From: Peter Wen
To: Internet:jzabel@atlintl.com; Internet:Mporr@atlintl.com
Date: 07/26/2006 4:38:22 PM
Subject: Revised AMR 3.4 Input

Mark/Joe,

Attached is my revised AMR 3.4 input, incorporating the infomation provided in the applicant's 07/19/2006 letter and earlier Erach's comments. As of today, the ADAMS number for the 07/19/2006 letter is still not available. It needs to be filled in when it becomes available. Please process this input from your ends. Thank you.

Peter

CC: internet:erachp@comcast.net; James Davis

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Subject:	Revised AMR 3.4 Input
Creation Date	07/26/2006 4:38:14 PM
From:	Peter Wen
Created By:	PXW@nrc.gov

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3.4 Aging Management of Steam and Power Conversion System

This section of the audit and review report document the project team's review and evaluation of PNPS aging management review (AMR) results for the aging management of the steam and power conversion system component and component groups associated with the following systems:

- condensate storage system
- main steam system, turbine-generator and auxiliaries, and main condenser
- miscellaneous systems within the steam and power conversion system in scope for 10 CFR 54.4(a)(2). (These steam and power conversion subsystems are included by PNPS in LRA Section 3.3, Auxiliary Systems, but are evaluated in this section.)

3.4.1 Summary of Technical Information in the Application

In the PNPS LRA Section 3.4, the applicant provided the results of its AMRs for the steam and power conversion system components and component groups.

In PNPS LRA Table 3.4.1, "Summary of Aging Management Program for Steam and Power Conversion System," the applicant provided a summary comparison of its AMR line-items with the AMR line-items evaluated in the GALL Report for the steam and power conversion system components and component groups. The applicant also identified for each component type in the PNPS LRA Table 3.4.1 those components that are consistent with the GALL Report, those for which the GALL Report recommends further evaluation, and those components that are not addressed in the GALL Report together with the basis for their exclusion.

In the PNPS LRA Tables 3.4.2-1 and 3.4.2-2, the applicant provided a summary of the AMR results for component types associated with (1) condensate storage system, (2) main steam system, (3) turbine-generator and auxiliaries, and (4) main condenser system.

In the PNPS LRA Tables 3.3.2-14-1, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18 and 3.3.2-14-35, the applicant provided results for component types associated with the following steam and power conversion subsystems in scope for 10 CFR 54.4(a)(2):

- Circulating Water System, Nonsafety-Related Components Affecting Safety-Related Systems (CWS)
- Condensate System, Nonsafety-Related Components Affecting Safety-Related Systems
- Condensate Demineralizer System, Nonsafety-Related Components Affecting Safety-Related Systems (CDS)
- Condensate Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems (CST)
- Extraction Steam System, Nonsafety-Related Components Affecting Safety-Related Systems
- Feedwater System, Nonsafety-Related Components Affecting Safety-Related Systems
- Feedwater Heater Drains and Vents System, Nonsafety-Related Components Affecting Safety-Related Systems

- Main Condenser System, Nonsafety-Related Components Affecting Safety-Related Systems
- Main Steam System, Nonsafety-Related Components Affecting Safety-Related Systems
- *Turbine Generator and Auxiliary System, Nonsafety-Related Components Affecting Safety-Related Systems*

Specifically, the information for each component type includes intended function, material, environment, aging effect requiring management, AMPs, the GALL Report Volume 2 item, cross reference to the PNPS LRA Table 3.4.1 (Table 1), and generic and plant-specific notes related to consistency with the GALL Report.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effect requiring managements (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.4.2 Project Team Evaluation

The project team reviewed PNPS LRA Section 3.4 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team reviewed certain identified AMR line-items to confirm the applicant's claim that these AMR line-items were consistent with the GALL Report. The project team did not repeat its review of the matters described in the GALL Report. However, the project team did verify that the material presented in the PNPS LRA was applicable and that the applicant had identified the appropriate GALL Report AMR line-items. The project team's audit evaluation is documented in Section 3.4.2.1 of this audit and review report. In addition, the project team's evaluations of the AMPs are documented in Section 3.0.3 of this audit and review report.

The project team reviewed those selected AMR line-items for which further evaluation is recommended by the GALL Report. The project team confirmed that the applicant's further evaluations were in accordance with the acceptance criteria in SRP-LR. The project team's audit evaluation is documented in Section 3.4.2.2 of this audit and review report.

The project team also reviewed of the remaining AMR line-items that were not consistent with or not addressed in the GALL Report to determine whether or not these AMRs are technical acceptable. The audit included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The project team's evaluation is documented in Section 3.4.2.3 of this audit and review report.

Finally, the project team reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the steam and power conversion system components.

Table 3.4-1 below provides a summary of the project team's evaluation of components, aging effects/aging mechanisms, and AMPs listed in LRA Section 3.4 that are addressed in the GALL Report. It also includes the section of the audit and review report in which the project team's evaluation is documented.

Table 3.4-1 Project Team Evaluation for Steam and Power Conversion System Components in the GALL Report

Item No.	Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Project Team Evaluation
3.4.1-1	Steel piping, piping components, and piping elements exposed to steam or treated water	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.1)
3.4.1-2	Steel piping, piping components, and piping elements exposed to steam	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry (B.1.32.2)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.2.1)
3.4.1-3	PWR Only				
3.4.1-4	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry (B.1.32.2)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.2.1)
3.4.1-5	Steel heat exchanger components exposed to treated water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Water Chemistry (B.1.32.2)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.9)

Item No.	Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Project Team Evaluation
3.4.1-6	Steel and stainless steel tanks exposed to treated water	Loss of material due to general (steel only) pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry-BWR (B.1.32.2)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.7.1 and 3.4.2.2.2.1 for steel tanks)
3.4.1-7	Steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to general, pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Oil Analysis (B.1.22)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.2.2)
3.4.1-8	Steel piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Plant specific	Periodic Surveillance and Preventative Maintenance (B.1.24)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.3)
3.4.1-9	Stainless steel and copper alloy heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	None	Not applicable at PNPS. See Audit Report Section 3.4.2.2.4.1.
3.4.1-10	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	None	Not applicable at PNPS. See Audit Report Section 3.4.2.2.4.2.
3.4.1-11	Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) 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	None	Not applicable at PNPS. See Audit Report Section 3.4.2.2.5.1.

Item No.	Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Project Team Evaluation
3.4.1-12	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	None	Not applicable at PNPS. See Audit Report Section 3.4.2.2.5.2.
3.4.1-13	Stainless steel piping, piping components, piping elements exposed to steam	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Water Chemistry-BWR (B.1.32.2)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.6)
3.4.1-14	Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water > 60°C (> 140°F)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Water Chemistry-BWR (B.1.32.2)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.6)
3.4.1-15	Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry-BWR (B.1.32.2)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.7.1)
3.4.1-16	Stainless steel piping, piping components, and piping elements; tanks, and heat exchanger components exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry-BWR (B.1.32.2)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.7.1)
3.4.1-17	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	Plant specific	Buried Piping and Tanks Inspection (B.1.2)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.7.2)

Item No.	Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Project Team Evaluation
3.4.1-18	Copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Oil Analysis (B.1.22)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.7.3)
3.4.1-19	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Oil Analysis (B.1.22)	Consistent with GALL, which recommends further evaluation. (See Audit Report Section 3.4.2.2.8)
3.4.1-20	Steel tanks exposed to air - outdoor (external)	Loss of material/ general, pitting, and crevice corrosion	Aboveground Steel Tanks	System Walkdown Program (B.1.30)	Consistent with GALL. (See Audit Report Section 3.4.2.1.1)
3.4.1-21	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.
3.4.1-22	Steel bolting and closure bolting exposed to air with steam or water leakage, air - outdoor (external), or air - indoor uncontrolled (external);	Loss of material due to general, pitting and crevice corrosion; loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	Bolting Integrity Program (B.1.33)	Consistent with GALL. (See Audit Report Section 3.4.2.1.2)
3.4.1-23	Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water > 60°C (> 140°F)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.
3.4.1-24	Steel heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.

Item No.	Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Project Team Evaluation
3.4.1-25	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.
3.4.1-26	Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.
3.4.1-27	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.
3.4.1-28	Steel external surfaces exposed to air - indoor uncontrolled (external), condensation (external), or air outdoor (external)	Loss of material due to general corrosion	External Surfaces Monitoring	System Walkdown Program (B.1.30)	Consistent with GALL. (See Audit Report Section 3.4.2.1)
3.4.1-29	Steel piping, piping components, and piping elements exposed to steam or treated water	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion (B.1.11)	Consistent with GALL. (See Audit Report Section 3.4.2.1)
3.4.1-30	Steel piping, piping components, and piping elements exposed to air outdoor (internal) or condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Periodic Surveillance and Preventive Maintenance Program (B.1.24)	Consistent with GALL. (See Audit Report Section 3.4.2.1.1)
3.4.1-31	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	Periodic Surveillance and Preventive Maintenance Program (B.1.24)	Consistent with GALL. (See Audit Report Section 3.4.2.1.3)

Item No.	Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Project Team Evaluation
3.4.1-32	Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	Periodic Surveillance and Preventive Maintenance Program (B.1.24)	Consistent with GALL. (See Audit Report Section 3.4.2.1.3)
3.4.1-33	Stainless steel heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.
3.4.1-34	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.
3.4.1-35	Copper alloy >15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Selective Leaching of Materials	Selective Leaching of Materials (B.1.25)	Consistent with GALL. (See Audit Report Section 3.4.2.1)
3.4.1-36	Gray cast iron piping, piping components, and piping elements exposed to soil, treated water, or raw water	Loss of material due to selective leaching	Selective Leaching of Materials	Selective Leaching of Materials (B.1.25)	Consistent with GALL. (See Audit Report Section 3.4.2.1)
3.4.1-37	Steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements exposed to steam	Loss of material due to pitting and crevice corrosion	Water Chemistry	Water Chemistry-BWR (B.1.32.2)	Consistent with GALL. (See Audit Report Section 3.4.2.1)
3.4.1-38	PWR Only				
3.4.1-39	PWR Only				
3.4.1-40	Glass piping elements exposed to air, lubricating oil, raw water, and treated water	None	None	None	Consistent with GALL. (See Audit Report Section 3.4.2.3.2)

Item No.	Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Project Team Evaluation
3.4.1-41	Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external)	None	None	None	Consistent with GALL. (See Audit Report Section 3.4.2.3.2)
3.4.1-42	Steel piping, piping components, and piping elements exposed to air - indoor controlled (external)	None	None	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.
3.4.1-43	Steel and stainless steel piping, piping components, and piping elements in concrete	None	None	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.
3.4.1-44	Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	None	Not applicable at PNPS. See Audit Report Section 3.4.2.3.

3.4.2.1 AMR Results That Are Consistent with The GALL Report

Summary of Information in the Application

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the PNPS LRA is acceptable.

In PNPS LRA Sections 3.4.2.1 and 3.3.2.1.14, the applicant identified the materials, environments, and aging effects requiring management, and aging management programs for the following steam and power conversion systems:

- condensate storage system
- main steam system, turbine-generator and auxiliaries, and main condenser
- miscellaneous systems within the steam and power conversion system in scope for 10 CFR 54.4(a)(2).

The applicant identified the following programs that manage the aging effects related to the above steam and power conversion systems:

- Buried Piping and Tank Inspection (B.1.2)
- Flow Accelerated Corrosion Program (B.1.14)
- Periodic Surveillance and Preventive Maintenance (B.1.24)
- Selective Leaching Program (B.1.27)
- System Walkdown (B.1.30)
- Water Chemistry Control - BWR Program (B.1.32.2)
- Water Chemistry Control - Auxiliary Systems Program (B.1.32.1)
- One-Time Inspection (B.1.23)
- Oil Analysis (B.1.22)
- Bolting Integrity Program (B.1.33)

Project Team Evaluation

The project team reviewed its assigned PNPS LRA AMR line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the condensate system, condensate transfer system, feedwater system, main condenser, main generator and auxiliary system, main steam system, and main turbine and auxiliary system components that are subject to an AMR.

3.4.2.1.1 Loss of Material Due to General, Pitting, and Crevice Corrosion

In LRA Table 3.4.2-1, Condensate Storage System (Page 3.4-29), that cites Table 3.4.1, Items 3.4.1-20 and 3.4.1-30, the applicant proposed to manage loss of material of steel tanks (condensate storage tanks) exposed to air-outdoor external environment and condensation internal environment using AMP B.1.30, "System Walkdown Program" and AMP B.1.24, " Periodic Surveillance and Preventive Maintenance Program," respectively. However, the AMP recommended by the GALL Report for this AERM is GALL AMP XI.M29, "Aboveground Steel Tanks Program." The applicant included a reference to Note E to the associated Table 2 line items, indicating a different AMP is credited.

The project team reviewed the AMR results lines referenced to Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report. The project team reviewed the applicant's System Walkdown Program and Periodic Surveillance and Preventive Maintenance Program and the evaluation is documented in Section 3.0.3.1.11 and Section 3.0.3.3.5 of this audit and review report, respectively. The project team found the use of System Walkdown Program and Periodic Surveillance and Preventive Maintenance Program to manage loss of material due to general, pitting, and crevice corrosion for condensate storage tank to be acceptable because both programs manage material degradation through visual inspections. However, GALL Report, Aboveground Steel Tanks Program has some detection of aging effects attributes associated with it that are not addressed in the System Walkdown Program and Periodic Surveillance and Preventive Maintenance Program. For example, the GALL AMP specifies that thickness measurement of the tank bottom is to be taken to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation. The project team asked the applicant to clarify how this detection of aging effects at the tank bottom surface will be performed.

In a letter dated July 19, 2006 **(MIxxxxxxxxx)**, the applicant stated that to ensure that significant degradation on the bottom of the condensate storage tanks is not occurring, a one-time ultrasonic thickness examination in accessible areas on the tank bottom will be performed. The applicant also stated that standard examination and sampling techniques will be utilized. This is identified as license renewal commitment number 36. In addition, the applicant revised LRA Table 3.4.1, Item 3.4.1-20 to specify the one-time inspection program to ensure that significant degradation on the bottom of the condensate storage tanks is not occurring. The applicant also stated that LRA Section B.1.23 program description and LRA Section A.2.1.25 were revised to include a one-time inspection activity of an ultrasonic thickness examination on the bottom of the condensate storage tanks prior to the period of extended operation.

On the basis of its review, the project team found that by adding a commitment to perform an UT inspection on the condensate storage tank bottom, the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.4.2.1.2 <u>Loss of Material Due to General, Pitting, and Crevice Corrosion; Loss of Preload due to Thermal Effects, Gasket Creep, and Self-loosening</u>

The applicant does not include a Bolting Integrity Program in the PNPS LRA. Instead, the applicant credits System Walkdown Program to manage loss of material for steel bolting. The GALL Report AMP, XI.M18, "Bolting Integrity", provides several recommendations in the 10-element evaluation such as selection of bolting materials, use of lubricants and sealants, and additional recommendations of NUREG-1339. The System Walkdown Program may be acceptable for inspection, however, it does not address the preventive actions. For LRA Section 3.4, this applies to Table 3.4.1, Item 3.4.1-22. The project team asked the applicant to clarify how PNPS meets these recommendations or provide justification why a bolting program should not be provided.

In its response, the applicant stated that a Bolting Integrity program will be developed that will address the aging management of bolting in the scope of license renewal. Also, a copy of the aging management program basis will be provided for review. The LRA will be supplemented to include descriptions of Bolting Integrity Program in Appendices A and B and to identify where the program is applicable. Subsequently, in a letter dated July 19, 2006 **(MLxxxxxxxxx)**, the applicant provided a ten-element description of its Bolting Integrity program, LRA Appendix B.1.33, and stated that the program applies to all bolting exposed to air with aging effects requiring management except reactor vessel closure studs. The project team reviewed the Bolting Integrity program and the evaluation is documented in Section **3.0.3.2.9** of this audit and review report. The project team concluded that the applicant's Bolting Integrity program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited. On the basis that the applicant's Bolting Integrity program applies to steel bolting and closure bolting exposed to air where the applicant had previously included a reference to Note E, the project team found the taking credit of Bolting Integrity program to be acceptable because it brings the component, material, environment, aging effect and aging management program for these components into conformance with what is described in the GALL report.

On the basis of its review of AMR results lines as described in the preceding paragraphs and its comparison of the applicant's results with corresponding recommendations in the GALL Report, the project team found that the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.4.2.1.3 Loss of Material Due to General, Pitting, Crevice Corrosion, and Microbiologically-Influenced Corrosion

In LRA Table 3.3.2-14-1, condensate storage system, that cites Table 3.4.1, Items 3.4.1-31 and 3.4.1-32, the applicant proposed to manage loss of material of steel heat exchanger (shell) and stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water using AMP B.1.24, "Periodic Surveillance and Preventive Maintenance Program." However, the AMP recommended by the GALL Report for this AERM is GALL AMP XI.M20, "Open-Cycle Cooling Water System Program." The applicant included a reference to Note E to the associated Table 2 line items, indicating a different AMP is credited.

The project team reviewed the AMR results lines referenced to Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report. The project team reviewed the applicant's Periodic Surveillance and Preventive Maintenance Program and its evaluation is documented in Section 3.0.3.3.5 of this audit and review report. The project team found the use of Periodic Surveillance and Preventive Maintenance Program to manage loss of material of steel heat exchanger (shell) and stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water to be acceptable because Periodic Surveillance and Preventive Maintenance Program detects leakage and manages material degradation through periodic visual inspections. The project team concludes that this AMP addressed the aging effect/mechanism, as recommended by the GALL Report.

On the basis of its review, the project team found that the applicant appropriately addressed the loss of material due to general, pitting, crevice corrosion, and microbiologically-influenced corrosion for steel heat exchanger (shell) and stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water.

Conclusion

The project team has evaluated the applicant's claim of consistency with the GALL Report. The project team also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the project team found that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team found that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2 AMR Results For Which Further Evaluation Is Recommended By The GALL Report

Summary of Information in the Application

In PNPS LRA Section 3.4.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the condensate system, condensate transfer system, feedwater system, main condenser, main generator and auxiliary system, main steam system, and main turbine and auxiliary system components and component groups. The applicant also provided information concerning how it will manage the related aging effects.

Project Team Evaluation

For some AMR line-items assigned to the project team in the PNPS LRA Tables 3.4.1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNPS LRA Section 3.4.2.2 against the criteria provided in the SRP-LR Section 3.4.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 AMR line-item in Section 3.4 citing the item in Table 1.

3.4.2.2.1 Cumulative Fatigue Damage

In the PNPS LRA Section 3.4.2.2.1, the applicant states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). The project team's evaluation of this TLAA is addressed separately in Section 4 of this audit and review report.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

3.4.2.2.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.4.2.2.2.1 against the criteria in SRP-LR Section 3.4.2.2.2.1.

SRP-LR Section 3.4.2.2.2.1 states that the loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and for steel piping, piping components, and piping elements exposed to steam. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.2.1, the applicant states that, at PNPS, there are no heat exchanger components included in the steam and power conversion systems except for components in scope solely based on criterion 10 CFR 54.4(a)(2). The condensers are included as part of the main condenser and MSIV leakage pathway but have no aging effects requiring management since their intended function is for holdup and plate-out of radioactive materials.

The applicant also stated that the loss of material due to general, pitting and crevice corrosion for carbon steel piping, piping components, and tanks, exposed to treated water and for carbon steel piping and components exposed to steam is an aging effect requiring management in the steam and power conversion systems at PNPS, and is managed by the Water Chemistry Control – BWR and Periodic Surveillance and Preventive Maintenance (PSPM) Programs. The effectiveness of the water chemistry control-BWR Program will be confirmed by the One-Time Inspection Program (OTI) through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow. The PSPM Program uses visual inspections and other NDE techniques to manage loss of material for carbon steel tanks in the condensate storage system.

In the discussion section of Table 3.4.1, Items 3.4.1-2, 3.4.1-4, and 3.4.1-6, the applicant stated that the OTI Program will be used to verify the effectiveness of the water chemistry program. However, for those line items in Tables 3.4.2-2, and 3.3.2-14-x where these Table 3.4.1 line items are referenced, only the Water Chemistry Control - BWR Program is credited. The project team asked the applicant a generic question to resolve the discrepancy why the OTI Program was not credited in the Table 2 line items that references these Table 1 line items.

In its response, the applicant stated that since the OTI Program is applicable to each water chemistry control program, it is also applicable to each line item in Table 2 that credits a water chemistry control program. LRA Table 3.4.1 indicates that the OTI Program is credited along with the water chemistry control programs for line items where GALL recommends a one-time inspection to confirm water chemistry control. Tables 3.4.2-2 and 3.3.2-14-x credit the OTI Program through reference to the associated Table 1 line item. The applicant further stated that the water chemistry control programs in LRA Appendices A and B will be revised to clearly indicate that the OTI Program will verify the effectiveness of the Water Chemistry Control - BWR Program.

In a letter dated July 19, 2006 **(MLxxxxxxxxx)**, the applicant stated that the effectiveness of the Water Chemistry Control - Auxiliary Systems, BWR, and Closed Cooling Water programs is confirmed by the One-Time Inspection program and that LRA Appendix A (UFSAR Supplement) is revised for these three water chemistry control programs to include the sentence, "The One-Time Inspection Program will confirm the effectiveness of the program."

The project team's evaluation of the "Water Chemistry Control -BWR Program" and "One-Time Inspection Program" is documented in Sections 3.0.3.1.13 and 3.0.3.1.8, respectively, of this audit and review report. The project team reviewed the applicant's water chemistry control - BWR program (AMP B.1.32.2) and verified that this aging management program included activities that monitor and control water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. In addition, the project team verified that the one-time inspection program (AMP B.1.23) included inspection activities to verify the effectiveness of the water chemistry program to manage loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. The project team concluded that these AMPs will adequately manage loss of material due to general, pitting and crevice corrosion for steel piping, piping components, and piping elements exposed to steam and for steel piping, piping components, and piping elements exposed to treated water.

In the discussion column entry of Table 3.4.1-6, the applicant stated that the PSPM program applies to the condensate storage tanks. During the audit and review, the project team asked the applicant to clarify whether it is using PSPM alone to manage the loss of material for the condensate storage tanks. In its response, the applicant stated that it intended to use the water chemistry control- BWR program in conjunction with PSPM to manage the effects of aging for the condensate storage tanks surfaces exposed to the treated water environment. The applicant also stated that the associated LRA Table 2 items will be supplemented to clarify this point.

In a letter dated July 19, 2006 **(MLxxxxxxxxx)**, the applicant stated that "LRA Table 3.4.2-1 is revised to include Water Chemistry Control - BWR Program in addition to Periodic Surveillance and Preventive Maintenance Program (PSPM) to manage aging effects on internal environments of component type tank (condensate storage tanks.)"

The project team found this response acceptable, because the applicant's aging management programs (water chemistry control- BWR program and PSPM) are consistent with the GALL Report recommendations (water chemistry and one-time inspection), with PSPM providing more frequent inspections than OTI.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.2.1 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion [Item 2]

The project team reviewed PNPS LRA Section 3.4.2.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2.2.

SRP-LR Section 3.4.2.2.2.2 states that a loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.2.2, the applicant states that a loss of material due to general, pitting and crevice corrosion for steel piping and components in steam and power conversion systems exposed to lubricating oil is managed by the Oil Analysis Program. This aging effect only applies to components in the turbine generator and auxiliary system and is included in the evaluation of systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) (see Table 3.3.2-14-35). The Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

In the discussion column entry of Table 3.4.1-7, the applicant indicated that it depends on operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the project team asked the applicant how it can make this statement if inspection has not been performed. In its response, the applicant stated that during the performance of routine maintenance on components that contain lubricating oil, visual inspections of these components would identify degraded conditions that could be attributed to an ineffective Oil Analysis Program. The corrective action program at PNPS has a low threshold for the identification of degraded condition such that corrosion or cracking of components would be identified as part of this program. The review of operating experience at PNPS for the last five years did not identify any condition reports that indicated an ineffective Oil Analysis Program or that identified degraded component conditions such as corrosion or cracking in a lubricating oil environment.

During the past five years, many visual inspections of components containing lubricating oil have been performed during corrective and preventive maintenance activities. The visual inspection of these components would identify degraded conditions such as corrosion or cracking that could be attributed to an ineffective Oil Analysis Program. No condition reports that identified degraded component conditions, such as corrosion and cracking in a lubricating oil environment, were initiated as a result of these inspections. These past inspections at PNPS serve in lieu of a one-time inspection to provide confirmation of the effectiveness of the Oil Analysis Program.

The project team reviewed Operating Experience Review Report, LRPD-05, Revision 0, and confirmed that there were no condition reports generated for degraded conditions of components in a lubricating oil environment. On the basis that periodic inspections of components in a lubricating environment are performed during maintenance activities, and that operating experience has shown no degraded conditions, the project team determined that the Oil Analysis Program is appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation. The Oil Analysis Program was evaluated by the project team and found acceptable for managing aging degradation. The project team's evaluation of the Oil Analysis Program is documented in Sections 3.0.3.2.13 of this audit and review report.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.2.2 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by

10 CFR 54.21(a)(3).

3.4.2.2.3 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion (MIC), and Fouling

The project team reviewed PNPS LRA Section 3.4.2.2.3 against the criteria in SRP-LR Section 3.4.2.2.3.

SRP-LR Section 3.4.2.2.3 states that a loss of material due to general, pitting, crevice, and MIC, and fouling could occur in steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

In the PNPS LRA Section 3.4.2.2.3, the applicant states that a loss of material due to general, pitting, crevice, and MIC, and fouling in steel piping, piping components, and piping elements exposed to raw water is managed by the Periodic Surveillance and Preventive Maintenance (PSPM) Program. The PSPM Program uses visual inspections and other NDE techniques to manage loss of material for carbon steel components.

During the audit and review, the project team asked the applicant to identify the specific components in the Circulating Water System that are represented by five line items in Table 3.3.2-14-1, which reference Table 3.4.1, item 3.4.1-8 and credit PSPM Program. The project team finds that the applicant's PSPM Program includes using visual or other NDE techniques to inspect a representative samples of circulating water system to manage internal loss of material. The project team's evaluation of the PSPM Program is documented in Section 3.0.3.3.5 of this audit and review report. The project team concluded that this AMP will assure detection of leakage before the loss of its intended function and that this AMP will adequately manage the loss of material due to general, pitting, crevice, and MIC, and fouling in steel piping, piping components, and piping elements exposed to raw water.

On the basis of its review, the project team found that the applicant appropriately addressed the loss of material due to general, pitting, crevice, and MIC, and fouling for steel piping, piping components, and piping elements exposed to raw water. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

3.4.2.2.4.1 Reduction of Heat Transfer Due to Fouling [Item 1]

The project team reviewed PNPS LRA Section 3.4.2.2.4.1 against the criteria in SRP-LR Section 3.4.2.2.4.1.

SRP-LR Section 3.4.2.2.4.1 states that the reduction of heat transfer due to fouling could occur for stainless steel and copper alloy heat exchanger tubes exposed to treated water. The existing aging management program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may not always have been adequate to preclude fouling. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.4.1, the applicant states that the steam and power conversion system at PNPS have no heat exchanger tubes with an intended function of heat transfer and associated aging effect of fouling. The applicant also stated that regarding Table 3.4.1, Item 3.4.1-9, the only components to which this GALL Report line item applies are in the high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) systems. The project team noted that there are no Table 2 line items in steam and power conversion system that reference Table 3.4.1, item 3.4.1-9.

On the basis that PNPS does not have any components from this group in the steam and power conversion system, the project team found that this aging effect is not applicable to PNPS.

3.4.2.2.4.2 Reduction of Heat Transfer Due to Fouling [Item 2]

The project team reviewed PNPS LRA Section 3.4.2.2.4.2 against the criteria in SRP-LR Section 3.4.2.2.4.2.

SRP-LR Section 3.4.2.2.4.2 states that the reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The existing aging management program relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that fouling is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.4.2, the applicant states that the steam and power conversion system at PNPS have no heat exchanger tubes with an intended function of heat transfer and associated aging effect of fouling. The applicant also stated that regarding Table 3.4.1, item 3.4.1-10, the only components to which this GALL Report line item applies are in the station blackout diesel generator and security diesel generator systems. The project team noted that there are no Table 2 line items in the steam and power conversion system that references Table 3.4.1, Item 3.4.1-10.

On the basis that PNPS does not have any components from this group in the steam and power conversion system, the project team found that, for this component type, this aging effect is not applicable to PNPS.

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

3.4.2.2.5.1 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.4.2.2.5.1 against the criteria in SRP-LR Section 3.4.2.2.5.1.

SRP-LR Section 3.4.2.2.5.1 states that the Loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel (with or without coating or wrapping) piping, piping components, piping elements and tanks exposed to 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 corrosion, 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.

In the PNPS LRA Section 3.4.2.2.5.1, the applicant states that the steam and power conversion system at PNPS have no carbon steel components that are exposed to soil. This item is not applicable to PNPS. The project team noted that there are no Table 2 line items in steam and power conversion system that reference Table 3.4.1, Item 3.4.1-11.

On the basis that PNPS does not have any components from this group, the project team found that this aging effect is not applicable to PNPS.

3.4.2.2.5.2 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion [Item 2]

The project team reviewed PNPS LRA Section 3.4.2.2.5.2 against the criteria in SRP-LR Section 3.4.2.2.5.2.

SRP-LR Section 3.4.2.2.5.2 states that the loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.5.2, the applicant states that the steam and power conversion system at PNPS have no heat exchanger components that are exposed to lubricating oil. This item is not applicable to PNPS. The project team noted that there are no Table 2 line items in steam and power conversion system that reference Table 3.4.1, Item 3.4.1-12.

On the basis that PNPS does not have any components from this group, the project team found that this aging effect is not applicable to PNPS.

3.4.2.2.6 Cracking Due to Stress Corrosion Cracking (SCC)

The project team reviewed PNPS LRA Section 3.4.2.2.6 against the criteria in SRP-LR

Section 3.4.2.2.6

SRP-LR Section 3.4.2.2.6 states that cracking due to SCC could occur in the stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60°C (>140°F), and for stainless steel piping, piping components, and piping elements exposed to steam. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that SCC is not occurring. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.6, the applicant stated that cracking due to SCC in stainless steel components exposed to steam is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

In the discussion section of Table 3.4.1, items 3.4.1-13 and 3.4.1-14, the applicant stated that the One-Time Inspection (OTI) Program will be used to verify the effectiveness of the water chemistry program. However, for those line items in Tables 3.4.2-2, 3.3.2-14-9, 3.3.2-14-16, 3.3.2-14-18, and 3.3.2-14-19 where these Table 3.4.1 line items are referenced in the steam and power conversion system, only the Water Chemistry Control - BWR Program is credited. The project team asked the applicant a generic question to resolve the discrepancy why the OTI Program was not credited in the Table 2 line items that references these Table 1 line items.

In its response, the applicant stated that since the OTI Program is applicable to each water chemistry control program, it is also applicable to each line item in Table 2 that credits a water chemistry control program. LRA Table 3.4.1 indicates that the OTI Program is credited along with the water chemistry control programs for line items where GALL recommends a one-time inspection to confirm water chemistry control. Tables 3.4.2-2 and 3.3.2-14-x credit the OTI Program through reference to the associated Table 1 line item. The applicant further stated that the water chemistry control programs in LRA Appendices A and B will be revised to clearly indicate that the OTI Program will verify the effectiveness of the Water Chemistry Control - BWR Program.

In a letter dated July 19, 2006 **(MLxxxxxxxxx)**, the applicant stated that the effectiveness of the Water Chemistry Control - Auxiliary Systems, BWR, and Closed Cooling Water programs is confirmed by the One-Time Inspection program and that LRA Appendix A (UFSAR Supplement) is revised for these three water chemistry control programs to include the sentence, "The One-Time Inspection Program will confirm the effectiveness of the program."

The project team's evaluation of the "Water Chemistry Control -BWR Program" and "One-Time Inspection Program" is documented in Sections 3.0.3.1.13 and 3.0.3.1.8, respectively, of this audit and review report. The project team reviewed the applicant's water chemistry control - BWR program (AMP B.1.32.2) and verified that this aging management program included activities that monitor and control water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. In addition, the project team verified that the one-time inspection program (AMP B.1.23) included inspection activities to verify the effectiveness of the water chemistry program to manage loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. The project team concluded that these AMPs will adequately manage loss of material due to general, pitting and crevice corrosion for steel piping, piping components, and piping elements exposed to steam and for steel piping, piping components, and piping elements exposed to treated water.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.6 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.7 Loss of Material Due to Pitting and Crevice Corrosion

3.4.2.2.7.1 Loss of Material Due to Pitting and Crevice Corrosion [Item 1]

The project team reviewed PNPS LRA Section 3.4.2.2.7.1 against the criteria in SRP-LR Section 3.4.2.2.7.1.

SRP-LR Section 3.4.2.2.7.1 states that a loss of material due to pitting and crevice corrosion could occur for stainless steel, aluminum, and copper alloy piping, piping components and piping elements and for stainless steel tanks and heat exchanger components exposed to treated water. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to pitting, and crevice corrosion. However, control of water chemistry does not preclude corrosion at locations of stagnant flow conditions. Therefore, the GALL Report recommends that the effectiveness of the water chemistry program should be verified to ensure that corrosion is not occurring. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.7.1, the applicant stated that the loss of material due to pitting and crevice corrosion for stainless steel and copper alloy components exposed to treated water is managed by the Water Chemistry Control – BWR Program. There are no aluminum components in the steam and power conversion systems. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

In the discussion section of Table 3.4.1, Items 3.4.1-15 and 3.4.1-16, the applicant stated that the One-Time Inspection (OTI) Program will be used to verify the effectiveness of the water chemistry program. However, for those line items in Tables 3.4.2-1, and various 3.3.2-14-x where these Table 3.4.1 line items are referenced in the steam and power conversion system, only the Water Chemistry Control - BWR Program is credited. The project team asked the applicant a generic question to resolve the discrepancy why the OTI Program was not credited in the Table 2 line items that references these Table 1 line items.

In its response, the applicant stated that since the OTI Program is applicable to each water chemistry control program, it is also applicable to each line item in Table 2 that credits a water chemistry control program. LRA Table 3.4.1 indicates that the OTI Program is credited along with the water chemistry control programs for line items where GALL recommends a one-time inspection to confirm water chemistry control. Tables 3.4.2-1 and 3.3.2-14-x credit the OTI Program through reference to the associated Table 1 line item. The applicant further stated that the water chemistry control programs in LRA Appendices A and B will be revised to clearly indicate that the OTI Program will verify the effectiveness of the Water Chemistry Control - BWR Program.

In a letter dated July 19, 2006 **(MLxxxxxxxxx)**, the applicant stated that the effectiveness of the Water Chemistry Control - Auxiliary Systems, BWR, and Closed Cooling Water programs is confirmed by the One-Time Inspection program and that LRA Appendix A (UFSAR Supplement) is revised for these three water chemistry control programs to include the sentence, "The One-Time Inspection Program will confirm the effectiveness of the program."

The project team's evaluation of the "Water Chemistry Control -BWR Program" and "One-Time Inspection Program" is documented in Sections 3.0.3.1.13 and 3.0.3.1.8, respectively, of this audit and review report. The project team reviewed the applicant's water chemistry control - BWR program (AMP B.1.32.2) and verified that this aging management program included activities that monitor and control water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. In addition, the project team verified that the one-time inspection program (AMP B.1.23) included inspection activities to verify the effectiveness of the water chemistry program to manage loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. The project team concluded that these AMPs will adequately manage loss of material due to general, pitting and crevice corrosion for steel piping, piping components, and piping elements exposed to steam and for steel piping, piping components, and piping elements exposed to treated water.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.1 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.7.2 <u>Loss of Material Due to Pitting and Crevice Corrosion [Item 2]</u>

The project team reviewed PNPS LRA Section 3.4.2.2.7.2 against the criteria in SRP-LR Section 3.4.2.2.7.2.

SRP-LR Section 3.4.2.2.7.2 states that a loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific aging management to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB- 1.

In the PNPS LRA Section 3.4.2.2.7.2, the applicant stated that the loss of material due to pitting and crevice corrosion for stainless steel piping and tubing exposed to soil is managed by the Buried Piping and Tanks Inspection Program. This program will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried components. Buried components will be inspected when excavated during maintenance. An inspection will be performed within 10 years of entering the period of extended operation, unless an opportunistic inspection occurred within this ten-year period. This program will manage the aging effect of loss of material such that the intended function of the components will not be affected.

The project team reviewed the Buried Piping and Tanks Inspection Program, which is consistent with the GALL AMP XI.M34. The project team's evaluation of the Buried Piping and Tanks Inspection Program is documented in Section 3.0.3.2.1 of this audit and review report. On the basis that periodic inspections, including opportunistic inspections will be performed on buried piping, the project team determined that the Buried Piping and Tanks inspection Program is appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.2 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.7.3 Loss of Material Due to Pitting and Crevice Corrosion [Item 3]

The project team reviewed PNPS LRA Section 3.4.2.2.7.3 against the criteria in SRP-LR Section 3.4.2.2.7.3.

SRP-LR Section 3.4.2.2.7.3 states that the Loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.7.3, the applicant states that loss of material due to pitting and crevice corrosion for copper alloy components in steam and power conversion systems exposed to lubricating oil is managed by the Oil Analysis Program. This aging effect only applies to components in the turbine generator and auxiliary system and is included in the evaluation of systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) (see Table 3.3.2-14-35). The Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

In the discussion column entry of Table 3.4.1-18, which linked to PNPS LRA Section

3.4.2.2.7.3, the applicant indicated that it depends on operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the project team asked the applicant how it can make this statement if inspection has not been performed. In its response, the applicant stated that during the performance of routine maintenance on components that contain lubricating oil, visual inspections of these components would identify degraded conditions that could be attributed to an ineffective Oil Analysis Program. The corrective action program at PNPS has a low threshold for the identification of degraded condition such that corrosion or cracking of components would be identified as part of this program. The review of operating experience at PNPS for the last five years did not identify any condition reports that indicated an ineffective Oil Analysis Program or that identified degraded component conditions such as corrosion or cracking in a lubricating oil environment.

During the past five years, many visual inspections of components containing lubricating oil have been performed during corrective and preventive maintenance activities. The visual inspection of these components would identify degraded conditions such as corrosion or cracking that could be attributed to an ineffective Oil Analysis Program. No condition reports that identified degraded component conditions, such as corrosion and cracking in a lubricating oil environment, were initiated as a result of these inspections. These past inspections at PNPS serve in lieu of a one-time inspection to provide confirmation of the effectiveness of the Oil Analysis Program.

The project team reviewed Operating Experience Review Report, LRPD-05, Revision 0, and confirmed that there were no condition reports generated for degraded conditions of components in a lubricating oil environment. On the basis that periodic inspections of components in a lubricating environment are performed during maintenance activities, and that operating experience has shown no degraded conditions, the project team determined that the Oil Analysis Program is appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation. The Oil Analysis Program was evaluated by the project team and found acceptable for managing aging degradation.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.3 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.8 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

The project team reviewed PNPS LRA Section 3.4.2.2.8 against the criteria in SRP-LR Section 3.4.2.2.8.

SRP-LR Section 3.4.2.2.8 states that the Loss of material due to pitting, crevice, and MIC could occur in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In the PNPS LRA Section 3.4.2.2.8, the applicant states that a loss of material due to pitting, crevice, and MIC for stainless steel components in steam and power conversion systems exposed to lubricating oil is managed by the Oil Analysis Program. This aging effect only applies to components in the turbine generator and auxiliary system and is included in the evaluation of systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) (see Table 3.3.2-14-35). The Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Operating experience at PNPS has confirmed the effectiveness of this program in maintaining contaminants within limits such that corrosion has not and will not affect the intended functions of these components.

In the discussion column entry of Table 3.4.1-19, which linked to PNPS LRA Section 3.4.2.2.8, the applicant indicated that it depends on operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the project team asked the applicant how it can make this statement if inspection has not been performed. In its response, the applicant stated that during the performance of routine maintenance on components that contain lubricating oil, visual inspections of these components would identify degraded conditions that could be attributed to an ineffective Oil Analysis Program. The corrective action program at PNPS has a low threshold for the identification of degraded condition such that corrosion or cracking of components would be identified as part of this program. The review of operating experience at PNPS for the last five years did not identify any condition reports that indicated an ineffective Oil Analysis Program or that identified degraded component conditions such as corrosion or cracking in a lubricating oil environment.

During the past five years, many visual inspections of components containing lubricating oil have been performed during corrective and preventive maintenance activities. The visual inspection of these components would identify degraded conditions such as corrosion or cracking that could be attributed to an ineffective Oil Analysis Program. No condition reports that identified degraded component conditions, such as corrosion and cracking in a lubricating oil environment, were initiated as a result of these inspections. These past inspections at PNPS serve in lieu of a one-time inspection to provide confirmation of the effectiveness of the Oil Analysis Program.

The project team reviewed Operating Experience Review Report, LRPD-05, Revision 0, and confirmed that there were no condition reports generated for degraded conditions of components in a lubricating oil environment. On the basis that periodic inspections of components in a lubricating environment are performed during maintenance activities, and that operating experience has shown no degraded conditions, the project team determined that the Oil Analysis Program is appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation. The Oil Analysis Program was evaluated by the project team and found acceptable for managing aging degradation.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.8 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

The project team reviewed PNPS LRA Section 3.4.2.2.9 against the criteria in SRP-LR Section 3.4.2.2.9.

SRP-LR Section 3.4.2.2.9 states that a loss of material due to general, pitting, crevice, and galvanic corrosion can occur for steel heat exchanger components exposed to treated water. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation. Acceptance criteria are described in Branch Technical Position IQMB-1.

In the PNPS LRA Section 3.4.2.2.9, the applicant states that a loss of material due to general, pitting, crevice, and galvanic corrosion for steel heat exchanger components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control - BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

In the discussion section of Table 3.4.1, item 3.4.1-5, the applicant stated that the One-Time Inspection (OTI) Program will be used to verify the effectiveness of the water chemistry program. However, for those line items in Table 3.3.2-14-x where these Table 3.4.1 line items are referenced, only the Water Chemistry Control - BWR Program is credited. The project team asked the applicant a generic question to resolve the discrepancy why the OTI Program was not credited in the Table 2 line items that references these Table 1 line items.

In its response, the applicant stated that since the OTI Program is applicable to each water chemistry control program, it is also applicable to each line item in Table 2 that credits a water chemistry control program. LRA Table 3.4.1 indicates that the OTI Program is credited along with the water chemistry control programs for line items where GALL recommends a one-time inspection to confirm water chemistry control. Table 3.3.2-14-x credit the OTI Program through reference to the associated Table 1 line item. The applicant further stated that the water chemistry control programs in LRA Appendices A and B will be revised to clearly indicate that the OTI Program will verify the effectiveness of the Water Chemistry Control - BWR Program.

In a letter dated July 19, 2006 **(MLxxxxxxxxx)**, the applicant stated that the effectiveness of the Water Chemistry Control - Auxiliary Systems, BWR, and Closed Cooling Water programs is confirmed by the One-Time Inspection program and that LRA Appendix A (UFSAR Supplement) is revised for these three water chemistry control programs to include the sentence, "The One-Time Inspection Program will confirm the effectiveness of the program."

The project team's evaluation of the "Water Chemistry Control -BWR Program" and "One-Time Inspection Program" is documented in Sections 3.0.3.1.13 and 3.0.3.1.8, respectively, of this audit and review report. The project team reviewed the applicant's water chemistry control - BWR program (AMP B.1.32.2) and verified that this aging management program included activities that monitor and control water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. In addition, the project team verified that the one-time inspection program (AMP B.1.23) included inspection activities to verify the effectiveness of the water chemistry program to manage loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. The project team concluded that these AMPs will adequately manage loss of material due to general, pitting and crevice corrosion for steel piping, piping components, and piping elements exposed to steam and for steel piping, piping components, and piping elements exposed to treated water.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.9 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

The applicant referenced LRA Section B.0.3. The project team's evaluation of Section B.0.3 is provided in Section 3.0.4 of this audit and review report.

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the GALL Report recommends further evaluation, the project team determined that the applicant adequately addressed the issues that were further evaluated. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3 AMR Results That Are Not Consistent With The GALL Report Or Not Addressed In The GALL Report

Summary of Information in the Application

In PNPS LRA Table 3.4.1, Summary of Aging Management Evaluations for the Steam and Power Conversion System, the applicant provides information regarding components or material/environment combination in the GALL Report that it evaluated and identified as not applicable to its plant.

In PNPS LRA Tables 3.4.2-1, 3.4.2-2, 3.3.2-14-1, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18 and 3.3.2-14-35, the applicant provides additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report.

Specifically, the applicant indicates, via Notes F through J, that neither the identified component nor the material / environment combination is evaluated in the GALL Report and provided information concerning how the aging effect requiring management will be managed.

Project Team Evaluation

The project team reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

Aging Effect/Mechanism in Table 3.4.1 That Are Not Applicable for PNPS

In PNPS LRA Table 3.4.1, Item 3.4.1-21 discussion column the applicant states that cracking due to cyclic loading, stress corrosion cracking of the high-strength steel closure bolting exposed to air with steam or water leakage is not applicable to PNPS because high-strength steel closure bolting is not used in the steam and power conversion system.

On the basis that there is no high-strength steel closure bolting in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS LRA Table 3.4.1, Item 3.4.1-23 discussion column the applicant states that cracking due to stress corrosion cracking of stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (>140°F) is not applicable to PNPS because there are no stainless steel components exposed to closed-cycle cooling water in the steam and power conversion system.

On the basis that there are no stainless steel components exposed to closed-cycle cooling water in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-24 discussion column the applicant states that the loss of material due to general, pitting, crevice, and galvanic corrosion of steel heat exchanger components exposed to closed cycle cooling water is not applicable to PNPS because there are no steel heat exchanger components exposed to closed cycle cooling water in the steam and power conversion system.

On the basis that there are no steel heat exchanger components exposed to closed cycle cooling water in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-25 discussion column the applicant states that the loss of material due to pitting and crevice corrosion of stainless steel piping, piping components, piping elements, and hear exchanger components exposed to closed cycle cooling water is not applicable to PNPS because there are no stainless steel components exposed to closed cycle cooling water in the steam and power conversion system.

On the basis that there are no stainless steel components exposed to closed cycle cooling water in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-26 discussion column the applicant states that the loss of material due to pitting, crevice, and galvanic corrosion of copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water is not applicable to PNPS because there are no copper alloy components exposed to closed cycle cooling water in the steam and power conversion system.

On the basis that there are no copper alloy components exposed to closed cycle cooling water in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-27 discussion column the applicant states that the reduction of heat transfer due to fouling of steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water is not applicable to PNPS because there are no heat exchanger tubes exposed to closed cycle cooling water in the steam and power conversion system.

On the basis that there are no heat exchanger tubes exposed to closed cycle cooling water in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-33 discussion column, the applicant states that the loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling of stainless steel heat exchanger components exposed to raw water is not applicable to PNPS because there are no stainless steel heat exchanger components exposed to raw water in the steam and power conversion system.

On the basis that there are no stainless steel heat exchanger components exposed to raw water in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-34 discussion column the applicant states that the reduction of heat transfer due to fouling of steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water is not applicable to PNPS because there are no heat exchanger tubes exposed to raw water with an intended function of heat transfer in the steam and power conversion system.

On the basis that there are no heat exchanger tubes exposed to raw water with an intended function of heat transfer in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-42 discussion column the applicant states that the aging of steel piping, piping components, and piping elements exposed to controlled indoor air is not applicable to PNPS because there are no steel components exposed to controlled indoor air in the steam and power system.

On the basis that there are no steel components exposed to controlled indoor air in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-43 discussion column the applicant states that the aging of steel and stainless steel piping, piping components, and piping elements in concrete is not applicable to PNPS because there are no steel or stainless steel components exposed to concrete in the steam and power conversion system.

On the basis that there are no steel or stainless steel components exposed to concrete in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

In PNPS Table 3.4.1, Item 3.4.1-44 discussion column the applicant states that the aging of steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas is not applicable to PNPS because there are no steel, stainless steel. aluminum, or copper alloy components exposed to gas in the steam and power conversion system.

On the basis that there are no steel, stainless steel. aluminum, or copper alloy components exposed to gas in the steam and power conversion system at PNPS, the project team finds that, for this component type, this aging effect is not applicable to PNPS.

Steam and Power Conversion System AMR Line Items That Have No Aging Effect (PNPS LRA Tables 3.4.2-1, 3.4.2-2, 3.3.2-14-1, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18 and 3.3.2-14-35)

In PNPS LRA Tables 3.4.2-1, 3.4.2-2, 3.3.2-14-1, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18 and 3.3.2-14-35, the applicant identified AMR line-items where no aging effects were identified as a result of its aging review process. Specifically, instances in which the applicant states that no aging effects were identified occurred in the following areas:

Condenser components fabricated from carbon steel, copper alloy, titanium and elastomer exposed to indoor air, treated water, or steam >270°F

In PNPS LRA Table 3.4.2-2 (Pages 3.4-31 and 32), via plant-specific Note 401, the applicant stated that:

> Aging management of the main condenser is not based on analysis of materials, environments and aging effects. Condenser integrity required to perform the post-accident intended function (holdup and plateout of MSIV leakage) is continuously confirmed by normal plant operation. This intended function does not require the condenser to be leak-tight, and the post-accident conditions in the condenser will be essentially atmospheric. Since normal plant operation assures adequate condenser pressure boundary integrity, the post-accident intended function to provide holdup volume and plateout surface is assured. Based on past precedence (NUREG-1796, Dresden and Quad Cities SER, Section 3.4.2.4.4, and NUREG-1769, Peach Bottom SER, Section 3.4.2.3), the staff concluded that main condenser integrity is continually verified during normal plant operation and no aging management program is required to assure the post-accident intended function.

The project team reviewed the past precedents and noted that PNPS had similar intended function for the main condenser. The project team found that to maintain the intended function of plateout and holdup during post-accident conditions, the main condenser and the components which make up the main condenser complex need remain intact. During normal plant operations, condenser vacuum is monitored continuously to verify its integrity. The acceptable performance of main condenser during normal plant operation is adequate assurance that it will perform the plateout and holdup post-accident function. Therefore, the project team concurred with the applicant's conclusion that no aging management program is required to assure the post-accident intended function and this aging effect is not applicable to PNPS.

Glass in condensation external environment (Table 3.3.2-14-1)

Glass as a material is impervious to normal plant environments. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation.

Plastic in condensation external and raw water internal environments (Table 3.3.2-14-1)

In accordance with Section 2.1.8 of Appendix A of the EPRI technical report, 1003056, "Non-Class 1 Mechanical implementation Guidelines and Mechanical Tools," Revision 3, PVC and thermoplastics are relatively unaffected by water or humidity.

Unlike metals, plastics do not display corrosion rates. Rather than depending on an oxide layer for protection, they depend on chemical resistance to the environment to which they are exposed. Therefore based on industry experience review and the assumption of proper design and application of the material, aging of plastics in condensation external and raw water internal is not an applicable aging effect.

On the basis of its review of current industry research and operating experience, the project team found that condensation external and raw water internal environments, on plastic and glass will not result in aging that will be of concern during the period of extended operation. Therefore, the project team concluded that there are no applicable aging effects requiring management for plastic and glass components exposed to condensation external and raw water internal environments. Furthermore, as described above, the project team also concluded that condenser components fabricated from carbon steel, copper alloy, titanium and elastomer exposed to indoor air, treated water, or steam >270°F environment, there are no aging effects and no aging management program is required to assure the post-accident function.

On the basis of its audit and review of the applicant's program, the project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.1 Condensate Storage System- Summary of Aging Management Evaluation - PNPS LRA Table 3.4.2-1

The project team reviewed the PNPS LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the Condensate storage system component groups.

In LRA Table 3.4.2-1, the applicant proposed to manage loss of material for stainless steel for components types of bolting, piping, tubing, and valve body exposed to an external environment of condensation using PNPS AMP B.1.30, "System Walkdown Program."

The project team reviewed the System Walkdown Program and its evaluation is documented in Section 3.0.3.1.11 of this audit and review report. The System Walkdown Program description states that this program entails inspection of external surfaces of components subject to aging management review. This program is consistent with the GALL Report AMP XI.M36, "External Surfaces Monitoring Program". On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of loss of material for components types of bolting, piping, tubing, and valve body exposed to an external environment of condensation are effectively managed using System Walkdown Program.

3.4.2.3.2 Main Condenser and MSIV Leakage Pathway - Summary of Aging Management Evaluation - PNPS LRA Table 3.4.2-2

The project team reviewed the PNPS LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the main condenser and MSIV leakage pathway component groups.

In LRA Table 3.4.2-2, the applicant proposed to manage cracking due to fatigue of stainless steel material for component types of orifices, thermowells, tubing and valve body exposed to an internal environment of steam > 270°F using metal fatigue TLAA. The evaluation of metal fatigue is documented in Section 4.3.2 of this audit and review report.

3.4.2.3.3 Circulating Water System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-1

The project team reviewed the PNPS LRA Table 3.3.2-14-1, which summarizes the results of AMR evaluations for the circulating water non-safety related component groups affecting safety-related systems.

In LRA Table 3.4.2-14-1, the applicant proposed to manage loss of material for copper alloy >15% Zn and copper alloy<15% Zn for components types of piping, strainer housing, tubing, and valve body exposed to an external environment of condensation using PNPS AMP B.1.30, "System Walkdown Program.".

The project team reviewed the System Walkdown Program and its evaluation is documented in Section 3.0.3.1.11 of this audit and review report. The System Walkdown Program description states that this program entails inspection of external surfaces of components subject to aging management review. This program is consistent with the GALL Report AMP XI.M36, "External Surfaces Monitoring Program". On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of loss of material for components types of piping, strainer housing, tubing, and valve body exposed to an external environment of condensation are effectively managed using System Walkdown Program. On this basis, the project team found that management of loss of material in circulating water system is acceptable.

3.4.2.3.4 Condensate System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-3

The project team reviewed PNPS LRA Table 3.3.2-14-3, which summarizes the results of AMR evaluations for the condensate system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.5 Condensate Demineralizer System - Summary of Aging Management Evaluation - PNPS]LRA Table 3.3.2-14-4

The project team reviewed PNPS LRA Table 3.3.2-14-4, which summarizes the results of AMR evaluations for the condensate demineralizer system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.6 Condensate Storage and Transfer System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-5

The project team reviewed PNPS LRA Table 3.3.2-14-5, which summarizes the results of AMR evaluations for the condensate storage and transfer system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.7 Extraction Steam System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-9

The project team reviewed the PNPS LRA Table 3.3.2-14-9, which summarizes the results of AMR evaluations for the extraction steam non-safety related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-9, the applicant proposed to manage cracking due to fatigue of nickel alloy and stainless steel materials for component types of expansion joint, tubing and valve body exposed to an internal environment of steam > 270°F or treated water > 270°F using metal fatigue TLAA. The evaluation of metal fatigue is documented in Section 4.3.2 of this audit and review report.

In Table 3.3.2-14-9, the applicant proposed to manage cracking and loss of material of nickel alloy material for component type of expansion joint exposed to an environment of steam > 270°F or treated water > 270°F using PNPS AMP B.1.32.2, "Water Chemistry Control - BWR Program."

The project team reviewed the Water Chemistry Control - BWR Program and its evaluation is documented in Section 3.0.3.1.13 of this audit and review report. This program is consistent with the GALL Report AMP XI.M2, "Water Chemistry." On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found that since the water chemistry will be periodically monitored and controlled within established levels of contaminants, the aging effect of cracking and loss of material of nickel alloy material for component type of expansion joint exposed to an environment of steam > 270°F or treated water > 270°F is effectively managed using the Water Chemistry Control - BWR Program . However, verification of the effectiveness of the program is not performed. The project team asked the applicant a generic question to resolve the discrepancy why the OTI Program was not credited in the these Table 2 line items.

In its response, the applicant stated that since the OTI Program is applicable to each water chemistry control program, it is also applicable to each line item in Table 2 that credits a water chemistry control program. The applicant further stated that the water chemistry control programs in LRA Appendices A and B will be revised to clearly indicate that the OTI Program will verify the effectiveness of the Water Chemistry Control - BWR Program.

In a letter dated July 19, 2006 **(MLxxxxxxxxx)**, the applicant stated that the effectiveness of the Water Chemistry Control - Auxiliary Systems, BWR, and Closed Cooling Water programs is confirmed by the One-Time Inspection program and that LRA Appendix A (UFSAR Supplement) is revised for these three water chemistry control programs to include the sentence, "The One-Time Inspection Program will confirm the effectiveness of the program."

As described above, the project team concluded that these AMPs will adequately manage cracking and loss of material of nickel alloy material for component type of expansion joint exposed to an environment of steam > 270°F or treated water > 270°F.

3.4.2.3.8 Feedwater System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-10

The project team reviewed PNPS LRA Table 3.3.2-14-10, which summarizes the results of AMR evaluations for the feedwater system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.9 Feedwater Heater Drains and Vents System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-11

The project team reviewed PNPS LRA Table 3.3.2-14-11, which summarizes the results of AMR evaluations for the feedwater heater drains and vents system non-safety related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.10 Main Condenser - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-17

The project team reviewed the PNPS LRA Table 3.3.2-14-17, which summarizes the results of AMR evaluations for the main condenser non-safety related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-17, the applicant proposed to manage cracking due to fatigue of stainless steel material for component types of orifice exposed to an internal environment of steam > 270°F using metal fatigue TLAA. The evaluation of metal fatigue is documented in Section 4.3.2 of this audit and review report.

3.4.2.3.11 Main Steam System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-18

The project team reviewed the PNPS LRA Table 3.3.2-14-18, which summarizes the results of AMR evaluations for the main steam system non-safety related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-18, the applicant proposed to manage cracking due to fatigue of stainless steel material for component types of orifice and tubing exposed to an internal environment of steam > 270°F using metal fatigue TLAA. The evaluation of metal fatigue is documented in Section 4.3.2 of this audit and review report.

3.4.2.3.12 Turbine Generator and Auxiliary System - Summary of Aging Management Evaluation - PNPS LRA Table 3.3.2-14-35

The project team reviewed the PNPS LRA Table 3.3.2-14-35, which summarizes the results of AMR evaluations for the turbine generator and auxiliary system non-safety related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-35, the applicant proposed to manage loss of material of carbon steel , stainless steel, and copper alloy<15% Zn materials for component types of filter housing, heater exchanger (shell), heater housing, orifice, piping, pump casing, strainer housing, tank, thermowell, tubing, and valve body exposed to treated water environment using PNPS AMP B.1.32.1, "Water Chemistry Control - Auxiliary Systems Program."

The project team reviewed the Water Chemistry Control - Auxiliary Systems program and its evaluation is documented in Section 3.0.3.3.6 of this audit and review report. The program monitors conductivity, corrosion products and dissolved oxygen in accordance with industry recommendation. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team found the aging effect of loss of material of carbon steel , stainless steel, and copper alloy<15% Zn materials for component types of filter housing, heater exchanger (shell), heater housing, orifice, piping, pump casing, strainer housing, tank, thermowell, tubing, and valve body exposed to treated water environment are effectively managed using PNPS AMP B.1.32.1, "Water Chemistry Control - Auxiliary Systems Program. However, verification of the effectiveness of the Water Chemistry Control - Auxiliary Systems Program is not described in the associated LRA Table 2 line items. The project team asked the applicant a generic question to resolve the discrepancy why the OTI Program was not credited in the these Table 2 line items.

In its response, the applicant stated that since the OTI Program is applicable to each water chemistry control program, it is also applicable to each line item in Table 2 that credits a water chemistry control program. The applicant further stated that the water chemistry control programs in LRA Appendices A and B will be revised to clearly indicate that the OTI Program will verify the effectiveness of the Water Chemistry Control - BWR Program.

In a letter dated July 19, 2006 **(MLxxxxxxxxx)**, the applicant stated that the effectiveness of the Water Chemistry Control - Auxiliary Systems, BWR, and Closed Cooling Water programs is confirmed by the One-Time Inspection program and that LRA Appendix A (UFSAR Supplement) is revised for these three water chemistry control programs to include the sentence, "The One-Time Inspection Program will confirm the effectiveness of the program."

As described above, the project team concluded that these AMPs will adequately manage loss of material of carbon steel, stainless steel, and copper alloy<15% Zn materials for component types of filter housing, heater exchanger (shell), heater housing, orifice, piping, pump casing, strainer housing, tank, thermowell, tubing, and valve body exposed to treated water environment.

Conclusion

On the basis of its review, the project team found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not addressed in the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Conclusion

On the basis of its review, the project team concluded that the applicant has demonstrated that the aging effects associated with the steam and power conversion system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable UFSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the steam and power conversion components, as required by 10 CFR 54.21(d).