effects.

   In certain cases as identified in the GALL Report, inspection of select components is to be undertaken to verify the effectiveness of the chemistry control program and to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation.

5. ***Monitoring and Trending:*** The frequency of sampling water chemistry varies (e.g., continuous, daily, weekly, or as needed) based on plant operating conditions and the EPRI water chemistry guidelines. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions.

6. ***Acceptance Criteria:*** Maximum levels for various contaminants are maintained below the system specific limits as indicated by the limits specified in the corresponding EPRI water chemistry guidelines. Any evidence of aging effects or unacceptable water chemistry results is evaluated, the root cause identified, and the condition corrected.

7. ***Corrective Actions:*** When measured water chemistry parameters are outside the specified range, corrective actions are taken to bring the parameter back within the acceptable range and within the time period specified in the EPRI water chemistry guidelines. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the corrective actions.

8. ***Confirmation Process:*** Following corrective actions, additional samples are taken and analyzed to verify that the corrective actions were effective in returning the concentrations of contaminants such as chlorides, fluorides, sulfates, dissolved oxygen, and hydrogen peroxide to within the acceptable ranges. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process.

9. ***Administrative Controls:*** Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address administrative controls.

10. ***Operating Experience:*** The EPRI guideline documents have been developed based on plant experience and have been shown to be effective over time with their widespread use. The specific examples of operating experience are as follows:

    BWR: Intergranular stress corrosion cracking (IGSCC) has occurred in small- and large-diameter BWR piping made of austenitic stainless steels and nickel-base alloys. Significant cracking has occurred in recirculation, core spray, residual heat removal (RHR) systems, and reactor water cleanup (RWCU) system piping welds. IGSCC has also occurred in a number of vessel internal components, including core shroud, access hole cover, top guide, and core spray spargers (Nuclear Regulatory Commission [NRC] Bulletin 80-13, NRC Information Notice [IN] 95-17, NRC Generic Letter [GL] 94-03, and NUREG-1544). No occurrence of SCC in piping and other components in standby liquid control systems exposed to sodium pentaborate solution has ever been reported (NUREG/CR-6001).

    PWR Primary System: The primary pressure boundary piping of PWRs has generally not been found to be affected by SCC because of low dissolved oxygen levels and control of primary water chemistry. However, the potential for SCC exists due to inadvertent introduction of contaminants into the primary coolant system from unacceptable levels of contaminants in the boric acid, introduction through the free surface of the spent fuel pool (which can be a natural collector of airborne contaminants), or introduction of oxygen during cooldown (NRC IN 84–18). Ingress of demineralizer resins into the primary system has caused IGSCC of Alloy 600 vessel head penetrations (NRC IN 96-11, NRC GL 97-01). Inadvertent introduction of sodium thiosulfate into the primary system has caused IGSCC of steam generator tubes. The SCC has occurred in safety injection lines (NRC INs 97-19 and 84-18), charging pump casing cladding (NRC INs 80-38 and 94-63), instrument nozzles in safety injection tanks (NRC IN 91-05), and safety-related SS piping systems that contain oxygenated, stagnant, or essentially stagnant borated coolant (NRC IN 97-19). Steam generator tubes and plugs and Alloy 600 penetrations have experienced primary water stress corrosion cracking (PWSCC) (NRC INs 89-33, 94-87, 97-88, 90-10, and 96-11; NRC Bulletin 89-01 and its two supplements).

PWR Secondary System: Steam generator tubes have experienced ODSCC, IGA, wastage, and pitting (NRC IN 97-88, NRC GL 95-05). Carbon steel support plates in steam generators have experienced general corrosion. The steam generator shell has experienced pitting and stress corrosion cracking (NRC INs 82-37, 85-65, and 90-04).

Such operating experience has provided feedback to revisions of the EPRI water chemistry guideline documents.

References

10 CFR Part 50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants*, Office of the Federal Register, National Archives and Records Administration, 2005.

BWRVIP-29 (EPRI TR-103515), *BWR Water Chemistry Guidelines-1993 Revision, Normal and Hydrogen Water Chemistry*, Electric Power Research Institute, Palo Alto, CA, February 1994.

BWRVIP-79, *BWR Water Chemistry Guidelines,* Electric Power Research Institute, Palo Alto, CA, March 2000.

BWRVIP-130, *BWR Water Chemistry Guidelines,* Electric Power Research Institute, Palo Alto, CA, October 2000.

EPRI TR-102134, *PWR Secondary Water Chemistry Guideline-Revision 3*, Electric Power Research Institute, Palo Alto, CA, May 1993.

EPRI TR-105714, *PWR Primary Water Chemistry Guidelines–Revision 3*, Electric Power Research Institute, Palo Alto, CA, Nov. 1995.

EPRI TR-1002884, *PWR Primary Water Chemistry Guidelines*, Electric Power Research Institute, Palo Alto, CA, October 2003.

NRC Bulletin 80-13, *Cracking in Core Spray Piping*, U.S. Nuclear Regulatory Commission, May 12, 1980.

NRC Bulletin 89-01, *Failure of Westinghouse Steam Generator Tube Mechanical Plugs*, U.S. Nuclear Regulatory Commission, May 15, 1989.

NRC Bulletin 89-01, Supplement 1, *Failure of Westinghouse Steam Generator Tube Mechanical Plugs*, U.S. Nuclear Regulatory Commission, November 14, 1989.

NRC Bulletin 89-01, Supplement 2, *Failure of Westinghouse Steam Generator Tube Mechanical Plugs*, U.S. Nuclear Regulatory Commission, June 28, 1991.

NRC Generic Letter 94-03, *Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors*, U.S. Nuclear Regulatory Commission, July 25, 1994.

NRC Generic Letter 95-05, *Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking*, U.S. Nuclear Regulatory Commission, August 3, 1995.

XI.M32 ONE-TIME INSPECTION

Program Description

The program includes measures to verify the effectiveness of an aging management program (AMP) and confirm the insignificance of an aging effect. Situations in which additional confirmation is appropriate include (a) an aging effect is not expected to occur but the data is insufficient to rule it out with reasonable confidence; (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected; or (c) the characteristics of the aging effect include a long incubation period. For these cases, there is to be confirmation that either the aging effect is indeed not occurring, or the aging effect is occurring very slowly so as not to affect the component or structure intended function during the period of extended operation.

A one-time inspection may also be used to provide additional assurance that aging that has not yet manifested itself is not occurring, or that the evidence of aging shows that the aging is so insignificant that an aging management program is not warranted. (Class 1 piping less than or equal to NPS 4 is addressed in Chapter XI.M35, *One Time Inspection of ASME Code Class 1 Small Bore-Piping)*

One-time inspections may also be used to verify the system-wide effectiveness of an AMP that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. For example, effective control of water chemistry can prevent some aging effects and minimize others. However, there may be locations that are isolated from the flow stream for extended periods and are susceptible to the gradual accumulation or concentration of agents that promote certain aging effects. This program provides inspections that either verifies that unacceptable degradation is not occurring or trigger additional actions that will assure the intended function of affected components will be maintained during the period of extended operation.

The elements of the program include (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize an intended function before the end of the period of extended operation.

When evidence of an aging effect is revealed by a one-time inspection, the routine evaluation of the inspection results would identify appropriate corrective actions.

As set forth below, an acceptable verification program may consist of a one-time inspection of selected components and susceptible locations in the system. An alternative acceptable program may include routine maintenance or a review of repair or inspection records to confirm that these components have been inspected for aging degradation and significant aging degradation has not occurred. One-time inspection, or any other action or program, created to verify the effectiveness of an AMP and confirm the absence of an aging effect, is to be reviewed by the staff on a plant-specific basis.

Evaluation and Technical Basis

1. ***Scope of Program:*** The program includes measures to verify that unacceptable degradation is not occurring, thereby validating the effectiveness of existing AMPs or confirming that there is no need to manage aging-related degradation for the period of extended operation. The structures and components for which one-time inspection is specified to verify the effectiveness of the AMPs (e.g., water chemistry control, etc.) have been identified in the Generic Aging Lessons Learned (GALL) Report. Examples include the feedwater system components in boiling water reactors (BWRs) and pressurized water reactors (PWRs).

2. ***Preventive Actions:*** One-time inspection is an inspection activity independent of methods to mitigate or prevent degradation.

3. ***Parameters Monitored/Inspected:*** The program monitors parameters directly related to the degradation of a component. Inspection is to be performed by qualified personnel following procedures consistent with the requirements of the American Society of Mechanical Engineers (ASME) Code and 10 CFR 50, Appendix B, using a variety of nondestructive examination (NDE) methods, including visual, volumetric, and surface techniques.

4. ***Detection of Aging Effects:*** The inspection includes a representative sample of the system population, and, where practical, focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin.

   The program will rely on established NDE techniques, including visual, ultrasonic, and surface techniques that are performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR Part 50, Appendix B.

   The inspection and test techniques will have a demonstrated history of effectiveness in detecting the aging effect of concern. Typically, the one time inspections should be performed as indicated in the following table.

Examples of Parameters Monitored or Inspected And Aging Effect for Specific Structure or Component[9]			
Aging Effect	**Aging Mechanism**	**Parameter Monitored**	**Inspection Method[10]**
Loss of Material	Crevice Corrosion	Wall Thickness	Visual (VT-1 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	Galvanic Corrosion	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	General Corrosion	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	MIC	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	Pitting Corrosion	Wall Thickness	Visual (VT-1 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	Erosion	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Heat Transfer	Fouling	Tube Fouling	Visual (VT-3 or equivalent) or Enhanced VT-1 for CASS
Cracking	SCC or Cyclic Loading	Cracks	Enhanced Visual (VT-1 or equivalent) and/or Volumetric (RT or UT)
Loss of Preload	Thermal Effects, Gasket Creep and Self-loosening	Loosening of Components	Visual (VT-3 or equivalent)

With respect to inspection timing, the population of components inspected before the end of the current operating term needs to be sufficient to provide reasonable assurance that the aging effect will not compromise any intended function at any time during the period of extended operation. Specifically, inspections need to be completed early enough to ensure that the aging effects that may affect intended functions early in the period of extended operation are appropriately managed. Conversely, inspections need to be timed to allow the inspected components to attain sufficient age to ensure that the aging effects with long incubation periods (i.e., those that may affect intended functions near the end of the period of extended operation) are identified. Within these constraints, the applicant should schedule the inspection no earlier than 10 years prior to the period of extended operation, and in such a way as to minimize the impact on plant operations. As a plant will have accumulated at least 30 years of use before inspections under this program begin, sufficient times will have elapsed for aging effects, if any, to be manifest.

[9] The examples provided in the table may not be appropriate for all relevant situations. If the applicant chooses to use an alternative to the recommendations in this table, a technical justification should be provided as an exception to this AMP. This exception should list the AMR line item component, examination technique, acceptance criteria, evaluation standard and a description of the justification.
[10] Visual inspection may be used only when the inspection methodology examines the surface potentially experiencing the aging effect.

5. ***Monitoring and Trending:*** The program provides for increasing of the inspection sample size and locations in the event that aging effects are detected. Determination of the sample size is based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience. Unacceptable inspection findings are evaluated in accordance with the site corrective action process to determine the need for subsequent (including periodic) inspections and for monitoring and trending the results.

6. ***Acceptance Criteria*:** Any indication or relevant conditions of degradation detected are evaluated. For example, the ultrasonic thickness measurements are to be compared to predetermined limits, such as the design minimum wall thickness for piping.

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

8. ***Confirmation Process:*** See Item 7, above.

9. ***Administrative Controls:*** See Item 7, above.

10. ***Operating Experience:*** This program applies to potential aging effects for which there are currently no operating experience indicating the need for an aging management program. Nevertheless, the elements that comprise these inspections (e.g., the scope of the inspections and inspection techniques) are consistent with industry practice.

References

10 CFR Part 50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants*, Office of the Federal Register, National Archives and Records Administration, 2005.

10 CFR 50.55a, *Codes and Standards*, Office of the Federal Register, National Archives and Records Administration, 2005.

ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, ASME Boiler and Pressure Vessel Code, 2001 edition including the 2002 and 2003 Addenda, American Society of Mechanical Engineers, New York, NY.

XI.M34 BURIED PIPING AND TANKS INSPECTION

Program Description

The program includes (a) preventive measures to mitigate corrosion, and (b) periodic inspection to manage the effects of corrosion on the pressure-retaining capacity of buried steel piping and tanks. Gray cast iron, which is included under the definition of steel, is also subject to a loss of material due to selective leaching, which is an aging effect managed under Chapter XI.M33, "Selective Leaching of Materials."

Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried piping and tanks are inspected when they are excavated during maintenance and when a pipe is dug up and inspected for any reason.

This program is an acceptable option to manage buried piping and tanks, except further evaluation is required for the program element/attributes of detection of aging effects (regarding inspection frequency) and operating experience.

Evaluation and Technical Basis

1. ***Scope of Program:*** The program relies on preventive measures such as coating, wrapping and periodic inspection for loss of material caused by corrosion of the external surface of buried steel piping and tanks. Loss of material in these components, which may be exposed to aggressive soil environment, is caused by general, pitting, and crevice corrosion, and microbiologically-influenced corrosion (MIC). Periodic inspections are performed when the components are excavated for maintenance or for any other reason. The scope of the program covers buried components that are within the scope of license renewal for the plant.

2. ***Preventive Actions:*** In accordance with industry practice, underground piping and tanks are coated during installation with a protective coating system, such as coal tar enamel with a fiberglass wrap and a kraft paper outer wrap, a polyolifin tape coating, or a fusion bonded epoxy coating to protect the piping from contacting the aggressive soil environment.

3. ***Parameters Monitored/Inspected:*** The program monitors parameters such as coating and wrapping integrity that are directly related to corrosion damage of the external surface of buried steel piping and tanks. Coatings and wrappings are inspected by visual techniques. Any evidence of damaged wrapping or coating defects, such as coating perforation, holidays, or other damage, is an indicator of possible corrosion damage to the external surface of piping and tanks.

4. ***Detection of Aging Effects:*** Inspections performed to confirm that coating and wrapping are intact are an effective method to ensure that corrosion of external surfaces has not occurred and the intended function is maintained. Buried piping and tanks are opportunistically inspected whenever they are excavated during maintenance. When opportunistic, the inspections are performed in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems, within the areas made accessible to support the maintenance activity.

The applicant's program is to be evaluated for the extended period of operation. It is anticipated that one or more opportunistic inspections may occur within a ten-year period. Prior to entering the period of extended operation, the applicant is to verify that there is at least one opportunistic or focused inspection is performed within the past ten years. Upon entering the period of extended operation, the applicant is to perform a focused inspection within ten years, unless an opportunistic inspection occurred within this ten-year period. Any credited inspection should be performed in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems.

5. ***Monitoring and Trending:*** Results of previous inspections are used to identify susceptible locations.

6. ***Acceptance Criteria:*** Any coating and wrapping degradations are reported and evaluated according to site corrective actions procedures.

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

8. ***Confirmation Process:*** See Item 7, above.

9. ***Administrative Controls:*** See Item 7, above.

10. ***Operating Experience:*** Operating experience shows that the program described here is effective in managing corrosion of external surfaces of buried steel piping and tanks. However, because the inspection frequency is plant-specific and depends on the plant operating experience, the applicant's plant-specific operating experience is further evaluated for the extended period of operation.

References

10 CFR Part 50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants*, Office of the Federal Register, National Archives and Records Administration, 2005.

EXHIBIT 3

LIQUID RADIOACTIVE RELEASE
LESSONS LEARNED TASK FORCE
FINAL REPORT

September 1, 2006

Task Force Members:

Stuart Richards, NRR
Timothy Frye, NRR
James Shepherd, NMSS
Thomas Nicholson, RES
George Kuzo, Region II
Undine Shoop, OEDO
Stacie Sakai, NRR
Michael Shannon, Region IV
Andrea Keim, NRR
Stephen Klementowicz, NRR
Ronald Nimitz, CHP, Region I
Steven Orth, Region III
Scott Burnell, OPA
Rich Allen, Illinois Emergency Management Agency, Bureau of Environmental Safety

1.0 INTRODUCTION

1.1 Objective and Scope

Following reports earlier this year of inadvertent releases of radioactive liquids to the environment from nuclear power plants, the Nuclear Regulatory Commission's (NRC) Executive Director for Operations chartered a Task Force to conduct a lessons-learned review of these incidents. The levels of tritium and other radionuclides measured thus far do not present a health hazard to the public. Nonetheless, the task force members, (comprised of representatives from all four regional offices, the Office of Nuclear Reactor Regulation (NRR), the Office of Nuclear Material Safety and Safeguards, the Office of Nuclear Regulatory Research (RES), the Office of Public Affairs (OPA), the Office of the Executive Director of Operations (OEDO) and a representative from the State of Illinois), were instructed to identify and recommend areas for improvement applicable to the NRC and to industry. The Task Force reviewed and evaluated the following: industry experience; health impacts; regulatory framework; NRC inspection, enforcement and reporting aspects; industry actions; international perspectives; and communications with external stakeholders.

Consistent with its charter, the Task Force assessed: historical data on inadvertent releases of radioactive liquid; the possible health impact of these releases; existing regulations; NRC inspection program requirements, including enforcement; industry actions in response to these events; public communications; implications for decommissioning; and Department of Energy (DOE) Facility lessons learned. During its review, members of the Task Force participated in several public meetings related to this topic, which were attended by industry representatives and other public stakeholders. The Task Force also examined the following documentation: (1) inspection reports; (2) licensee event reports; (3) enforcement actions; (4) technical guidance documents from industry and the International Atomic Energy Agency (IAEA); (5) NRC policy and procedural documentation; (6) applicable industry codes; and (7) other pertinent documentation.

1.2 Background

As part of the normal operation of nuclear power plants, small amounts of radioactive gases and liquids are typically released to the environment. The discharge of radioactive gases and liquids, or effluents, can have environmental impacts on man and the environment. The NRC addresses this by specific regulations which limit these releases, and by verifying, both during the licensing process and throughout the operation of the nuclear power plant, that facility operation does not significantly impact plant workers, members of the public, and the environment. The NRC's regulations require releases of radioactive effluents beyond a plant's boundaries to be As Low As is Reasonably Achievable (ALARA). For radioactive liquids, the ALARA criterion is 3 mrem [0.03 millisievert (mSV)] per year (about 1 percent of the average annual radiation dose for a U.S. citizen).

One of the radionuclides released from nuclear power plants is tritium. Tritium is a weakly radioactive isotope of hydrogen with a half-life of 12.5 years that decays by emitting a low energy beta particle (or electron). Tritium is produced in nuclear reactors, but also occurs naturally in the environment due to cosmic rays interacting with atmospheric gases. The most common form of tritium is in water, since both tritium and non-radioactive hydrogen react in the same way with oxygen to produce water. Tritiated water is colorless and odorless. Tritium can also be found in such everyday self-illuminating devices as watches and exit signs.

The NRC requires that organizations that operate nuclear power plants (referred to as licensees) control, monitor, and report the results of environmental monitoring around their plants to ensure that potential impacts are detected and reviewed. Licensees accomplish this, in part, through their Radiological Environmental Monitoring Program (REMP). The REMP requires various off-site samples to be taken. The location and type of sample is usually selected based on the mechanisms in which radionuclides can reach the public, typically referred to as environmental pathways. These pathways include airborne and waterborne mechanisms, as well as ingestion, typically of milk and fish. Samples must be taken at required intervals, which are analyzed for the presence of specified radiological constituents. Each plant's REMP specifies reporting levels for radioactivity concentrations in environmental samples, including reporting levels for tritium in water.

If the reporting levels in the REMP are exceeded, the licensee must prepare and submit a report to the NRC that identifies the event and defines the corrective actions taken. The problem must also be reported to the NRC in the licensee's Annual Radiological Environmental Operating Report. In addition, the NRC inspects each licensee's effluent and environmental monitoring programs once every two years, to ensure NRC requirements are met. The status of licensee programs is documented by the NRC in inspection reports that are available to the public. Each licensee's Annual Radiological Environmental Operating Report is also available to the public.

The regulations that provide the limits on radioactive effluent releases and their associated radiation doses have been periodically revised over the years as new standards were developed. In 1975, the NRC amended its regulations (in 10 CFR Parts 50.34a and 50.36a, and Appendix I to 10 CFR Part 50) to provide numerical guides for design objectives and limiting conditions for operation to meet the ALARA radiation dose criterion. Adoption of these ALARA regulations required that power plant releases be kept to doses well below the radiation exposure limits for the public in 10 CFR Part 20, which is 100 mrem (1.0 mSv). In the decades following this amendment, the amount of routine radioactive effluents released from nuclear power plants decreased significantly, a direct result of the addition of improved radioactive waste treatment systems and improved fuel performance.

Almost all of the radioactive liquid released from nuclear power plants is discharged to the environment in a planned and monitored manner via systems and programs designed for that purpose. However, many licensees have experienced radioactive liquid releases that were inadvertent and not monitored. They have been caused by both human error, and by equipment failure or degradation. In some instances, the release of radioactive liquid was not recognized by the licensee until well after the release apparently started. It is the unplanned, unmonitored releases that are the focus of this report. If such a release is identified by the licensee, existing NRC regulations do not require routine onsite ground-water monitoring in the Restricted Area during facility operations, however, licensees will typically establish onsite ground-water monitoring and sampling programs once the source of the contamination is attributed to identified structure, system, or component leakage. These efforts ensure the licensee meets the requirements of 10 CFR 50.75(g)(1) which require, in part, that licensees keep a record of spills or other unusual occurrences involving the spread of contamination in and around the facility and site for decommissioning purposes. Onsite (and offsite) monitoring and sampling programs also ensure that the licensee meets 10 CFR 20.1501 requirements to conduct reasonable surveys under the circumstances in order to evaluate the concentrations or quantities of radioactive material and the potential radiological hazards present at the site.

NRC follow-up to an event where the licensee contaminated an area of their property can include routine inspection of the licensee's radiological effluent and environmental monitoring programs, or a radiation protection specialist from an NRC Regional Office may be sent to the site sooner, if the NRC concludes the event warrants a reactive inspection. If no radiation dose limits are exceeded, which is typically the case, the licensee has the option of remediating the contamination, or waiting until the plant is decommissioned to address the issue.

2.0 INDUSTRY EXPERIENCE REVIEW

2.1 Scope and Criteria

This section provides an overview of known inadvertent releases of radioactive liquid to the environment from power reactors, primarily from 1996 to the present.

The events described below do not constitute a complete list of all events that may have occurred during this time period. In order to complete a comprehensive review for lessons learned in a timely manner, the Task Force focused on identifying a cross-section of events that represented different causes, pathways of liquid release, impacts to the environment, and corrective actions to remediate. Events that received notable public attention were also included.

In addition to reviewing the known inadvertent releases of radioactive liquid to the environment at power reactor sites over the last 10 years, the Task Force also reviewed an event that occurred in 1986 at the Hatch facility. The Task Force reviewed this event because a notice of violation and proposed imposition of a civil penalty resulted. In addition, the volume of water released was substantial.

The Task Force identified three main areas of components which have leaked: spent fuel pools, underground piping, and valves on effluent discharge lines. In addition to the leakage of components, operator actions have also been the cause of several inadvertent releases.

2.2 Detailed Discussion of Review

Braidwood

In March 2005, the Illinois Environmental Protection Agency notified the licensee of reports of tritium in wells in a nearby community. The licensee began monitoring ground-water between the community of Godley, Illinois, and the Braidwood Nuclear Power Plant (Braidwood). The licensee measured tritium in a drainage ditch near the plant access road, but contaminated ground water was not identified at that time.

On November 30, 2005, Exelon informed the NRC that elevated levels of tritium had been measured in shallow, ground-water monitoring wells at Braidwood. At that time, the licensee had measured levels as high as 58,000 picocuries per liter (pCi/L). The licensee attributed the contamination to historical leakage of vacuum breaker valves along the circulating water blowdown line. Subsequently, the licensee suspended all further releases of liquid radioactive material. The circulating water blowdown line is routinely used for radioactive liquid releases to the Kankakee River. At Braidwood, the circulating water blowdown line is about 5 miles long and contains 11 vacuum breaker valves, spaced along the length of the line.

The licensee's investigation found that significant unplanned radioactive releases from three of the 11 vacuum breaker valves occurred during 1996, 1998, and 2000. Additional minor releases were also identified between 1996 and 2005. The 1996 event resulted in the leakage of approximately 250,000 gallons of water. The 1998 and 2000 events each resulted in a release of approximately 3,000,000 gallons of water. Each leak occurred during a period coincident with ongoing, liquid radioactive releases through the blowdown line, resulting in tritium entering the ground-water system in the vicinity of the leaking vacuum breaker valve.

Between March 2005 and March 2006, Exelon sampled the water in drinking water wells of several nearby homeowners. The licensee identified tritium levels between 1,400 and 1,600 pCi/L in one residential drinking water well. The United States Environmental Protection Agency (EPA) drinking water standard for tritium is 20,000 pCi/L. This standard is also referred to as the Maximum Contaminant Level (MCL). The remaining residential well samples had no measurable tritium above normal background levels. In addition to the nearby homeowner's wells, the licensee sampled the ground water onsite and offsite, and found tritium levels as high as 225,000 to 250,000 pCi/L.

On April 6, 2006, a drain cooler relief valve in the feedwater system lifted and remained open, resulting in secondary plant steam being released to the environment through a vent in the turbine building wall. Approximately 114,000 gallons of feedwater was released as steam and most of the steam condensed on plant property. The system containing the feedwater was known to contain tritium as a result of past leakage from the liquid radioactive waste processing system. The licensee sampled on-site locations for tritium contamination, which indicated concentrations of up to 46,000 pCi/L of tritium. Based on the information provided, there is no indication that NRC effluent release limits have been exceeded, and the release does not present a health and safety hazard to plant personnel or to the public.

Exelon has undertaken remediation activities to reduce the levels of the tritium in the ground water at the Braidwood site. The Braidwood ground water tritium interim remediation plan is available through the NRC's electronic document database, ADAMS, under accession number ML061020107. ADAMS can be accessed via the NRC website. Due to intense public interest from local officials and residents, the licensee has held three public information forums: a public information meeting was sponsored by the village of Godley, IL; a public meeting was sponsored by U. S. Senator Richard Durbin; and a meeting with local officials was organized by U.S. Representative Jerry Weller.

Byron

On February 10, 2006, Exelon informed the NRC that elevated levels of tritium had been detected in several vacuum breaker valve vaults at Byron Station, near Rockford, Illinois. Subsequently, the licensee suspended releases of liquid radioactive effluents. The vacuum breaker valve vaults are located along approximately 2.5 miles of the circulating water blowdown line. In a manner similar to Braidwood, the line is normally used to carry non-radioactive water to the Rock River. It is also used for planned liquid radioactive effluent releases. The licensee installed additional monitoring wells to characterize the extent of the contamination and inspect the line for leaks. Two out of six monitoring wells near the vacuum breaker valve vaults showed low levels of tritium. One monitoring well had a tritium concentration of about 3,800 pCi/L and the other had a concentration of about 450 pCi/L. On March 31, 2006, Exelon notified the NRC of slightly elevated concentrations of tritium in the ground water on licensee property close to the blowdown line.

The licensee is currently monitoring the ground water, but has not taken any remediation actions. The licensee has responded to the State of Illinois Environmental Protection Agency denying violations of state regulations and indicated that they would submit an investigation report to the agency that documents the contamination and demonstrates that it will not migrate off the property at concentrations above 200 pCi/L. The licensee has not discussed plans for future remediation with the NRC staff.

Callaway

On June 14, 2006, Union Electric Company notified the NRC of elevated tritium levels along the blowdown discharge pipeline at the Callaway Plant, near Fulton, Missouri. The radioactive material is believed to have leaked from air-relief valves during routine radiological releases through the discharge pipeline. Tritium samples ranged from 20,000 to 200,000 pCi/L. Radioactive cobalt and cesium were detected in the surface soil inside the manholes where the valves are located. Positive sample locations were on the licensee's property. In addition, there is no evidence of radioactive contamination in drinking water based on the licensee's sampling and analysis of water in the wells.

Dresden

In August 2004, Exelon identified contaminated ground water in onsite monitoring wells at Dresden Nuclear Power Station (Dresden), near Morris, Illinois. The monitoring wells had been installed due to historical leaks related to the condensate storage tank that had occurred in the 1990's. The 2004 identification of contaminated water was due to a leaking underground pipe connected to the condensate storage tank. Subsequent onsite sampling identified tritium levels consistent with those present in the condensate storage tank of about 8,000,000 pCi/L. The licensee isolated the leaking pipe and replaced the faulty section of piping.

On January 3 and 19, 2006, onsite well samples indicated an increase in tritium concentration. The licensee increased the well's sampling frequency. On February 11, 2006, Exelon measured a well sample indicating 486,000 pCi/L of tritium present and determined that there was a potential leak in the underground, non-safety, high pressure coolant injection system suction and return piping, which is connected to the condensate storage tank. Sample results were as high as 680,000 pCi/L, measured on February 13, 2006. The licensee isolated the piping and realigned the system from the condensate storage tanks to the torus. Although the leak has not been fully identified by the licensee, Exelon had actions in progress to replace the piping and continue its evaluation.

Hatch

On December 3, 1986, Hatch released an estimated 141,500 gallons of water from the spent fuel pool (SFP) to a gap between the two reactor buildings and subsequently to other onsite buildings and the surrounding environment. Operational/configurational control errors resulted in the deflation of SFP seals and the resultant release. Based on estimates from recovery activities, approximately 124,000 gallons of liquid containing 0.20 curies (Ci) of tritium and 0.373 Ci of mixed fission products were released to a swamp located within the owner controlled area but which ultimately drains to the Altamaha River. Results of initial environmental surveys conducted by the licensee staff and independently by the State of Georgia, Department of Natural Resources verified that both the tritium and fission products released to the swamp and subsequently to the river posed no immediate danger to downstream water users (if any), or to nearby residents. The long-term onsite and offsite radiological impacts are assessed entirely through continuing monitoring of the contaminated area and adjacent off-site pathways. Specifically, in response to the event, the licensee established and maintained a long-term augmented environmental monitoring program. Periodic reports submitted to the NRC indicate a general reduction in activity in the swamp area resulting from radioactive decay and weathering and the potential erosion and migration of the radionuclides within the originally contaminated area.

Indian Point

Indian Point is located near Buchanan, New York. In August 2005, the licensee (Entergy) was excavating the ground near the Indian Point Unit 2 Fuel Storage Building Loading Bay, which is adjacent to the south wall of the spent fuel pool. On August 22, 2005, a hairline crack with moisture was discovered along the south wall of the spent fuel pool. Initial samples did not detect any radioactivity and spent fuel pool leakage was not suspected. On September 1, 2005, contamination was first detected on a sample from the crack. A second crack was discovered two weeks later and a temporary collection device was installed to capture leaking liquid. Analyses of the moisture indicated that the material had the same radiological and chemical properties as spent fuel pool water. The primary radioactive constituent was identified as tritium. The leak from the crack increased following the first measurable sample of 12 milliliters, which was collected on September 12, 2005. The leakage increased to a maximum of 1-2 liters per day and remained stable. It declined to a minimal amount by late December 2005.

On September 29, 2005, the licensee sampled water from an existing monitoring well in the

Unit 2 Transformer Yard. On October 5, 2005, the results from the sample were reported and indicated an unexpected concentration of tritium in onsite ground water. Prior to the September 2005 sample, the well was last analyzed for tritium in 2000 and none was detected. As Entergy continued its investigation into the source of the contamination, hydrological information and sample analyses of monitoring wells led to the conclusion that some contaminated ground water likely will, or has migrated to the Hudson River. Note, however, that the Hudson River is the discharge point for normal planned and monitored releases.

In an effort to reduce Unit 2 spent fuel pool leakage, Entergy has conducted Unit 2 spent fuel pool liner inspections. Accessible areas of the pool above the fuel racks were inspected and six suspect areas coated with epoxy. The licensee is also inspecting the walls adjacent to the fuel racks.

In addition to the detection of tritium, the radionuclides nickel-63, cesium-137, strontium-90, and cobalt-60 have been detected onsite at Indian Point. It is suspected that these isotopes are a result of leakage from the Unit 1 spent fuel pool which resulted in the contamination of some groundwater in the vicinity. Even though Unit 1 has been permanently shut down since 1974, its spent fuel pool still contains expended fuel and radioactive water. A curtain drain groundwater collection system surrounding the facility was expected to capture the contaminated groundwater, however, it is likely that some portion may be bypassing the drain system. Currently, the licensee operates a filter/demineralizer system in the spent fuel pool to reduce the concentration of radioactive material that may continue to leak from the Unit 1 facility until the fuel is removed in 2008.

Oyster Creek

On September 17 and 18, 1996, Oyster Creek Nuclear Generating Station, near Toms River, New Jersey, inadvertently discharged approximately 133,000 gallons of radioactively contaminated water to the environment from the condensate transfer system. The water was discharged to the canal, which eventually discharges to Barnegat Bay, from the circulating water discharge tunnel via the fire protection system and a portion of the service water system. The cause of the discharge was attributed to an operator opening an incorrect valve when placing a temporary system in service. The highest concentration of tritium measured was 16,000 pCi/L at the discharge point to the discharge canal, which is below the EPA drinking water standard.

Palo Verde

On March 1, 2006, a water sample collected from a test hole by Arizona Public Service Company at the Palo Verde Nuclear Generating Station Unit 3, near Phoenix, Arizona, identified tritium levels of 71,400 pCi/L. An environmental consultant, contracted by the licensee to determine the apparent cause, reported that tritiated water was found in Units 2 and 3 subsurface soils, but only Unit 3 indicated tritium levels above the EPA drinking water standard. Plant staff concluded that most of the elevated onsite tritium contamination was due to past operational practices during boric acid concentrator system (evaporator system) releases, resulting in rain deposition and washdown of roof drains. Prior to the mid-1990s, the licensee allowed evaporator system batch releases to occur during rainy days. During those releases, gaseous tritiated vapors were condensed by rain, and the resulting water runoff on the site was absorbed into the ground and also ran into the storm drain system.

It was determined that: (1) the tritiated water at elevated levels was confined onsite; (2) no elevated levels have been found in wells located outside the protected area; (3) there was no evidence of an offsite release of the radioactive water.

The licensee plans to install new monitoring wells in August 2006 and has agreed with the State of Arizona to pump sections of tritiated water from the ground subsurface based on data gathered from the wells. The licensee continues to evaluate and monitor the issue.

Perry

On March 28, 2006, a quarterly sample from a manhole in the underdrain system at the Perry Nuclear Power Plant, near Painesville, Ohio, operated by FirstEnergy Nuclear Operating Company, was collected and analyzed for tritium and gamma-producing isotopes. The underdrain system provides a means of controlling ground water level in the plant area. About 60,000 pCi/L of tritium was detected in the manhole. No gamma-producing isotopes were detected. Samples taken at other points in the underdrain system indicate lower levels of tritium. The licensee attributes the tritium to leakage from a flange in the feedwater system venturi. The leakage migrated through two elevations, through gaps, cracks, and spaces between structures, and into the underdrain system. The leaking flange has been repaired and tritium concentrations have decreased.

The licensee's assessment of this event is that the underdrain system captured the tritiated water, preventing ground-water contamination. Ground-water flow is mostly directed to the underdrain system. Initial measurements for tritium have confirmed the ground water is not contaminated. The licensee plans to install additional ground-water wells to confirm this conclusion.

Point Beach

In 1999, tritium and other radionuclides were identified near a retention pond at the Point Beach Nuclear Power Plant, near Manitowoc, Wisconsin. The retention pond was surrounded by a fence and was located outside the protected area, but within the owner controlled area. The retention pond was taken out of service in September 2002. It was subsequently remediated, capped, and abandoned. The characterization report assessed the contamination and determined that there was no health or safety impact to the public.

The contamination was apparently the result of a steam generator tube leak in 1975 and leakage from a buried pipe in 1997.

As part of the retention pond closure project, a subsurface ground-water survey was conducted in the immediate vicinity of the pond by digging seven trenches to a depth of approximately twelve feet, or to the depth of the impermeable clay layer. Tritium concentration in sand lenses in the top twelve feet of soil around the former retention pond ranged from 177 to 14,250 pCi/L. Based on those results, Point Beach has no plans to install special monitoring wells to sample surface ground water.

Currently, Point Beach conducts additional sampling to monitor ground water, monthly samples from the subsurface drainage system, and storm water runoff drains which empty into the beach area. The licensee also performs monthly sampling of intermittent streams on the east and west sides of the former retention pond. Tritium has been detected in these streams in concentrations ranging from the minimum detectable activity levels of about 200 pCi/L up to 400 pCi/L. The tritium in these streams came from leakage and discharges from the former retention pond which was constructed in 1968. It has been determined that the tritium is restricted to the area around the former retention pond and south-eastward in its drainage path to Lake Michigan.

Salem

On September 18, 2002, Salem Nuclear Station, near Wilmington, Delaware, operated by PSEG Nuclear, LLC, found evidence of contaminated water leakage through a wall into the

Unit 1 Auxiliary Building Mechanical Penetration Room. The licensee initiated an investigation and determined that the contamination was due to Unit 1 Spent Fuel Pool water that had leaked into a narrow seismic gap between the Unit 1 Auxiliary Building and Unit 1 Fuel Handling Building, and entered the Mechanical Penetration Room. Further licensee reviews determined that the tell-tale drain system for the Unit 1 spent fuel pool had become obstructed, which caused a build up of water between the spent fuel pool liner and concrete structure. The water then migrated through a wall and penetrations. The licensee cleaned the tell-tale drain system, which cleared the water buildup and stopped the leakage.

The licensee also initiated actions to evaluate possible migration of spent fuel pool water to the ground water because the seismic gap was ultimately connected with the ground water. The licensee initiated drilling wells. On February 6, 2003, the licensee identified tritium contamination in non-potable ground water near the Unit 1 fuel handling building. The licensee subsequently initiated an extensive ground-water sampling program to fully characterize the contamination. Maximum tritium levels of 15,000,000 pCi/L were identified in the ground water near the seismic gap. The licensee established, in conjunction with the State of New Jersey, an extensive ground-water remediation program. Which includes ongoing remediation of the seismic gap. As of December 2005, the licensee extracted about 1.6 curies of tritium with approximately 2 – 4 curies remaining to be extracted.

PSEG's evaluations did not identify any immediate health and safety consequences to onsite workers or members of the public. No contamination is believed to have migrated to the unrestricted area. The remediation efforts have created an in-gradient of water causing the water to flow toward the plant instead of offsite. No other plant related radionuclides were identified in the ground water.

Seabrook

In June 1999, the Seabrook power plant, operated by FPL Energy, near Seabrook, N.H., measured elevated tritium concentrations in the sump during routine monitoring of a discharge from the Steam Generator Blowdown Demineralizer (SGBD) sump. The sump is monitored as part of Seabrook's REMP. The licensee's investigation identified that the tritium activity was associated with an input to the sump from the Containment Annulus. Seabrook's investigation identified the source of the tritium leakage to be from a defect in the liner of the cask loading pool, which is connected to the fuel transfer canal in the Fuel Handling Building.

Seabrook initiated ground-water sampling in 2000 and detected a maximum tritium concentration of about 750,000 pCi/L in a sample of non-potable water collected from the annulus sump in close proximity to the location of the leak. The licensee subsequently installed ground-water dewatering wells to pump the water from areas of highest tritium concentrations and provide for its controlled discharge.

Seabrook installed additional monitoring wells as the result of a hydrology study, to identify the extent of the ground-water contamination. Seabrook's study did not identify any migration of radioactive contaminated water to the unrestricted area. Currently, ground water tritium levels are at or near background levels. The licensee continues to monitor the ground water on a routine, periodic basis to identify any changes.

Three Mile Island

On May 17, 2006, personnel at the Three Mile Island nuclear power plant, near Harrisburg, Pennsylvania, identified water coming from a utility access manway in the owner controlled parking lot. The licensee initially determined the source of the water to be a leak in a domestic water line since it was the only known source of water in the area. The licensee subsequently pumped out about 2000 gallons of water to parking lot asphalt during the period May 17- 20, 2006. Review by the licensee identified the manway to be an access port to underground telephone cables and initiated actions to identify the source of the leakage. On May 27, plant personnel again identified water coming from the location. The licensee pumped out another 2000 gallons to the parking lot asphalt.

On June 1, 2006, the licensee sampled and analyzed the water from the manway and identified elevated concentrations of tritium. The water contained a tritium concentration of 45,000 pCi/L. However, samples taken from four nearby ground-water monitoring wells indicated no elevated tritium in the surrounding ground water. Well samples taken in the vicinity of this manway indicate levels of 200 pCi/L which is the background lower limit of detection.

The licensee identified that the water had come from the condensate system and had reached the parking lot via an underground telephone cable conduit run. The water had entered a below floor grade telephone cable raceway which allowed the contaminated water to flow into the cable conduit run. Engineers identified the source of the tritium water leak to be an underground four inch de-icing line, within the protected area, from the condensate system to the condensate storage tank. The four inch pipe was excavated and temporarily patched to stop the leak. The licensee team continued enhanced monitoring of ground- water wells and also verified no tritium water had left the owner controlled area (island) via the underground cable conduit runs.

Watts Bar

Readily detectable concentrations of tritium have been identified in recently established onsite ground water monitoring wells at the Watts Bar Nuclear plant site. These wells were established as supplemental Radiological Environmental Monitoring Program requirements associated with Unit 1 modifications for upcoming production of tritium for DOE. Based on the establishment of additional onsite groundwater monitoring wells and evaluation of current onsite hydrology, a complex scenario of groundwater contamination resulting from two separate onsite systems/structures were identified. The first source included small leaks in a radioactive liquid effluent line which resulted in a dual branch plume of tritium. The leaks resulted in elevated levels of radionuclide contamination near the degraded piping and subsequent migration of the tritium into the ground water. The second source was determined to be leakage through the fuel transfer tube sleeve into the Shield Building annulus of the abandoned Unit 2 facilities with the tritium migrating into the ground water adjacent to the shield building. The licensee has developed and implemented corrective actions to prevent further leakage from the identified sources, and to mitigate contamination were possible, e.g., decontamination of soils associated with the radioactive liquid effluent waste line break. Current trends in onsite groundwater well tritium concentrations appear to indicate that the corrective actions have been successful and that fluctuations in onsite ground water sample results are attributable to migration of the tritium contaminated groundwater plumes. On two occasions in calender year 2005, tritium concentrations measured within REMP groundwater wells within the owner controlled areas exceeded the Offsite Dose Calculation Manual reporting levels (quarterly average concentration exceeding 30,000 pCi/L). Supplemental wells established to monitor tritium levels within the protected area also indicated elevated tritium levels. However, no tritium or other radionuclides have been detected at levels exceeding background concentrations from water samples collected from off-site wells, public drinking water, or the Tennessee River.

Wolf Creek

The circumstances at Wolf Creek are not related to an event, but are discussed here to illustrate an issue that is likely generic and should be addressed by the NRC staff. The plant discharges its routine radioactive liquid effluent into an onsite lake in accordance with its license, the ODCM, and within NRC ALARA criteria. The REMP sample data shows levels of tritium in the water, but below any reporting criteria. The average tritium concentration in the lake is about 13,000 pCi/L. The licensee uses the lake water for the plant fire protection system. Periodically they purge out the fire protection system and drain the water onto the plant property.

The issue is that the licensee is taking water from a known source of discharged licensed material and have sample data which supports that there is detectable levels of licensed radioactive material in the water introduced into the fire protection system. The licensee does not perform any radiological surveys of the water that is taken into the fire protection system. They also do not perform any radiological surveys of the discharged water, or environmental monitoring to see if the water discharged onsite is adversely impacting the environment.

The staff believes there are other licensees with similar circumstances. Given the available information, the staff does not consider the situation to be a health risk for either the public or for workers onsite.

2.3 Recommendation

(1) The staff should review and develop a position to address using lake water that contains licensed radioactive material for other site purposes, such as for use in the fire protection system.

The following table summarizes the plant events described above:

Nuclear Power Plant	Date of Release Discovery	Source of Release	Radionuclides Detected
Braidwood	March 2005	Vacuum breaker valves on the circulating water blowdown line	Tritium
Byron	February 2006	Vacuum breaker valves on the circulating water blowdown line	Tritium
Callaway	June 2006	Vacuum breaker valves on the circulating water blowdown line	Tritium, cobalt-58, cobalt-60, cesium-134, cesium-137
Dresden	August 2004, January 2006	Non-safety related HPCI suction and return line	Tritium
Hatch	December 1986	Fuel transfer canal due to operator action	Tritium
Indian Point	August 2005 - Unit 1 leakage predates August 2005	Unit 1 and Unit 2 spent fuel pools	Tritium, nickel-63, cesium-137, strontium-90, and cobalt-60
Oyster Creek	September 1996	Condensate transfer system due to operator action	Tritium
Palo Verde	March 2006	Rain condensing onto property after a gaseous release	Tritium
Perry	March 2006	Feedwater venturi	Tritium
Point Beach	1999	Retention pond	Tritium, cesium-137
Seabrook	June 1999	Spent fuel pool	Tritium
Salem	September 2002	Spent fuel pool	Tritium
Three Mile Island	May 2006	Condensate storage tank	Tritium
Watts Bar	August 2002	Effluent release pipe and SFP transfer tube sleeve	Tritium and mixed fission products

Table 1 Summary of Inadvertent Releases of Radioactive Liquids at NPPs

Braidwood Vacuum Breakers in the Blowdown Line

The licensee identified elevated levels of tritium in ground water at the Braidwood site and in adjacent property, and determined the tritium originated from historical spills from underground piping (circulating blowdown system) that periodically transported liquid radioactive effluent discharges. Since 1996, the licensee documented 17 leaks from piping vacuum breakers. The large volume leaks in 1998 and 2000 were determined to be caused by inadequate preventive maintenance and inadequate design configuration. The licensee's initial corrective actions were to correct individual instances of leakage. Following the significant leak in 2000, the licensee performed a root cause evaluation, which recommended that the licensee institute a preventative maintenance program and modify certain system components.

The primary function of the circulating water blowdown system at the Braidwood site is to provide dilution and a pathway for liquid radioactive waste releases. The secondary function of the circulating water blowdown system is to provide dilution for liquid radioactive waste releases. The blowdown piping is constructed of reinforced concrete pipe.

The circulating water blowdown piping at Braidwood is designated by the licensee as a Safety Category II SSC, which has no public health or safety implication. As stated in the Updated Final Safety Analysis Report (UFSAR), "Safety Category II systems or portions of systems and components do not follow the requirements of Appendix B to 10 CFR 50. The quality assurance standards for these systems and components follow normal industrial standards and any other requirements deemed necessary by the Licensee." Additionally, the blowdown piping does not meet the scoping requirements for the maintenance rule. SSCs that do not meet the scoping criteria of the maintenance rule may continue to have appropriate maintenance activities performed on them as determined by the licensee, based upon factors such as the consequence of SSC failure on power production or economic importance, but it is neither required nor inspected by the NRC.

A further review of the Braidwood UFSAR determined that most radiological waste system components are similarly classified as Safety Category II or Quality Group D. These components are not subject to mandatory in-service inspection or in-service testing requirements that typically apply to SSCs essential to the performance of a safety function.

Based on experience, the task force considered the applicability of NRC requirements to similar SSCs at other plants to be typical of those applied at Braidwood.

Palo Verde, Salem, and Indian Point Spent Fuel Pool Leakage

Palo Verde Unit 1, Salem Unit 1, and Indian Point Units 1 and 2, have experienced spent fuel pool (SFP) leakage that has resulted in the release of radioactive water to the environment. Fuel handling and storage facilities are designed to store spent fuel and remove decay heat from the fuel; protect the fuel from mechanical damage; prevent the loss of water from the pool that could uncover the fuel; and provide the capability for limiting the potential offsite radiation exposures in the event of a significant release of radioactivity from the pool. License technical specifications typically require monitoring to maintain an adequate level of water in the SFP, however, due to evaporation rates and the relative large volumes of water in SFPs, licensees are generally unable to distinguish small leaks from normal evaporation changes in the pool level.

In July, 2005 at Palo Verde Unit 1, the licensee observed water seepage from the SFP south wall. A second leak was found outside the fuel building on the SFP east wall. Chemistry samples of the leakage indicated that the water was from the SFP. Previously, the licensee had identified that the SFP tell-tale drain lines were plugged. The blocked lines caused SFP water to back-up and leak through two adjacent concrete walls. Typically, SFPs are constructed with tell-tale drain lines (leak collection system), which collect any SFP leakage behind the seams of the SFP liner. A review of the requirements applicable to the SFP determined that the SFP structure is constructed and classified as Seismic Category I, the pool liner and the leak detection system are typically listed as not applicable to seismic category or quality group classification. The task force could not identify any generic regulatory requirements that apply to maintenance, surveillance, or routine testing of the SFP liner or the leak detection system. For this specific licensee, however, a self-revealing noncited violation was identified as a result of the licensee's failure to monitor leakage properly using the spent fuel pool leak detection surveillance as required by a site-specific procedure. The NRC staff noted in the inspection report (Inspection Report numbers 05000528/2005004, 05000529/2005004; and 05000530/2005004) that the significance determination process does not specifically address SFP issues.

A similar issue was documented in NRC Information Notice 2004-05, "Spent Fuel Pool Leakage to Onsite Ground Water," related to evidence of radioactive leakage through an interior wall at Salem Unit 1. On September 18, 2002, the licensee for Salem Unit 1 identified evidence of radioactive water leakage through an interior wall. The licensee established a comprehensive task action plan to identify and stop the source of the leakage and evaluate possible undetected leakage outside building structures. The NRC conducted a special inspection regarding the leakage from the Unit 1 fuel handling building (FHB). The staff's inspection report (Inspection Report numbers 05000272/2003006; 05000311/2003006) identified a self-revealing non-cited violation of 10 CFR 50, Appendix B, Criterion XVI, involving failure to promptly detect and correct a condition adverse to quality involving undetected accumulation of borated, contaminated water behind the Unit 1 FHB walls. The licensee's evaluation found that the SFP telltale drains were blocked. The licensee cleaned the telltale drains, which allowed the drainage of the accumulated water between the liner and the SFP concrete structure.

On August 22, 2005, Indian Point Unit 2, identified leakage during the excavation adjacent to the spent fuel pool south wall. The SFP wall consists of four-foot-thick concrete, and is heavily reinforced with steel rebar. The inside of the SFP is lined with 1/4-inch stainless steel plate anchored to the concrete such that the plate and concrete are in contact, with only a small interstitial area between. The SFP is a Class 1 structure as specified in the Indian Point Unit 2 Updated Final Safety Analysis Report. Indian Point Unit 2 was designed and licensed without a spent fuel pool liner leak collection system. The design provisions for the Indian Point Unit 2 SFP include pool level instrumentation with alarms in the control room and 150 gallons per minute water makeup capacity in the event of a design basis accident.

In addition to the identified leakage from the SFP wall, the licensee detected groundwater contamination in onsite monitoring wells. This led the NRC staff to conduct a special inspection to better understand the source of the radiological contamination, the cause, the extent of condition, any potential impact on the spent fuel pool integrity, and to confirm that public health and safety was being maintained as required by the regulatory requirements. The staff's inspection is documented in NRC Special Inspection Report No. 05000247/2005011. Currently, the licensee is investigating if there is a leak in the spent fuel pool stainless steel liner. Approximately 40% of the liner has been inspected with no leaks identified. The licensee is investigating methods and techniques to inspect additional areas of the liner. The licensee is also installing additional monitoring wells to assess and characterize groundwater movement and behavior relative to groundwater contamination in the vicinity of Unit 2. The NRC special inspection staff also reviewed the licensee's structural analysis and confirmed that the assumptions and analytical methods used by the licensee were reasonable, appropriate, and correctly applied. Based on staff's review, it was concluded that the leakage condition affecting the Indian Point Unit 2 SFP structure would not adversely affect the integrity of the structure or its safety function. The NRC staff is continuing to monitor and will issue a followup report related to the licensee's actions to identify, control, mitigate, and remediate (as necessary) the groundwater contamination.

Dresden Storage Tank Piping Leak

In 2004, leakage was discovered in the supply line piping between the condensate storage tank and the high pressure coolant injection (HPCI) system. The piping is approximately 175 feet long and is located in a dirt trench. The licensee replaced approximately 75 feet of piping where leaks had been identified in 2004. The replaced section of piping is buried in a low-strength grout material. In February, 2006, the licensee identified elevated levels of tritium in a monitoring well located near the underground piping. The licensee suspects that the current leak is from the 100 feet of piping that was not replaced in 2004. The licensee had planned to replace the piping in June, 2006 prior to the identification of elevated tritium. The condensate storage tank and associated piping is made of aluminum and is not categorized as Class I. In addition, the licensee has not categorized the condensate storage tank and the associated piping to the HPCI system as safety related. The licensee's UFSAR lists the safety related water source as the torus for the HPCI system. The piping is classified as non-safety related, although the licensee lists it as Augmented Quality under the Exelon quality assurance program. The piping is designed to meet ANSI B31.1 standards. The piping is wrapped with polypropylene pipe wrap material to provide protection from corrosion and electrolysis. The piping consists of 12-inch, 16-inch, 18-inch and 24-inch diameter sections having a nominal wall thickness of 0.375-inch. The required installation testing includes hydrotesting and visual inspection. The licensee's technical specifications require quarterly HPCI surveillance using the subject section of piping as part of the flow path. In addition, the Exelon excavation procedures have the licensee visually inspect the buried piping if the area is excavated in the future . The task force could not identify any generic regulatory requirements that applied to maintenance, surveillance, or routine testing of non-safety related condensate storage tanks and associated piping.

3.2.2.3 Conclusions

Review of regulatory requirements for SSCs that have experienced unmonitored or unplanned liquid radioactive effluent releases as described above, leads to the following conclusions:

(1) Systems containing radioactive liquid that are designated as safety-related, or that are addressed under some aspect of a licensee's quality assurance program, are generally subject to maintenance, inspections, tests, and/or other quality assurance requirements that provide added assurance that the system will not leak, or if it does leak, that the leakage will be detected. Systems that are not safety-related and that are not covered under the quality assurance program generally are subject to less of these measures.

(2) Systems or structures can experience undetected radioactive leaks over a prolonged period of time. Systems or structures that are buried or that are in contact with soil, such as SFPs, tanks in contact with the ground, and buried pipes, are particularly susceptible to undetected leakage.

(3) SFP leakage may be reduced by improved maintenance and trending of the telltale leak detection/monitoring system.

(4) SFP performance deficiencies are not specifically addressed in the NRC inspection program significance determination process.

(5) Leakage from components containing radioactive liquids may be reduced by the use of improved materials, the use of higher level consensus code repair/replacement requirements, improved quality assurance, improved design standards, improved and expanded inspection requirements, improved protection of buried components (galvanic protection, coatings) and/or improved design considerations.

(6) Available information does not suggest a propensity for SFP liner leakage to damage structures. However, long term effects are continuing to be reviewed.

3.2.2.4 Recommendations

The following recommendations address the above conclusions.

(1) SSC's may have a radioactive leak without prompt detection, therefore the NRC should require adequate assurance that leaks and spills will be detected before radionuclides migrate offsite via an unmonitored pathway.

(2) Determine whether there is a need for improved design, materials, and/or quality assurance requirements for SSC's that contain radioactive liquids for new reactors.

(3) The staff should consider whether further action is warranted to enhance the performance of SFP telltale drains at nuclear power plants.

(4) The staff should verify that there has been an evaluation of the effects of long term SFP leakage (boric acid) on safety significant structures (concrete, rebar), or the staff should perform such an evaluation.

(5) The staff should assess whether the maintenance rule adequately covers SSCs that contain radioactive liquids.

(6) The staff should verify that the license renewal process reviews degradation of systems containing radioactive material such as those discussed in this report.

3.2.3 Other Regulatory Limits on Ground-Water Contamination

3.2.3.1 Scope and Criteria

As indicated earlier, inadvertent releases of radioactive material to the environment can result in a heightened level of public concern, as well as concerns expressed by State and local officials. These concerns can be traced, in part, to violations of State environmental protection or natural resource protection regulations. This section provides an overview of relevant state regulations that may result in violations. It takes no position on whether any of these regulations might be pre-empted by federal law.

3.2.3.2 Detailed Discussion of Review

States can use three general types of regulations for nuclear utility compliance determinations: National Pollutant Discharge Elimination System (NPDES) Permit Regulations, Numerical Standards for Ground Water Quality and Non-numerical Rules for Ground Water Quality.

NPDES Permits

The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Most States have been delegated authority by the EPA to issue NPDES permits. It is important to note that NPDES permits are not for discharges to ground water but for discharges to surface water. Nevertheless, it is recognized that discharges to surface water bodies or discharges directly to the surface may result in recharge to a shallow aquifer. Therefore, States have considered it appropriate to cite utilities for unpermitted discharges when they lead to degradation of a ground-water resource.

The NPDES permit application requires the applicant to list all pollutants in the discharge. As defined in the Clean Water Act, the term " pollutant" includes "radioactive materials." However,

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Entergy Nuclear Generation Company and	)	Docket No. 50-293-LR
Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-848-02-LR
	)	
(Pilgrim Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of (1) "Entergy's Motion for Summary Disposition of Pilgrim Watch Contention 1"; (2) "Statement of Material Facts"; and (3) "Declaration of Alan Cox in Support of Entergy's Motion for Summary Disposition of Pilgrim Watch Contention 1," with Exhibits, were served on the persons listed below by deposit in the U.S. Mail, first class, postage prepaid, and where indicated by an asterisk by electronic mail, this 8th day of June, 2007.

*Administrative Judge
Ann Marshall Young, Esq., Chair
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
amy@nrc.gov

*Administrative Judge
Dr. Richard F. Cole
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
rfc1@nrc.gov

*Administrative Judge
Paul B. Abramson
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
pba@nrc.gov

*Secretary
Att'n: Rulemakings and Adjudications Staff
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
secy@nrc.gov, hearingdocket@nrc.gov

Office of Commission Appellate Adjudication
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

*Susan L. Uttal, Esq.
*Marian L. Zobler, Esq.
Office of the General Counsel
Mail Stop O-15 D21
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
slu@nrc.gov; mlz@nrc.gov

*Mr. Mark D. Sylvia
Town Manager
Town of Plymouth
11 Lincoln St.
Plymouth MA, 02360
msylvia@townhall.plymouth.ma.us

*Ms. Mary Lampert
148 Washington Street
Duxbury, MA 02332
mary.lampert@comcast.net

*Chief Kevin M. Nord
Fire Chief and Director, Duxbury Emergency Management Agency
688 Tremont Street
P.O. Box 2824
Duxbury, MA 02331
nord@town.duxbury.ma.us

*Sheila Slocum Hollis, Esq.
Duane Morris LLP
1667 K Street, N.W.
Suite 700
Washington, D.C. 20006
sshollis@duanemorris.com

*Richard R. MacDonald
Town Manager
878 Tremont Street
Duxbury, MA 02332
macdonald@town.duxbury.ma.us

Paul A. Gaukler