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LR-N10-0372

U.S. Nuclear Regulatory Commission
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Salem Nuclear Generating Station, Unit No. 1 and Unit No. 2
Facility Operating License Nos. DPR-70 and DPR-75
NRC Docket Nos. 50-272 and 50-311

Subject: Response to NRC Request for Additional Information, dated October 12, 2010, related to the Buried Piping Inspection Program associated with the Salem Nuclear Generating Station, Units 1 and 2 License Renewal Application

References:
1. Letter from Ms. Bennett Brady (USNRC) to Mr. Thomas Joyce (PSEG Nuclear, LLC) "REQUEST FOR ADDITIONAL INFORMATION FOR SALEM NUCLEAR GENERATING STATION UNITS 1 AND 2 LICENSE RENEWAL APPLICATION FOR BURIED PIPING INSPECTION PROGRAM (TAC NOS. ME1834 AND ME1836)", dated August 6, 2010

2. PSEG Letter LR-N10-0322 to USNRC, "Response to NRC Request for Additional Information, dated August 6, 2010, related to the Buried Piping Inspection Program associated with the Salem Nuclear Generating Station, Units 1 and 2 License Renewal Application," dated September 7, 2010

3. Letter from Ms. Bennett Brady (USNRC) to Mr. Thomas Joyce (PSEG Nuclear, LLC) "REQUEST FOR ADDITIONAL INFORMATION FOR SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION FOR BURIED PIPING INSPECTION PROGRAM (TAC NOS. ME1834 AND ME 1836)", dated October 12, 2010

In Reference 1, the staff requested additional information related to the Buried Piping Inspection Program associated with the Salem Nuclear Generating Station, Units 1 and 2 License Renewal Application (LRA). In Reference 2, PSEG responded to that request for information. After review of that submittal and further discussions between NRC staff and PSEG, the staff requested additional information (Reference 3).

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Enclosure A contains the responses to that request for additional information. Enclosure B provides updates to affected sections of the LRA.

Enclosure C contains updates to LRA Appendix A, Section A.5, the License Renewal Commitment List. There are no other new or revised regulatory commitments contained in this letter.

If you have any questions, please contact Mr. Ali Fakhar, PSEG Manager - License Renewal, at 856-339-1646.

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

Executed on 11/10/10

Sincerely,

Paul J. Davison

Paul J. Davison
Vice President, Operations Support
PSEG Nuclear LLC

Enclosures: A. Response to Request for Additional Information

B. Salem License Renewal Application Updates

C. LRA Appendix A, Section A.5, License Renewal Commitment List Update

cc: William M. Dean, Regional Administrator – USNRC Region I
B. Brady, Project Manager, License Renewal – USNRC
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Enclosure A

Response to Request for Additional Information

RAI B.2.1.22-02
(Follow-up to RAI B.2.1.22)

RAI B.2.1.22-02
Follow-up to RAI B.2.1.22

Background:

Given that there have been a number of recent industry events involving leakage from buried or underground piping, the staff required further information to evaluate the impact that these recent industry events might have on the applicant's Buried Piping Inspection and Buried Non-Steel Piping Inspection Programs. By letter dated August 6, 2010, the staff issued RAI B.2.1.22 requesting that the applicant provide information regarding how Salem will incorporate the recent industry OE into its aging management reviews and programs. The applicant responded on September 7, 2010. In reviewing the response, the staff had further questions.

Issue

a) The applicant's response stated that, "Planned direct visual inspections of excavated piping typically include the entire circumference and a length of approximately eight (8) feet (based on a standard shoring box size), when practical." The staff does not have enough information to evaluate the statement, "when practical." While the staff acknowledges that examining buried pipe from the exterior surface may sometimes not be possible due to plant configuration (e.g., the piping is located underneath foundations); nevertheless, it is important to expose a large enough length of the piping in order to establish reasonable assurance of the condition of the piping system. The staff believes that in instances where it is not possible to expose eight feet of piping during each inspection, an alternative examination should be proposed. The staff notes that it is reasonable to substitute an ultrasonic volumetric examination from the interior of the pipe provided the surface is properly prepared.

b) The applicant's response stated that, "Salem Unit 1 and 2 buried piping systems do not have cathodic protection installed. None of the seven (7) above systems within the scope for license renewal have dedicated cathodic protection systems. The lack of cathodic protection is an input to the risk ranking methodology." The staff believes that cathodic protection is an important preventive measure for steel piping. The staff notes that there have been several instances where coating failures have occurred or specified coatings have not been installed, resulting in either leakage occurring or pipe minimum wall thicknesses being challenged, examples include:

    i. From the LRA, "In 2001, a section of the buried No. 12 service water piping at Salem Unit1 was excavated to determine the cause of leakage. The source of leakage was a break in the steel bell ring, which is installed over one pipe joint section of the service water piping. The apparent cause of the break was a crack

that occurred during the installation of the steel bell ring or an initial flaw in the metal. Additionally, the metal and mortar was cracked in about the same area, which could indicate that this area was cracked at installation. Contributing to the growth of the initial crack and subsequent corrosion of the steel bell ring was improper protection of the carbon steel bell ring on the underground Service Water buried pipe joint. Therefore the apparent cause of the failure was an installation flaw and improper coating protection of the joint and not an age related failure mechanism."

ii. From the LRA, "In 2004, buried carbon steel piping in the Salem Unit 1 Fuel Oil System was excavated to repair leakage at a welded joint. The socket-welded joint was not properly wrapped with a protective tape. The wrap for this joint was originally missing altogether and the leakage was caused by direct exposure to groundwater and subsequent corrosion, not by aging."

iii. In the RAI response, the applicant stated an example from 2010 where it was determined that a significant portion of the Unit 1 buried AFW system piping had it's coating inadvertently removed during construction. This resulted in areas of the piping degrading, although all degraded portions were determined to be operable after re-analysis.

iv. In the RAI response, the applicant stated an example from 2010, "A small pipe leak was found on a 1-inch Control Air System pipe buried in sand in the Fuel Transfer Tube Area (FTTA). The through wall leak was located at a location where the protective coating on an elbow was damaged. The apparent cause of the coating damage was that personnel previously stepped on the pipe thus damaging the coating."

The staff believes that cathodic protection is an important preventive measure for steel piping where soil resistivity values are below 20,000 ohm cm. The staff also believes that an acceptable alternative to protecting steel piping with a cathodic protection system is to demonstrate that actual corrosion rates are low enough such that minimum design wall thickness for the buried pipe will not be reached within the period of extended operation. The staff notes that the analyses that accompanied the buried pipe inspections of the Unit 1 AFW system demonstrated that the pipe wall as-found conditions were determined to meet operability limits; however, the staff lacks sufficient information to determine if the minimum design wall thickness would have been met through the period of extended operation. The staff also notes that the applicant, given recent operating experience, has proposed to perform three additional opportunistic or focused excavations and direct inspections of carbon steel piping and components

during each ten year period commencing ten years prior to the period of extended operation.

c) Given that the non-radioactive drain system, as stated in LRA Section 2.3.3.18 interfaces with areas such as the diesel generator sump, fuel handling building, refueling water storage tank pipe tunnel, and sump piping that ends at the interface with the Unit 2 radwaste system the staff does not have enough information to determine if the non-radioactive drain system contains hazardous material during normal operation (i.e., material which, if released, could be detrimental to the environment such as diesel fuel and radioisotopes that exceed EPA drinking water standards). The staff believes that there is a minimum set of excavated and visual inspections of buried piping segments that contain hazardous materials that should be conducted to establish a reasonable basis of assurance that aging effects are not adversely impacting buried pipe and resulting in the release of hazardous materials to the environment.

d) Neither the LRA nor RAI response described the quality of the backfill in the vicinity of buried in-scope piping. The staff understands that the presence of rocks and sharp objects in the backfill around buried pipes is a leading precursor of degradation of buried piping when over time, ground movement causes these materials to come in contact with the buried pipe resulting in damage to the pipe's coating or external surfaces.

Request:

a) Define what is meant by "when practical" in relation to the length of piping being excavated for inspection. Additionally, where it is not practical to excavate and inspect eight feet of piping for each inspection, state what alternative means will be utilized to determine the condition of the piping material, or justify why inspecting less than eight feet of piping in the context of all planned inspections for each discrete material type provides a reasonable assurance of the condition of the buried pipe and coatings where applicable.

b) For buried in-scope steel piping respond to the following:

   i. Provide sufficient detail for the staff to determine that the site soil resistivity in the vicinity of all buried steel pipe exceeds 20,000 ohm cm and if this is the case, explain why the corrosion on the AFW system occurred to such a degree as was observed during inspections, or
   ii. Provide sufficient detail for the staff to determine that all buried in-scope steel piping will meet or exceed the minimum design wall thickness throughout the period of extended operation assuming that no coatings are applied to the piping, or

iii. Justify why the inspections that have been conducted, and the proposed four inspections of steel piping in each ten year period commencing ten years prior to the period of extended operation are sufficient to determine the extent of condition of missing or damaged coatings before any buried in-scope steel piping segment will not meet the minimum design wall thickness throughout the period of extended operation.

c) For buried in-scope piping respond to the following:

i. Does the non-radioactive drain system contain hazardous material during normal operation?

ii. If the non-radioactive drain system contains hazardous material during normal operation, state what percent of total linear feet of buried in-scope non-radioactive drain system piping will be inspected by excavation and direct inspection during each ten year period starting ten years prior to the period of extended operation. If there are no planned inspections for this piping, justify why it is acceptable to not inspect in-scope buried pipe containing hazardous materials.

d) For buried in-scope piping respond to the following

i. Provide details on the quality of the backfill in the vicinity of in-scope buried pipes.

ii. If there is no information on the condition of the quality of backfill beyond initial installation specifications (i.e., no documented observations of the quality of the backfill), justify why the planned inspections are adequate to detect potential pipe degradation as a result of coating damage or holidays, or damage to the exterior surface of non-coated piping.

PSEG Response:

a) The Salem Buried Pipe Program plans to excavate, expose, and examine a minimum of eight feet of pipe for each committed inspection of buried pipe documented in Salem LRA Table A.5, "License Renewal Commitment List" items 22 and 44. In PSEG's response to RAI B.2.1.22, the phrase "when practical" was intended to capture the rare situations where unexpected physical limitations discovered during the excavation process will prevent a minimum eight foot long section of pipe from being exposed for inspection. The use of the term, "when practical" was not intended to allow for the performance of "bell-hole" or "key-hole" excavations shorter than eight continuous feet for license renewal credited inspections.

However, in reviewing possible inspection candidates which will meet the commitments, Salem has determined that the phrase "when practical" was not necessary for committed buried pipe inspections in the previous RAI response. Therefore, Salem retracts the phrase ("when practical") from the first paragraph of page 5, Enclosure "A" in PSEG's response to Salem RAI B.2.1.22, contained in PSEG letter LR-N10-0322 dated September 7, 2010, as shown below. Revisions are indicated with strikethroughs for deleted text.

> "Planned direct visual inspections of excavated piping typically include the entire circumference and a length of approximately eight (8) feet (based on a standard shoring box size)~~, when practical~~."

b) Given the option to respond to either "i", "ii", or "iii" in the "Request", Salem has elected to respond to "iii". The response is provided below.

iii. Portions of the Salem Unit 1 and 2 Auxiliary Feedwater, Service Water, Circulating Water, Compressed Air, Demineralized Water, Non-radioactive Drain, and Fire Protection Systems within scope of license renewal contain buried coated steel piping. The committed four carbon steel inspections, one ductile iron inspection, and one gray cast iron inspection during each ten-year period, beginning ten years prior to entry into the period of extended operation, are sufficient to determine the extent of condition for potential missing or damaged coatings as discussed below.

Buried metallic portions of these systems within the scope of license renewal were backfilled consistent with NACE SP0169-2007 section 5.2.3 and ASTM D 448-8. Portions of three of these systems (Auxiliary Feedwater, Service Water, and Compressed Air) contain safety-related pipe. Each system within the scope of license renewal is discussed below.

Auxiliary Feedwater System
Currently, the Salem Unit 1 and 2 Auxiliary Feedwater (AFW) Systems contain an integrated total of approximately 475 feet of buried coated carbon steel pipe that is within the scope of license renewal. This buried piping is classified as safety-related pipe. All of the Unit 1 buried AFW piping (approximately 300 feet)

was replaced during the April 2010 outage. The portion that was located in the Fuel Transfer Tube Area (FTTA) (approximately 125 feet) was relocated above ground. Therefore, Unit 1 AFW system now has approximately 175 feet of new buried coated carbon steel pipe, all of which was installed in 2010.

As part of the extent of condition review (driven by the Corrective Action Program), excavation and inspection of buried portions of the Unit 2 AFW System is planned for the next Unit 2 refueling outage, scheduled for the Spring of 2011. Also, Salem plans to replace and relocate above ground, approximately 125 feet of the Unit 2 AFW System buried carbon steel pipe located in the FTTA. A portion of this piping was excavated as part of the Unit 1 extent of condition evaluations and found to be coated.

After the planned Spring 2011 replacement of the AFW pipe located in the Unit 2 FTTA, the total amount of buried AFW coated carbon steel pipe, for both units, within the scope of license renewal will be approximately 350 feet. This piping is located outside the Unit 1 and Unit 2 Containment buildings, with all 175 feet of the Unit 1 piping being new and recently replaced in the Spring of 2010.

To support the license renewal commitment, at least one location will be selected from the buried AFW System pipe for inspection during each ten-year period, beginning ten years prior to entry into the period of extended operation. Salem will inspect a different segment in each ten year period. These inspections will provide a representative sample of safety-related buried coated carbon steel pipe in the AFW System. They will also provide reasonable assurance that loss of carbon steel material aging effects will be adequately managed so that the intended function of buried AFW System pipe will be maintained consistent with the current licensing basis during the period of extended operation. The commitment clarification described above is included in Enclosures B and C of this letter.

Service Water System

The Unit 1 and 2 Service Water Systems contain approximately 1700 feet of buried coated carbon steel pipe which is within the scope of license renewal, approximately 60 feet of which is classified as safety-related. This 60 feet of safety-related piping is the total combined length of approximately 30 wall penetrations located at the Service Water Intake Structure, Auxiliary Building, and Service Water pipe tunnel, as well as the Service Water discharge connections to the Circulating Water System. Salem plans to inspect two Service Water System pipe segments externally during the next refueling outage in 2011, as well as perform the internal Open-Cycle Cooling Water Aging Management Program (Salem LRA Appendix B, Section B.2.1.11) inspections. These internal inspections assess the condition of the internal coatings, metal and concrete surfaces, in addition to identifying potentially broken pre-stressing wires in the pre-stressed concrete cylinder pipe.

To support the license renewal commitment, at least one location will be selected from the buried safety-related portions of the Service Water System for inspection during each ten year period, beginning ten years prior to entry into the period of extended operation. Salem will inspect a different segment in each ten

year period. These inspections will provide a representative sample for safety-related buried coated carbon steel pipe in the Service Water System. They will also provide reasonable assurance that loss of carbon steel material aging effects will be adequately managed so that the intended function of buried Service Water System pipe will be maintained consistent with the current licensing basis during the period of extended operation. The commitment clarification described above is included in Enclosures B and C of this letter.

Based on discussions with the Staff during a September 28, 2010 conference call, it was determined that additional clarification to the "Issue" section of this RAI was needed. Provided below is a clarification to an operating experience event that is cited in "b) i." of the Staff's "Issue" section of this RAI.

> The 2001 operating experience event contained on LRA page B-209 describes a leak that occurred at a bell and spigot pipe joint on the Service Water system. The leak occurred due to a break in the steel ring with contributing factors originating from the internal surface of the pipe. Upon excavation, the exterior surface of the pipe was found coated.

Compressed Air System
The Unit 1 and 2 Compressed Air Systems contain approximately 2350 feet of buried coated carbon steel pipe which is within the scope of license renewal, approximately 1700 feet of which is classified as safety-related.

To support the license renewal commitment, at least one location will be selected from the buried safety-related portion of the Compressed Air System for inspection during each ten year period, beginning ten years prior to entry into the period of extended operation. Salem will inspect a different segment in each ten year period. These inspections of the Compressed Air System will provide a representative sample of safety-related buried coated carbon steel pipe within the scope of license renewal. They will also provide reasonable assurance that loss of carbon steel material aging effects will be adequately managed so that the intended function of buried Compressed Air System pipe will be maintained consistent with the current licensing basis during the period of extended operation. The commitment clarification described above is included in Enclosures B and C of this letter.

Fire Protection System
Buried portions of the Unit 1 and 2 Fire Protection Systems within the scope of license renewal are coated carbon steel, ductile iron, and gray cast iron piping and fittings that do not contain hazardous materials.

> **Buried Fire Protection System Carbon Steel Pipe**
> At Salem, 12-inch and 10-inch buried fire mains within the scope of license renewal supply fire water from the fire pumps to the Auxiliary, Turbine, and Containment Buildings. Approximately 150 feet of these fire mains are externally-coated carbon steel pipe.
>
> To support the license renewal commitment, at least one location will be selected from buried Fire Protection carbon steel buried fire mains within the

scope of license renewal for inspection during each ten year period, beginning ten years prior to entry into the period of extended operation. These inspections will provide a representative sample for buried coated carbon steel pipe in the Fire Protection System. They will also provide reasonable assurance that loss of carbon steel material aging effects will be adequately managed so that the intended function of buried Fire Protection System pipe will be maintained consistent with the current licensing basis during the period of extended operation.

Buried Fire Protection System Ductile Iron and Gray Cast Iron
At Salem, most of the buried 12-inch and 10-inch fire mains that supply fire water from the fire pumps to the Auxiliary, Turbine, and Containment Buildings are externally-coated ductile iron piping with gray cast iron components. The Fire Protection System is the only system within the scope of license renewal that contains buried ductile iron and gray cast iron piping and components. Therefore, one excavation and inspection of ductile iron piping and one excavation and inspection of gray cast iron buried components will be performed on the Fire Protection System to fulfill the commitments to inspect these materials during each ten year period, beginning ten years prior to entry into the period of extended operation.

Demineralized Water, Non-radioactive Drain, and Circulating Water Systems

The Demineralized Water System contains approximately 400 feet of non safety-related, buried, coated carbon steel piping that is within the scope of license renewal.

The Non-radioactive Drain System contains approximately 100 feet of non safety-related, buried, coated carbon steel piping that is within the scope of license renewal.

During the review of information in support of this RAI, it was identified that the Circulating Water System contains approximately 10 feet of non safety-related, buried, coated carbon steel piping that is within the scope of license renewal, but was inadvertently omitted from the aging management review summary contained in the LRA.

As a result of this finding, LRA Table 3.3.2-4 (page 3.3-156) is revised to include the line items for Carbon Steel piping and fittings exposed to external groundwater/soil and internal raw water environments. In addition, LRA Section 3.3.2.1.4, "Circulating Water system" (page 3.3-7), LRA Section 3.3.2.2.8, "Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC)" (page 3.3-43), and LRA Table 3.3.1, Item Number 3.3.1-19 (page 3.3-64) and Item Number 3.3.1-76 (page 3.3-103) are revised as shown in Enclosure B of this letter.

Summary
The committed inspections for carbon steel pipe, as stated in LRA Table A.5, "License Renewal Commitment List", Item 22, will be performed on buried safety-related segments, and on carbon steel Fire Protection System main segments. Therefore, inspection results will be biased towards systems that perform more safety significant functions. Conditions such as missing or damaged coating or degraded piping will be entered into the corrective action program where the need for additional inspections may be planned as part of the extent of condition evaluations. This would include all systems within the scope of license renewal.

Based on the discussion above, the committed inspections for one carbon steel segment each, on safety related portions of the Service Water, Auxiliary Feedwater, and Compressed Air Systems, as well as one carbon steel segment on Fire Protection System mains, during each ten year period, beginning ten years prior to entry into the period of extended operation, will provide reasonable assurance that loss of carbon steel material aging effects will be adequately managed so that the intended function of buried carbon steel portions of these systems will be maintained consistent with the current licensing basis during the period of extended operation.

Also, the additional committed inspections of buried ductile iron and gray cast iron, for a total of six steel inspections during each ten year period, beginning ten years prior to entry into the period of extended operation, provides reasonable assurance that the loss of material aging effect of buried steel will be adequately managed so that the intended function of these systems will be maintained consistent with the current licensing basis during the period of extended operation. Six steel inspections during each ten year period, beginning ten years prior to entry into the period of extended operation exceeds the recommended number of inspections in Table 4a "Inspection of Buried Pipe" in AMP XI.M41, NUREG-1801, Draft Revision 2, Generic Aging Lessons Learned Report (September 23, 2010 Version for Advisory Committee on Reactor Safeguards).

c) i. There are no buried portions of the Non-radioactive Drain System within the scope of license renewal that contain hazardous materials during normal operation.

ii. Based on the response to "c) i.", a response to this section is not necessary.

d) i. Direct buried metallic portions of the systems within the scope of license renewal were backfilled during original construction in accordance with construction backfill specifications. Bedding material within at least 6 inches of the pipe was required to be granular chrome ore or granular limestone. Backfill more than 6 inches from the pipe contained a coarser material of up to 3½ inches in diameter. These requirements are consistent with NACE SP0169-2007, section 5.2.3, and ASTM D 448-8.

Plant procedures require that these specifications are followed during repair, inspection, and replacement activities when buried piping is backfilled.

ii. Existing Buried Pipe Program inspection procedures require documentation of degraded coating and factors contributing to the degradation (e.g. foreign objects). The procedure specifically requires documenting observed stones in excavated soil

regardless of whether the coating is damaged. Review of the reports for the inspections described in Salem LRA Appendix B.2.1.22 and PSEG's response to RAI B.2.1.22 show that excavated soil was sand and fillcrete with no large stones or foreign objects. Analysis of the soil removed during the 2010 AFW and Compressed Air line excavations indicate that the excavated sand was consistent with the original specifications.

Therefore, based on the original construction backfill specifications, recent inspection results which indicate no coating damage due to coarse backfill, and the procedure requirements to document contributing factors for coating degradation and the presence of stones, the planned inspections are adequate to detect potential degradation of buried piping and damage to the respective coatings.

Enclosure B

Salem Generating Station License Renewal Application Updates

Note: To facilitate understanding, portions of the original LRA have been repeated in this Enclosure, with revisions indicated. Existing LRA text is shown in normal font. Changes are highlighted with ***bolded italics*** for inserted text and strikethroughs for deleted text.

LRA Section 3.3.2.1.4, "Circulating Water System" on pages 3.3-7 and 3.3-8 is revised as shown below to add the "Carbon Steel" material type. Revisions are indicated with ***bolded italics*** for inserted text.

3.3.2.1.4 Circulating Water System

Materials

The materials of construction for the Circulating Water System components are:

- Carbon and Low Alloy Steel Bolting
- ***Carbon Steel***
- Reinforced Concrete

Aging Management Programs

The following aging management programs manage the aging effects for the Circulating Water System components:

- Bolting Integrity (B.2.1.9)
- Buried Non-Steel Piping Inspection (B.2.2.4)
- ***Buried Piping Inspection (B.2.1.22)***
- Open-Cycle Cooling Water System (B.2.1.11)

LRA section 3.3.2.2.8, "Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC)" on pages 3.3-43 and 3.3-44, is revised as shown below. Revisions are indicated with ***bolded italics*** for inserted text.

3.3.2.2.8 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC)

Loss of material due to general, pitting, crevice corrosion, and microbiologically-influenced corrosion (MIC) could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

Salem will implement a Buried Piping Inspection program, B.2.1.22, to manage the loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion of the steel (including cement lined), gray cast iron, ductile cast iron piping, piping and fittings, fire hydrants, and valve(s) exposed to soil in the ***Circulating Water,*** Compressed Air, Fire Protection, Service Water, and Non-radioactive Drain systems. The Buried Piping Inspection aging management program manages buried steel piping and components for loss of material through the use of coatings and wrappings, and periodic inspections. The program relies on preventive measures such as coating and wrapping to mitigate corrosion and periodic inspection of external surfaces to identify coating degradation, if coated, or base metal corrosion, if uncoated. These inspections assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Buried Piping Inspection program is described in Appendix B.

LRA Table 3.3.1, "Summary of Aging Management Evaluations for the Auxiliary Systems" items 3.3.1-19 and 3.3.1-76 on pages 3.3-64 and 3.3-103, respectively, are revised as shown below. Revisions are indicated with ***bolded italics*** for inserted text.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-19	Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	Consistent with NUREG-1801. The Buried Piping Inspection program, B.2.1.22, will be used to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion of the steel structural components exposed to soil in the ***Circulating Water,*** Compressed Air, Fire Protection, Non-radioactive Drain, and Service Water Systems. See Subsection 3.3.2.2.8. Components in the Fire Protection system have been aligned to this item number based on material, environment and aging effect. The Aboveground Steel Tank program, B.2.1.17, will be substituted to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion of the steel tanks exposed to soil for the Fire Protection System. Components in the Containment Structure, and Fuel Handling Building have been aligned to this item number based on material, environment and aging effect. The Buried Non-Steel Piping Inspection, B.2.2.4, will be substituted to manage loss of material

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					due to general, pitting, crevice, and microbiologically-influenced corrosion of the steel structural components exposed to soil for the Containment Structure, and Fuel Handling Building System. Components in the Service Water Intake Structures have been aligned to this item number based on material, environment and aging effect. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.34 will be substituted to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion of the steel penetration sleeves exposed to soil for the Service Water Intake. Components in the Auxiliary Building, Pipe Tunnel, Switchyard, Turbine Building, Shore Protection and Dike, Service Building, Office Building, Containment Structure, Fire Pump House, and Yard Structures have been aligned to this item number based on material, environment and aging effect. The Structures Monitoring Program, B.2.2.5, will be substituted to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion of the steel piping, piping components, piping elements, and structural members exposed

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					to soil for these systems and structures.
3.3.1-76	Steel piping, piping components, and piping elements (without lining/coating or with degraded lining/coating) exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, fouling, and lining/coating degradation	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System program, B.2.1.11, will be used to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling of the steel piping, piping components and piping elements (without lining or with degraded lining), exposed to raw water for the ***Circulating Water and*** Service Water Systems.

LRA Table 3.3.2-4, "Circulating Water System", on page 3.3-156 is revised as shown below to add two line items which address Carbon Steel Piping and Fitting in "Groundwater/soil (External)" and "Raw Water (Internal)" environments. Revisions are indicated with ***bolded italics*** for inserted text.

Table 3.3.2-4 Circulating Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	*Pressure Boundary*	*Carbon Steel*	*Groundwater/ soil (External)*	*Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion*	*Buried Piping Inspection*	*VII.C1-18*	*3.3.1-19*	*A*
Piping and Fittings	*Pressure Boundary*	*Carbon Steel*	*Raw Water (Internal)*	*Loss of Material/General, Pitting, Crevice, Microbiologically Influenced Corrosion, and Fouling*	*Open-Cycle Cooling Water System*	*VII.C1-19*	*3.3.1-76*	*A*

LRA Appendix A, Section A.2.1.22, "Buried Piping Inspection" on pages A-20 and A-21 is revised as shown below. These revisions supersede the revisions in PSEG's response to Salem RAI B.2.1.22, contained in PSEG letter LR-N10-0322 dated September 07, 2010, as shown below. Revisions are indicated with strikethroughs for deleted text and ***bolded italics*** for inserted text.

A.2.1.22 Buried Piping Inspection

The Buried Piping Inspection aging management program is an existing program that manages the external surface aging effects of loss of material for piping and components in a soil or groundwater (external) environment. The Salem buried component activities consist of preventive and condition-monitoring measures to manage, detect and monitor the loss of material due to external corrosion for piping and components in the scope of license renewal that are in a soil environment.

External inspections of buried components will occur opportunistically when they are excavated during maintenance.

The Buried Piping Inspection aging management program will be enhanced to include:

1. At least one (1) opportunistic or focused excavation and inspection will be performed on each of the material groupings, which include carbon steel, ductile cast iron, and gray cast iron piping and components during each ten (10) year period, beginning ten (10) years prior to entry into the period of extended operation.

2. At least three (3) additional opportunistic or focused excavations and inspections will be performed on carbon steel piping and components during each ten (10) year period, beginning ten (10) years prior to entry into the period of extended operation. These inspections will be on buried piping segments in ***safety-related portions of the Auxiliary Feedwater, Service Water, and Compressed Air*** systems within the scope of license renewal~~, that have high-risk buried piping~~. ***A different segment for each system will be inspected in each ten year period.***

These enhancements will be implemented prior to the period of extended operation, with the inspections performed in accordance with the schedule described above.

LRA Appendix B, Section B.2.1.22, "Buried Piping Inspection" on pages B-110 through B-113 is revised as shown below. These revisions supersede the revisions in PSEG's response to Salem RAI B.2.1.22, contained in PSEG letter LR-N10-0322 dated September 07, 2010, as shown below. Revisions are indicated with strikethroughs for deleted text and ***bolded italics*** for inserted text.

B.2.1.22 Buried Piping Inspection

Program Description

The Buried Piping Inspection aging management program is an existing program that includes preventive measures such as coating and wrapping to mitigate corrosion and periodic inspection of external surfaces for loss of material to detect and monitor the effects of corrosion on the external surface of buried steel piping and components in a soil or groundwater (external) environment. The program provides for managing loss of material due to general corrosion, pitting, crevice corrosion and microbiologically-influenced corrosion (MIC). Preventive measures are in accordance with standard industry practices for maintaining external coatings and wrappings.

Salem does not have any buried tanks in the scope of license renewal.

External inspections of buried components using visual techniques will occur opportunistically when they are excavated during maintenance. The Buried Piping Inspection aging management program will be enhanced to include at least one (1) opportunistic or focused excavation and inspection on each of the material groupings, which include carbon steel, ductile cast iron, and gray cast iron piping and components during each ten (10) year period, beginning ten (10) years prior to entry into the period of extended operation.

At least three (3) additional opportunistic or focused excavations and inspections will be performed on carbon steel piping and components during each ten (10) year period, beginning ten (10) years prior to entry into the period of extended operation. These inspections will be on buried piping segments in ***safety-related portions of the Auxiliary Feedwater, Service Water, and Compressed Air*** systems within the scope of license renewal ~~that have high risk buried piping~~. ***A different segment for each system will be inspected in each ten year period.***

Any coating and wrapping degradation is reported and evaluated according to site corrective actions procedures. External component degradation is reported and evaluated whenever buried commodities are uncovered during yard excavation activities, which includes bolting. The Bolting Integrity program addresses the aging management of buried bolting. In addition, evidence of metal surface corrosion and any leakage detected through periodic testing and visual inspections will be evaluated and used to confirm the system and components ability to perform their intended functions. Any leakage identified is evaluated and appropriate corrective actions are implemented.

The program will be enhanced as described below to provide reasonable assurance that buried piping and components of all steel materials that are in scope of the Buried Piping Inspection program, including carbon steel, ductile cast iron, and gray cast iron at Salem will perform their intended function during the period of extended operation.

NUREG-1801 Consistency

There are no buried tanks at Salem units that are in scope for license renewal. The Buried Piping Inspection aging management program is consistent with the ten elements of aging management program XI.M34, "Buried Piping and Tanks Inspection," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented:

1. The Buried Piping Inspection aging management program will be enhanced to include at least one (1) opportunistic or focused excavation and inspection on each of the material groupings, which include carbon steel, ductile cast iron, and gray cast iron piping and components during each ten (10) year period, beginning ten (10) years prior to entry into the period of extended operation. **Program Elements Affected: Detection of Aging Effects (Element 4)**

2. At least three (3) additional opportunistic or focused excavations and inspections will be performed on carbon steel piping and components during each ten (10) year period, beginning ten (10) years prior to entry into the period of extended operation. These inspections will be on buried piping segments in ***safety-related portions of the Auxiliary Feedwater, Service Water, and Compressed Air*** systems within the scope of license renewal ~~that have high-risk buried piping~~. ***A different segment for each system will be inspected in each ten year period.*** **Program Elements Affected: Detection of Aging Effects (Element 4)**

Operating Experience

Operating experience shows that the program described is effective in managing corrosion of external surfaces of buried steel piping. As the inspection frequency is plant-specific and depends on the plant operating experience, the Salem plant-specific operating experience is further evaluated for the extended period of operation. Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion are being adequately managed. The following examples of operating experience provide objective evidence that the Buried Piping Inspection program will be effective in assuring that intended function(s) would be maintained consistent with the CLB for the period of extended operation:

1. In 2004, buried carbon steel piping in the Salem Unit 1 Fuel Oil System was excavated to repair leakage at a welded joint. The socket-welded joint was not properly wrapped with a protective tape. The wrap for this joint was originally missing altogether and the leakage was caused by direct exposure to groundwater and subsequent corrosion, not by aging. The joint was repaired and proper wrapping was applied. No further problem has been identified with this or any other portions of the buried carbon steel piping of the Fuel Oil System. The affected portion of the Fuel Oil System was not in scope for license renewal. This example provides objective evidence that buried piping is opportunistically inspected whenever they are excavated for maintenance, and that corrective actions are taken prior to loss of intended function.

2. In 2001, a section of the buried No. 12 service water piping at Salem Unit 1 was excavated to determine the cause of leakage. The cause of leakage was a break in the steel bell ring, which is installed over one pipe joint section of the service water piping. The apparent cause of this break was due to external loads from the road surface, and not caused by age-related degradation. The break was repaired and the external concrete coating was reapplied. Additionally, a Ram-Neck sealant was reapplied over the entire section of the bell, to prevent water intrusion. This sealant had to be replaced because of being displaced at the leak site. Additionally, the Ram-Neck sealant was top-coated with a flexible paint. Also, a WEKO seal was installed (internally) over the steel bell ring. An extent of condition study, as well as internal corrosion of some other bell-and-spigot joints, resulted in installation of WEKO seals on bell-and-spigot joints for all service water headers internally. With the exception of No. 11 service water header, all service water header joints now incorporate WEKO seals. Work on No. 11 service water header joints is planned for 2010.

   During this excavation, a section of coated carbon steel piping that discharges the backwash of the service water strainers was excavated and no deficiencies were identified.

   This provides objective evidence that excavation and inspection of piping and components have been occurring opportunistically at Salem.

3. In 2008, risk ranking of buried piping at Salem revealed that portions of the carbon steel Service Water piping were determined to be high risk. As a result, a plan was developed to conduct inspection of the external coated carbon steel through-wall penetrations of the 24-inch service water underground spools at the Service Water Intake Structure, entrance and exit of the pipe tunnel, entrance to the Auxiliary Building and entrance to the Diesel Building. Further evaluation is underway to determine if this inspection can be performed using non-destructive examination of piping (from the inside diameter) or if excavation will be required.

   This inspection, which is scheduled to take place during a refueling outage in October of 2009, provides objective evidence that an appropriate risk ranking methodology is in place and that focused inspection of the outer coating of the buried steel piping was planned as part of this aging management program.

A review of plant operating experience showed that excavation of buried piping has occurred, and no instances of significant age related deficiencies were documented. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Buried Piping Inspection program will effectively identify degradation prior to failure. The work planning process provides instructions to do exterior surface inspections when excavations occur. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Buried Piping Inspection program are planned, to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Buried Piping Inspection aging management program will provide reasonable assurance that loss of material aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

Enclosure C

Salem Generating Station License Renewal Commitments Updates

Note: To facilitate understanding, portions of the original LRA Appendix A, Table A.5, License Renewal Commitment List", have been repeated in this Enclosure, with revisions indicated. Existing text is shown in normal font. Changes are highlighted with ***bolded italics*** for inserted text and strikethroughs for deleted text.

LRA Appendix A, Table A.5, "License Renewal Commitment List", commitment 22 on page A-65 is revised as shown below. These revisions supersede the revisions in PSEG's response to Salem RAI B.2.1.22, contained in PSEG letter LR-N10-0322 dated September 07, 2010, as shown below. Any other actions described in this submittal represent intended or planned actions. They are described for the NRC's information and are not regulatory commitments. Revisions are indicated with strikethroughs for deleted text and ***bolded italics*** for inserted text.

A.5 License Renewal Commitment List

22	Buried Piping Inspection	Buried Piping Inspection is an existing program that will be enhanced to include: 1. At least one (1) opportunistic or focused excavation and inspection will be performed on each of the material groupings, which include carbon steel, ductile cast iron, and gray cast iron piping and components during each ten (10) year period, beginning ten (10) years prior to entry into the period of extended operation. 2. At least three (3) additional opportunistic or focused excavations and inspections will be performed on carbon steel piping and components during each ten (10) year period, beginning ten (10) years prior to entry into the period of extended operation. These inspections will be on buried piping segments in ***safety-related portions of the Auxiliary Feedwater, Service Water, and Compressed Air*** systems within the scope of license renewal ~~that have high-risk buried piping~~. ***A different segment for each system will be inspected in each ten year period.***	A.2.1.22	Program to be enhanced prior to the period of extended operation. Inspection Schedule identified in Commitment	Section B.2.1.22 Salem Letter LR-N10-0322 RAI B.2.1.22 ***Salem Letter LR-N10-0372 RAI B.2.1.22-02***