From: James Medoff
To: James Davis; Peter Wen
Date: 08/03/2006 11:33:55 AM
Subject: FYI: Forwarding Attachment 1 and Attachments 3 - 7 on Audit Report TLAA Sections.

Jim, Peter:

Here are all of the attachments containing the audit report TLAA writeup with the exception of Attachment 2, which contains the writeup for Section 4.3 on Metal Fatigue.

The audit report will not include a Section 4.2 on Neutron Irradiation Embrittlement. The TLAAs for Neutron Irradiation Embrittement as being assessed by DCI/CVIB (Ganesh Cheruvenki and Chris Syndor) and will be written up in the SER with Open Items. DCI/CVIB is also assessing BWRVIP Report TLAA in LRA Sections 4.7.1, 4.7.2.1, and 4.7.2.4. These TLAAs are also related to neutron irradiation embrittlement and will be written up in the SER with Open Items.

The audit report also does not included Section 4.5 as the PNPS design does not include a containment structure that is reinforced with carbon steel tendons.

Erach Patel will be sending in his revision to Audit Report Section 4.3.3. on Environmentally-Impact Metal Fatigue and his recommnended edits to Audit Report Sections 4.3.1 and 4.3.2 on Class 1 and Non-Class 1 metal Fatigue later today. I hope to get will send you Attachment 2 containing the writeups for Section 4.3 and its subsections by COB today, but will definitely get them to you by noon tomorrow at latest. Therefore we will make the date for forwarding the sections to ATL.

Thanks,

Jim

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ATTACHMENT 1

AUDIT REPORT INPUTS FOR SECTION 4.1
OF THE PILGRIM LICENSE RENEWAL APPLICATION

4.0, TIME LIMITED AGING ANALYSES

AND

4.1, IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses

Paragraph §54.21(c)(1) of Part 54 to Title 10, *Code of Federal Regulations* (10 CFR 54.21(c)(1)), requires applicant's for license renewal to identify all time-limited aging analyses (TLAAs) for their license renewal applications (LRAs). TLAAs are defined in Paragraph §54.3 of Part 54 to Title 10, *Code of Federal Regulations* (i.e., 10 CFR 54.3), as analyses that comply with the following six criteria:

(1) involve systems, structures, and components that are within the scope of license renewal, as delineated in 10 CFR 54.4(a)

(2) consider the effects of aging

(3) involve time-limited assumptions defined by the current operating term (for example 40 years)

(4) are determined to be relevant by the applicant in making a safety determination

(5) involve conclusions, or provide the basis for conclusions, related to the capability of the system, structure, and component to perform its intended functions, as delineated in 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the CLB

According to criterion (3), TLAAs are certain plant-specific safety analyses that are based on an explicitly assumed 40-year plant life or some part of it. For a TLAA to conform with the time-limited assumption criterion in Criterion (3), the Statement of Consideration (SOC) on 10 CFR Part 54 states that the analysis is one that is applicable for either the entire current operating period and beyond or for the remainder of the current operating period and beyond. However, the SOC clarifies that, to be applicable, the time-frame assumption for the analyses does not need to extend beyond the expiration of the proposed period of extended operation (PEO) for the facility.

For each TLAA that is identified in accordance with 10 CFR 54.21(c)(1), the applicant must demonstrate:

(i) That the TLAA remains valid for the PEO; or

(ii) That the TLAA has been projected to the end of the PEO; or

(iii) That the effects of aging on the intended function will be adequately managed for the PEO.

In addition, pursuant to 10 CFR 54.21(c)(2), an applicant must provide a list of plant-specific exemptions granted under 10 CFR 50.12 that are based on TLAAs. For any such exemptions,

the applicant must provide an evaluation that justifies the continuation of the exemptions for the period of extended operation. Pursuant to 10 CFR 54.21(d), an applicant must include a Final Safety Analysis Report Supplement (FSAR) Supplement summary description for each TLAA that is included with the scope of an applicant's license renewal application.

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated all evaluations, analyses, assessments, and calculations for the Pilgrim Nuclear Power Station (PNPS) against the six criteria for TLAAs in 10 CFR 54.3. The applicant indicates that it had searched the PNPS current licensing basis (CLB) to determine which evaluations, analyses, assessments, and calculations met the definition of a TLAA in 10 CFR 54.3. The applicant identified that the search of the CLB included a search of the following PNPS-specific and generic document sources:

- Technical Specifications
- UFSAR
- docketed licensing correspondence
- Fire Protection Program documents
- NRC safety evaluation reports
- BWRVIP documents

The applicant also states that it reviewed additional industry documents that list generic time-limited aging analyses for the industry and that this provides additional assurance of the completeness of the PNPS-specific TLAA list. These documents included NEI 95-10; NUREG-1800, *Standard Review Plan (SRP) for Review for License Renewal Applications for Nuclear Power Plants*, Revision 1, September 2005; NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 1, September 2005; and NRC safety evaluation reports related to license renewal applications by other BWR licensees. Based on this CLB search, the applicant identifies that the following evaluations, analyses, assessments, and calculations met the six criteria for TLAAs in 10 CFR 54.3:

- The evaluations on reactor pressure vessel (RPV) neutron embrittlement: these evaluations are discussed in LRA Section 4.2 and its six subsections.

- The metal fatigue evaluations for Class 1 Components, Non-Class 1 Components, and Environmentally Impacted Class 1 piping: these evaluatons are discussed in LRA Section 4.3 and its three subsections.

- The evaluations on environmental qualification of electrical equipment: these evaluations are discussed in LRA Section 4.4.

- The evaluations for the containment liner plate, metal containments, and penetrations fatigue analysis: these evaluations are discussed in LRA Sections 4.6 and its subsection (Section 4.6.1)

- Other TLAAs, including those for: (1) the RPV internals thermal shock reflood analysis, (2) the generic adjusted reference temperature analyses for RPV circumferential welds in Boiling Water Reactor Vessel Internals Project (BWRVIP) Topical Report BWRVIP-05, (3) the generic fatigue analysis for RPV ID attachment welds in Topical Report BWRVIP-48, (4) the generic fatigue analysis for RPV instrument penetrations in

Topical Report BWRVIP-49, (5) the generic pressure-temperature limit analysis, fatigue analysis, Charpy-V impact upper shelf energy analysis, and circumferential/axial weld failure analysis of Topical Report BWRVIP-74, and (6) the generic core shroud fatigue analysis in Topical Report BWRVIP-76. The TLAAs are discussed in the Subsections to LRA Section 4.7.

The applicant provides the complete list of TLAAs for the application in Table 4.1-1 of the PNPS LRA. Pursuant to 10 CFR 54.21(c)(2), the applicant did not identify any exemptions that were based on a TLAA and granted under 10 CFR 50.12.

4.1.2 Staff Evaluation

The NRC reviewed the information to determine if the applicant had provided adequate information to meet the requirements of 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2). In LRA Section 4.1 and LRA Table 4.1-1, the applicant identified those TLAAs that were applicable to PNPS and within the scope of the PNPS LRA. The applicant did not identify any exemptions that were based on these TLAAs and granted in accordance with 10 CFR 50.12.

Of those TLAAs in LRA Table 4.1-1, the project team of the NRC's Division of License Renewal, Office of Nuclear Reactor Regulation, evaluated the following TLAAs for acceptablility:

(1) LRA Section 4.3, TLAA on "Metal Fatigue" Analyses, including LRA Subsection 4.3.1, "Class 1 Fatigue," LRA Subsection 4.3.2, "Non-Class 1 Fatigue," and LRA Subsection 4.3.3, "Effects of Reactor Water Environment on Fatigue Life."

(2) LRA Section 4.4, TLAA on "Environmental Qualification Analyses of Electric Equipment."

(3) LRA Section 4.6, TLAA on "Containment Liner Plate, Metal Containment, and Penetrations Fatigue Analyses."

(4) Three generic TLAA assessments performed by the Boiling Water Reactor Vessel and Internals Project (BWRVIP) on Metal Fatigue of reactor pressure vessel (RPV) interior attachment welds, RPV instrument penetrations, RPV core shroud tie rods, as provided in BWRVIP Topical Reports BWRVIP-48, -49, and -76, and discussed in Subsections 4.7.2.2, 4.7.2.3, 4.7.2.5 of the PNPS LRA.

The project team performed two audits of the TLAAs for the PNPS LRA, one audit performed on June 19-23, 2006, and a second followup audit performed on July 17-19, 2006. During these audits, the project team determined that the applicant had conservatively all PNPS-specific evaluations, analyses, assessments, and calculations that complied with the definition of a TLAA in 10 CFR 54.3, with the following exceptions:

The project team determined that the applicant had identified three flaw growth evaluations for Class 1 components that had the potential to be TLAAs for the PNPS LRA. The scope of the flaw evaluations include that N2F recirculation nozzle, the reciruculation nozzle thermal sleeves, and the control rod The NRC's determination on whether these flaw growth analyses need to be identified as TLAAs for the PNPS LRA is pending. If the NRC does determine that these flaw evaluations will be evaluated in one of the subsections to Section 4.0 of the NRC's Safety

Evaluation Report for the PNPS LRA.

The PNPS reactor building crane was procured to design specification CMAA-70. The project determined that the applicant did not identify the loading analysis for procurement of PNPS reactor building crane as a TLAA for the LRA. The project team determined that the PNPS reactor building crane had the potential to be a TLAA for the PNPS LRA because CMAA-70 requires cyclical loading evaluations for some type of cranes procured to the design standard. Section 2.4.2 of the PNPS LRA indicates that the reactor building crane was categorized as a Non-safety related Seismic II component. The project team asked the applicant to justify why a maximum stress allowable analysis was performed for polar crane, and if so whether it was a TLAA for the PNPS LRA. The applicant responded to the project team's question in a letter dated July 5, 2006. In its response, the applicant stated that whether CMAA-70 required a maximum stress reduction fatigue analysis depended on the Category for the crane. The applicant stated that it did not find any PNPS-specific loading analysis that was based on a "number-of-loading cycle-based" time-limited parameter. The staff determined that these the maximum stress level reduction-type fatigue analyses for CMAA-70 cranes were required to be performed if the cranes were categorized only for Seismic Category I (i.e., Service Class A-1) cranes that were procured to CMAA-70 design specifications and stated that these type of analyses were optional for Seismic Category II cranes that were procured to the CMAA-70 design specifications. Since the PNPS reactor building crane is categorized as Seismic Category II, the project team concludes that the reactor building cranes do not need to be within the scope of a CMAA-70-type TLAA analysis on metal fatigue.

The project team did not identify any PNPS-specific exemptions that were based on TLAAs including potential exemptions granted to PNPS for the plant's most recent pressure-temperature (P-T) limits for PNPS, which were approved April 13, 2001.

The NRC evaluates the remaining TLAAs for PNPS LRA in pertinent Subsections of Section 4.2 and 4.7 of the Safety Evaluation Report for the PNPS LRA. These additional TLAA are outside of the scope of this audit report, but are contained in LRA section 4.2 and 4.7 and include the following TLAAs:

(1) LRA Section 4.2.2, "Pressure/Temperature Limits"
(2) LRA Section 4.2.3, "Charpy Upper Shelf Energy"
(3) LRA Section 4.2.4, "Adjusted Reference Temperature"
(4) LRA Section 4.2.5, "Reactor Vessel Circumferential Weld Inspection Relief"
(5) LRA Section 4.2.6, "Reactor Vessel Axial Weld Failure Probability"
(6) LRA Section 4.7.1, "Reflood Thermal Shock Analysis of the Reactor Vessel Internals"
(7) LRA Section 4.7.2.1, "BWRVIP-05, RPV Circumferential Welds Analysis"
(8) LRA Section 4.7.2.4, "BWRVIP-74 Reactor Vessel" Analyses

The reviews of these additional TLAAs are performed as part of the NRC's technical staff evaluations for the PNPS LRA and were performed by the NRC staff in the NRC's Division of Component Integrity, Office of Nuclear Reactor Regulation. The applicant identifies that pressure-temperature (P-T) limits for the facilities are TLAAs for the PNPS LRA. However, the submittal of the P-T limits for the PEO do not need to be submitted for review and approval as part of the LRA. Instead the submittal of the P-T limits for the PEO will be processed through the NRC's normal 10 CFR 50.90 license amendment process. The applicant will be required to submit the P-T limits for the PEO to the NRC for review and have them approved prior to expiration of the end-of-life P-T limit curves for the current operating period. This is in

accordance with the 10 CFR 50.90 licensing process.

4.1.3 Conclusion

On the basis of its review, pending acceptable resolution of the staff's question on the potential for the three flaw evaluations to be TLAAs, the project team concludes that the applicant provided an acceptable list of TLAAs for the PNPS LRA, as required by 10 CFR 54.21(c)(1). In addition, pursuant to 10 CFR 54.21(c)(2), the project team concludes that the PNPS CLB does not included any exemptions which were granted on PNPS TLAAs in accordance with exemption acceptance criteria of 10 CFR 50.12.

ATTACHMENT 3

AUDIT REPORT INPUTS FOR SECTION 4.4
OF THE PILGRIM LICENSE RENEWAL APPLICATION

ENVIRONMENTAL QUALIFICATION OF ELECTRIC EQUIPMENT

4.4 Environmental Qualification of Electrical Equipment

The 10 CFR 50.49 environmental qualification (EQ) program has been identified as a time-limited aging analysis (TLAA) for the purposes of license renewal. The TLAA of EQ electrical components includes all long-lived, passive and active electrical components and instrumentation and controls (I&C) components that are important to safety and located in a harsh environment. The harsh environments of the plant are those areas that are subjected to environmental effects by a loss-of-coolant accident (LOCA) or a high-energy line break (HELB). The EQ equipment comprises safety-related and Q-list equipment; non-safety-related (NSR) equipment, the failure of which could prevent satisfactory accomplishment of any safety-related function; and necessary post-accident monitoring equipment.

As required by 10 CFR54.21(c)(1), the applicant must provide a list of EQ TLAAs. The applicant shall demonstrate that one of the following is true for each type of EQ equipment: (1) the analyses remain valid for the period of extended operation; (2) the analyses have been projected to the end of the period of extended operation; or (3) the effect of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.4.1 Summary of Technical Information in the Application

In LRA Section 4.4, the applicant summarized the evaluation of the environmental qualification of electrical equipment for the period of extended. The applicant states that the PNPS Environment Qualification of Electrical Components (EQ) Program manages component thermal, radiation and cyclical aging, as applicable, through the use of aging evaluation based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluations for EQ components that specify a qualification of at least 40 years are considered TLAA for license renewal. The EQ Program ensures that these EQ components are maintained in accordance with their qualification bases. The PNPS program is an existing program established to meet PNPS commitments for 10 CFR 50.49. It is consistent with NUREG-1801, Section X.E1, "Environment Qualification of Electric components." The PNPS program includes consideration of operating experience to modify bases and conclusions, including qualified life. Compliance with 10 CFR provides reasonable assurance that components can perform their intended function(s) during accident conditions after experience the effects of inservice aging. Based upon a review of the existing program and associated operating experience, continued implementation of the PNPS program EQ of Electrical Components Program provides reasonable assurance that the aging effects will be managed and that the in-scope EQ component will continue to perform their intended function(s) for the period of extended operation. The effects of aging will be managed by the PNPS program in accordance with the requirements of 10 CFR 54.21(c)(1)(iii).

4.4.2 Staff Evaluation

Regulatory Bases for EQ Evaluations

10 CFR 50.49(e)(5) contains provisions for aging that require, in part, consideration of all significant types of aging degradation that can affect component functional capability.

10 CFR 50.49(e)(5) also requires component replacement or maintenance prior to the end of designated life, unless additional life is established through ongoing qualification.
10 CFR 50.49(k) and (l) permit different qualification criteria to apply based on plant vintage. Environmental Qualification (EQ) regulatory guidance for compliance with these different qualification criteria is provided in the Regulatory Guide 1.89, Rev. 1, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants", the Division of Operating Reactors (DOR) Guidelines, and NUREG-0588. The EQ Program was established to demonstrate that certain electrical components located in harsh plant environment (that is, those areas of the plant that could be subject to the harsh environmental effects of loss of coolant accident [LOCA], high energy line breaks [HELB] or post-LOCA radiation) are qualified to perform their safety function operation in those harsh environments after the effects of in service aging. The EQ Program manages applicable component thermal, radiation, and cyclic aging effects for the current operating license period using the qualification methods established by 10 CFR 50.49(f). Maintaining qualification through the extended license renewal period requires that existing EQ evaluations be reanalyzed.

Scope of Review and Assessment

The staff reviewed Section 4.4 of the LRA and plant basis document to determine whether the applicant provided adequate information to meet the requirement of 10 CFR 54.21(c)(1) . For the electrical equipments identified in the basis document, the applicant uses 10 CFR 54.21(c)(1)(iii) in its TLAA evaluation to demonstrate that the aging effects of environmental qualification (EQ) equipment will be adequately managed during the period of extended operation. The staff reviewed the EQ program to determine whether it will assure that the electrical and I&C components covered under this program will continue to perform their intended functions consistent with the CLB for the period of extended operation. The staff's evaluation of the components qualification focused on how the EQ program manages the aging effects to meet the requirements delineated in 10 CFR 50.49.

The staff conducted an audit of the information provided in Section B.1.11 of the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit, the staff finds that the EQ program, which the applicant claimed to be consistent with the GALL program X.E1, "Environment Qualification of Electrical Components." is consistent with EQ program in the GALL report. Therefore, the staff finds that the EQ program is capable of programmatically managing the qualified life of components within the scope of the program for license renewal. The continued implementation of the EQ program provides reasonable assurance that the aging effects will be managed and that components within the scope of the EQ program will continue to perform their intended functions for the period of extended operation.

4.4.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of environmental qualification of electrical equipment in Section A.2.1.11 of LRA Appendix A. On the basis of its review of the FSAR supplement, the staff concludes that the summary description of the applicant's actions to address the environmental qualification of electrical equipment is adequate.

4.4.4 Conclusion

The staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), regarding environmental qualification of electrical equipment, that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

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ATTACHMENT 4

AUDIT REPORT INPUTS FOR SECTION 4.6
OF THE PILGRIM LICENSE RENEWAL APPLICATION

CONTAINMENT LINER PLATE, METAL CONTAINMENT, AND
PENETRATIONS FATIGUE ANALYSIS

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4.6 Containment Liner Plate, Metal Containment, and Penetration fatigue Analysis

4.6.1 Fatigue of Primary Containment Analysis

4.6.1.1 Summary of Technical Information in the Application

The applicant stated that the PNPS containment was analyzed as part of the Mark I containment long term program analyzed the torus and attached piping systems for fatigue due to mechanical loadings as well as thermal and anchor motion. This analysis was based on assumptions of the number of SRV actuations, operating basis earthquakes, and accident conditions during the life of the plant.

The analysis considered all BWR plants which utilized the mark I containment design. The analysis concluded that for all plants and piping systems considered, the fatigue usage factor for an assumed 40-year plant life was less than 0.5. Extending plant life by an additional 20 years would produce a usage factor below 0.75. Since less than 1.0, the fatigue criteria are satisfied. This TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.6.1.2 Staff Evaluation

The staff reviewed the LRA regarding TLAAs on fatigue of the safety relief valve (SRV) penetrations, the SRV discharge piping, and the torus piping systems. These fatigue analyses incorporate evaluation fatigue-induced cracked due to stresses induced by mechanical loadings as well as thermal and anchor motion.

Fatigue Analysis for SRV Penetrations and Discharge Piping

The fatigue analysis critieria and results for the SRV penetrations were established in MPR-751 Report. In this report, MPR limited the cumulative usage factor for SRP penetrations to a maximum value of 1.0. This is equivalent to the criteria for CUF values, as established for RCPB piping in Section III of the ASME Code and is acceptable. The report's generic calculation established that the SRV penetrations would be subject to a maximum number of 7500 cycles and established a maxium 40-year CUF value of 0.5 for SRV piping in boiling water reactor Mark I containments based on this number of cycles.

The applicant performed a 40-year plant specific fatigue analysis for the SRV penetrations in PNPS plant specific analysis report TR-5310-2, which was performed by Teledyne Engineering Services on behalf of the applicant. The plant-specific 40-year analysis indicated that the SRV penetrations are qualified for 7500 cycles of maximum load, as based on the number of SRV actuations (SRV openings) through 40 years of operations. Based on this number of cycles, the applicant's 40-year CUF value was 0.5. The applicant multiplied the 40-year SRV actuation value by a factor of 1.5 to project the number of actuations through 60 years of power operations. Based on this number cycles, the applicant project that the 60 year CUF value for the SRV penetrations is calculated as 0.75. The applicant's 40-year analysis established that the SRV discharge piping will be subjected to less than 134 cycles at maximum load at the expiration of the current operating period. The fatigue analysis for the SRV discharge piping is analogous to the type of fatigue analysis that is required for plant piping designed to the 1969

edition of ANSI B31.7 requirements and is acceptable to the staff. The applicant multiplied the 40-year SRV actuation value by a factor of 1.5 to project the number of actuations through 60 years of power operations. Based on this number cycles, the applicant project that the SRV discharge piping will be subjected to 201 cycles of operation through 60-years of power operation. The applicant established that PNPS plant specific analysis (TR-5310-2) states the SRV penetrations are qualified for 7500 cycles of maximum load. Based on this the project CUF for 60 years is calculated as 0.02. The applicant concludes that the plant specific CUF value is acceptable in accordance with 10 CFR 54.21(c)(1)(I). The staff found that, since this 60-year CUF value of 0.02 for the SRV penetrations is less that the CUF value of 0.5 established in MPR-751, the staff concludes that the 60-year CUF value for the SRV penetrations is acceptable in accordance with 10 CFR 54.21(c)(1)(i).

Fatigue Analysis for Torus Piping

The PNPS plant specific analysis (TR-5310-2) references the generic GE Mark I Containment Program for other torus attached piping (TAP). The plant-specific analysis limits the CUF values for the TAP to a mamixum value of 1.0. This is equivalent to criteria for CUF values as established for RCPB piping in Section III of the ASME Code and is acceptable. The generic GE Mark I Containment Program (based on 40 years of operation) establishes that 92% of the TAP would have cumulative usage factors of less than 0.3 and that 100% would have usage factors less than 0.5. The applicant conservatively multiplied the 40-year CUF values for the TAP by a factor of 1.5 to account for the additional 20 year of power operation. The projected 60-year calculations indicate that 92% of the TAP would have CUFs below 0.45, and 100% would have CUFs below 0.75. These calculations have thus been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The staff reviewed the applicant's response and found it acceptable because it conforms with nuclear industry practice.

4.6.1.2 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of primary containment, attached piping, and components fatigue analysis in LRA Section A.2.2.4. On the basis of its review of the UFSAR supplement, the staff found that the summary description of the applicant' s actions to address the primary containment, attached piping, and components fatigue analysis is adequate, because it reflects the information provided in the LRA.

4.6.1.3 Conclusion

On the basis of its review, as discussed above, the staff concluded that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for the containment liner plate, metal containment, and penetrations fatigue analyses TLAA, the analyses have been projected to the end of period of extended operation. The staff also concluded that the UFSAR supplement contains an appropriate summary description of fatigue of primary containment, attached piping, and components TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

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ATTACHMENT 5

AUDIT REPORT INPUTS FOR SECTION 4.7
OF THE PILGRIM LICENSE RENEWAL APPLICATION,
OTHER TLAAS

LRA SUBSECTION 4.7.2, TLAAS IN BWRVIP REPORTS

LRA SUBSUBSECTION 4.7.2.2, BWRVIP-48 - VESSEL ID
ATTACHMENT WELDS FATIGUE ANALYSIS

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4.7.2 TLAAs in BWRVIPs

4.7.2.2 BWRVIP-48, Vessel Attachment Welds Fatigue Analysis

EPRI Topical Report No. BWRVIP-48-A, "BWR Vessel and Internals Project, Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines" (BWRVIP-48-A [February 2002]) provides augmented inspection recommendations and flaw evaluation guidelines that were established by the Boiler Water Reactor Vessel and Internals Project (BWRVIP) for vessel attachment (bracket) welds in boiling water reactor (BWR) designs.[1] The BWRVIP evaluated the impact of metal fatigue on BWR RPV attachment welds in Section 2.2.2 of BWRVIP-48-A and assessed the impact of license renewal on the metal fatigue assessment for these attachment welds in Section A.4 of Appendix A to the report. The NRC approved the fatigue assessment for BWR RPV attachcment welds in a safety evaluation (SE) dated January 17, 2001.

4.7.2.2.1 Summary of Technical Information in the Application

In Section 4.7.2.2 of the LRA, the applicant identifies that the generic metal fatigue analysis in BWRVIP-48-A for the RPV bracket welds is a TLAA for the PNPS LRA. The applicant states that design of the PNPS RPV does not include any bracket welds that are outside the scope of the recommened analyses and guidelines in BWRVIP-48-A. The applicant therefore concludes that the generic metal fatigue analysis in BWRVIP-48-A is applicable and bounds the metal fatigue analysis for the PNPS bracket welds. The applicant therefore concludes the BWRVIP-48-A analysis as applied to the PNPS bracket welds has been projected to the expiration of the period of extended operation (PEO) and is acceptable in accordance with 10 CFR 54.21(c)(1)(ii).

4.7.2.2.2 Evaluation

Regulatory Basis for the BWR Vessel ID Attachment Weld Fatigue Analyses

The BWRVIP's metal fatigue analysis for U.S. BWR bracket welds was based on a bounding generic cumulative usage factor (CUF) assessment for these bracket welds, as reported in EPRI Topical Report BWRVIP-48-A. The calculational methods in Section III of the ASME Code for CUF calculations apply to the BWRVIP's bounding generic assessment for U.S. RPV bracket welds. These methods have been discussed in Section 4.3.1.2 of this audit report. The BWRVIP concluded that the metal fatigue CUF analyses for U.S. BWR RPV bracket welds yielded CUF values ranging from the 0.05 - 0.5. The BWRVIP also reported that more detailed studies yield CUF values less than 0.4. In BWRVIP-48-A, the BWRVIP stated that metal fatigue analyses for BWR RPV bracket welds would have to be identified as TLAAs for BWR applications if plant-specific metal fatigue analyses for the bracket welds existed in the CLB and if the analyses met the six criteria for TLAAs, as defined in 10 CFR 54.3.

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[1] The "-A" in the report number represents the NRC-approved version of the report. BWRVIP-48-A includes the NRC's assessment of the report's augmented inspection, flaw evaluation, and TLAA methodologies, which is provided in the report as a copy of the staff's SE of January 17, 2001.

The NRC assessed the augmented inspection methods, flaw evaluation methods, and TLAAs for BWR RPV bracket welds in the staff's SE of January 17, 2001. The calculational methods in Section III of the ASME Code for CUF calculations apply to the BWRVIP's bounding generic assessment for U.S. RPV bracket welds. These methods have been discussed in Section 4.3.1.2 of this audit report. The staff's SE on BWRVIP-48-A approved the generic metal fatigue CUF analyses for the BWR RPV bracket welds.

Scope of Review and Assessment

The applicant did not identify any plant-specific CUF calculation for the PNPS RPV bracket welds. The applicant did identify, however, that the RPV bracket weld configurations at PNPS were within the scope of those analyzed in BWRVIP-48-A and concluded that the generic CUF assessment in BWRVIP-48-A would be bounding for the design of the PNPS RPV bracket welds. Consistent with the staff's SE on BWRVIP-48-A, the project team concludes that metal fatigue of the PNPS RPV bracket welds does not need to be treated as a TLAA for the PNPS LRA because the current licensing basis (CLB) does not include a plant-specific 40-year CUF calculation for the RPV bracket welds. The project team also concludes that the generic CUF assessment in BWRVIP-48, as projected for 60-years of licensed operation and approved in the staff's SE of January 17, 2001, will provided a sufficient means of managing fatigue in these welds during the PEO.

4.7.2.2.3 UFSAR Supplement

The applicant provided the UFSAR Supplement summary description for the generic BWRVIP-48 fatigue analysis in LRA Section A.2.2.5. In a letter dated **Month Date**, 2006, the applicant amended the PNPS LRA to delete the BWRVIP-48 fatigue assessment for the RPV interior bracket welds as a TLAA for the application. The amendment of the LRA included deletion of UFSAR Section A.2.2.5 from the LRA. In Section 4.7.2.2.2 of this audit report, the project provided its regulatory basis for concluding that the generic fatigue analysis in EPRI Topical Report No. BWRVIP-48-A provides an acceptable basis for managing fatigue-induced cracking in these welds without the need for the analysis to be treated as a TLAA for the LRA. Therefore, based on the project team's assessment in Section 4.7.2.2.2 of this audit report, the project team concludes that it is acceptable to remove LRA UFSAR Supplement Section A.2.2.5 from the PNPS LRA.

4.7.2.2.4 Conclusion

On the basis of its review, as discussed above, the staff concluded that the applicant has provided a acceptable basis for deleting Section 4.7.2.2, "BWRVIP-48, Vessel ID Attachment Welds Fatigue Analysis," as a TLAA for the PNPS LRA. The staff also concluded that the applicant has provided an acceptable basis for deleting UFSAR Supplement Section A.2.2.5, "Vessel ID Attachment Welds Fatigue Analysis," from the PNPS LRA, as would otherwise be mandated in accordance with 10 CFR 54.21(d).

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ATTACHMENT 6

AUDIT REPORT INPUTS FOR SECTION 4.7
OF THE PILGRIM LICENSE RENEWAL APPLICATION,
OTHER TLAAS

LRA SUBSECTION 4.7.2, TLAAS IN BWRVIP REPORTS

LRA SUBSUBSECTION 4.7.2.3, BWRVIP-49 -
INSTRUMENT PENETRATIONSFATIGUE ANALYSIS

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4.7.2 TLAAs in BWRVIPs

4.7.2.3 BWRVIP-49, Instrument Penetrations Fatigue Analysis

EPRI Topical Report No. TR-108695, "BWR Vessel and Internals Project: Instrument Penetration Inspection and Flaw Evaluation Guidelines," (BWRVIP-49, [March 1998]) provides augmented inspection recommendations and flaw evaluation guidelines that were established by the Boiler Water Reactor Vessel and Internals Project (BWRVIP) for reactor pressure vessel instrumentation penetration nozzles (RPV IPNs) in boiling water reactor (BWR) designs. The BWRVIP assessed the impact of license renewal on the generic metal fatigue assessment for these RPV IPNs in Section A.4 of Appendix A to the report. The NRC approved the generic fatigue assessment for the RPV IPNs in a safety evaluation (SE) dated March 13, 2002. Section 4.3 of NUREG-1800, Revision 1, "Standard Review Plan for License Renewal Applications for Nuclear Power Plants." confirms that metal fatigue analyses for of RPV components are time-dependent analyses that conform to the definition of a time-limited aging analysis (TLAA) in 10 CFR 54.3.

4.7.2.3.1 Summary of Technical Information in the Application

The applicant identifies that the generic metal fatigue analysis in BWRVIP-49 for the PNPS RPV IPNs is a TLAA for the PNPS LRA. In Section 4.3.1 of the LRA, the applicant identified that the PNPS RPV INPs were exempted from a 40-year design basis CUF calculation under the Section III fatigue exemption criteria. The applicant therefore concludes that the generic metal fatigue analysis in BWRVIP-49 is applicable and bounds the metal fatigue analysis for the PNPS bracket welds. The applicant therefore concludes the BWRVIP-49 analysis as applied to the PNPS RPV IPNs has been projected to the expiration of the period of extended operation (PEO) and is acceptable in accordance with 10 CFR 54.21(c)(1)(ii).

4.7.2.3.2 Evaluation

The BWRVIP's metal fatigue analysis for U.S. BWR RPV IPNs was based on a bounding generic cumulative usage factor (CUF) assessment. The calculational methods in Section III of the ASME Code for CUF calculations apply to the BWRVIP's bounding generic assessment for U.S. RPV IPNs. These methods have been discussed in Section 4.3.1.2 of this audit report. The BWRVIP concluded that the metal fatigue CUF analyses for U.S. BWR RPV IPNs yielded CUF values that were less than 0.4 CUF threshold used to consider additional impact of the BWR coolant environment on the CUF calculations. In BWRVIP-49, the BWRVIP stated that metal fatigue analyses for BWR RPV IPNs would have to be identified as TLAAs for BWR applications if plant-specific metal fatigue analyses for the IPNs existed in the CLB and if the analyses met the six criteria for TLAAs, as defined in 10 CFR 54.3.

The NRC assessed the augmented inspection methods, flaw evaluation methods, and TLAAs for BWR RPV IPNs in the staff's SE of March 13, 2002. In this SE, the staff concluded that the thermal cycle CUFs for all U.S. BWRs were less than 0.4 for both the current operating period and the PEO. The staff therefore concluded that thermal fatigue of BWR RPV IPNs was not a significant aging effect for BWRs. However, BWRVIP-49 did state that a BWR license renewal applicant would have to identify that metal fatigue of its RPV IPNs is a TLAA if the applicant determined that plant-specific metal fatigue analysis existed at their facility that met the six

criteria for TLAAs established in 10 CFR 54.3. In Entergy's Letter of July 5, 2006, the applicant identified that the PNPS RPV IPNs were exempted from a CUF calculation under the Section III exemption criterion of Paragraph N–415.1 of the 1965 Edition of the ASME Code, Section III. The staff's basis for accepting the CUF exemption for the RPV IPNs is provided in Section 4.3.1.2 of this audit report. As a result, the applicant has not identified any plant-specific CUF calculation for the PNPS RPV IPNs. The applicant did identify, however, that the RPV IPNs at PNPS were within the scope of those analyzed in BWRVIP-49 and concluded that the generic CUF assessment in BWRVIP-49 would be bounding for the design of its RPV IPNs. Consistent with the staff's SE on BWRVIP-49, the project team concludes that metal fatigue of the PNPS RPV IPNs does not need to be treated as a TLAA for the PNPS LRA because the current licensing basis (CLB) did not require a plant-specific 40-year CUF calculation for the components. The project team also concludes that the generic CUF assessment in BWRVIP-49, as projected for 60-years of licensed operation and approved in the staff's SE of January 17, 2001, will provided a sufficient analysis for managing fatigue in these components during the PEO.

4.7.2.3.3 UFSAR Supplement

The applicant provided the UFSAR Supplement summary description for the generic BWRVIP-49 fatigue analysis in LRA Section A.2.2.6. In a letter dated **Month Date**, 2006, the applicant amended the PNPS LRA to delete the BWRVIP-49 fatigue assessment for the RPV IPNs as a TLAA for the application. The amendment of the LRA included deletion of UFSAR Section A.2.2.6 from the LRA. In Section 4.7.2.3.2 of this audit report, the project provided its regulatory basis for concluding that the generic fatigue analysis in EPRI Topical Report No. BWRVIP-49 provides an acceptable basis for managing fatigue-induced cracking in the PNPS RPV IPNs without the need for the generic analysis to be treated as a TLAA for the LRA. Therefore, based on the project team's assessment in Section 4.7.2.3.2 of this audit report, the project team concludes that it is acceptable to remove LRA UFSAR Supplement Section A.2.2.6 from the PNPS LRA.

4.7.2.3.4 Conclusion

On the basis of its review, as discussed above, the staff concluded that the applicant has provided a acceptable basis for deleting Section 4.7.2.3, "BWRVIP-49, Instrument Penetrations Fatigue Analysis," as a TLAA for the PNPS LRA. The staff also concluded that the applicant has provided an acceptable basis for deleting UFSAR Supplement Section A.2.2.6, "Instrument Penetrations Fatigue Analysis," from the PNPS LRA, as would otherwise be mandated in accordance with 10 CFR 54.21(d).

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ATTACHMENT 7

AUDIT REPORT INPUTS FOR SECTION 4.7
OF THE PILGRIM LICENSE RENEWAL APPLICATION,
OTHER TLAAS

LRA SUBSECTION 4.7.2, TLAAS IN BWRVIP REPORTS

LRA SUBSUBSECTION 4.7.2.5, BWRVIP-76 -
CORE SHROUD FATIGUE ANALYSIS

4.7.2 TLAAs in BWRVIPs

4.7.2.5 BWRVIP-76, Core Shourd Fatigue Analysis

EPRI Topical Report No. BWRVIP-76, "BWR Vessel and Internals Project, Core Shroud Inspection and Flaw Evaluation Guidelines" (BWRVIP-76 [November 1999]) provides augmented inspection recommendations and flaw evaluation guidelines that were established by the Boiler Water Reactor Vessel and Internals Project (BWRVIP) for core shrouds in boiling water reactor (BWR) designs. The BWRVIP evaluated the impact of metal fatigue on BWR core shrouds and whethe metal fatigue of BWR core shrouds needed to be identified as a TLAA for BWR LRAs in Section K.4 of Appendix K to the report. The NRC's approval of BWRVIP-76 is still pending completion of its review of the technical content in the report.

4.7.2.5.1 Summary of Technical Information in the Application

In Section 4.7.2.2 of the LRA, the applicant identifies that the generic metal fatigue analysis in BWRVIP-76 for the PNPS core shroud is a TLAA for the PNPS LRA. The applicant states that BWRVIP-76 identified that the generic fatigue analysis in Appendix K of the report identified that the fatigue analysis would only need to be treated as a TLAA if the facility had a corresponding plant-specific TLAA for the plant's core shroud design. The applicant stated that the PNPS core shroud tie rods were the only RPV internal components that received a 40-year CUF analysis. The applicant stated that the TLAA the PNPS core shroud tie rods is provided and evaluated in Section 4.3.1 of the PNPS LRA.

4.7.2.5.2. Evaluation

The project team evaluates the applicant's TLAA on Metal Fatigue of the PNPS core shrouds, and in particular for the core shroud tie rods, is provided in Section 4.3.1.2 of this audit report. The evaluation includes the staff's basis for concluding that Commitment #35 on the PNPS LRA provides an acceptable basis for approving the TLAA on Metal Fatigue of Class 1 components, including the core shroud tie rods, in accordance with 10 CFR 54.21(c)(1). The applicant has credited the BWR Internals Program to manage fatigue-induced cracking in the remaining RPV internals. The staff evaluates the applicant's basis for crediting the BWR Internals Program with management of fatigue-induced cracking in these RPV internals in Section 4.3.1.2 of this audit report.

4.7.2.5.3 UFSAR Supplement

The UFSAR Supplement summary description on the TLAA on Metal Fatigue of Class 1 components is provided in LRA Section A.2.2.2.1 of the PNPS LRA. The scope of this UFSAR Supplement summary description includes the applicant's plant-specific cumulative usage factor (CUF) analysis for the PNPS core shroud tie rods. The project team evaluates this TLAA in Section 4.3.1.3 of this audit report. The scope of the staff's evaluation in Section 4.3.1.3 of the audit report includes the evaluation of the UFSAR Supplement summary description for the TLAA on Metal Fatigue of Class 1 Components, including the PNPS core shroud tie rods.

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4.7.2.5.4 Conclusion

The scope of the staff's conclusion in Section 4.3.1.4 of the audit report is applicable to the evaluation of metal fatigue analysis for the PNPS core shroud tie rods.