RAS J-108

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the matter of

Entergy Corporation

Pilgrim Nuclear Power Station

License Renewal Application

Docket # 50-293

April 30, 2008

Pilgrim Watch Replies to Entergy's and NRC's Responses Opposing Pilgrim Watch's Motion Requesting that The record be Held Open for Sua Sponte Consideration of Cumulative Usage Factors

Pilgrim Watch replies to both Entergy's and NRC's objections in this filing. Entergy and NRC's April 21, 2008 objections to Pilgrim Watch's April 9, 2008 motion consisted of three points. They said that Pilgrim Watch filed the motion "inexcusably late;" Pilgrim Watch did not raise a serious safety issue; and that the Motion did not meet the criteria for either a stay of decision or admission of a new contention.

A. The Motion was late; but not inexcusably so.

1. Both Entergy and NRC claim that the cumulative usage factor (CUF)[1] issue had been brought forward at Vermont Yankee in May 2006 and therefore Pilgrim Watch should have been aware of the issue. Citizen groups cannot be expected to become intimately familiar with each and every license application. Pilgrim Watch raised the issue when we learned that NRC considered it "new and significant" and that the issue applied to other reactor sites.

[1] A figure used to appraise the possibility of fatigue failure is the cumulative usage factor (CUF), which is the ratio of the number of cycles experienced by a structure or component divided by the number of allowable cycles for that structure or component. At a nuclear power plant, the maximum number of cycles that should be experienced by any structure or component should always result in a CUF of less than 1.0. In other words, the number of actual cycles experienced should always be less than the number of allowable cycles.

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2. It is Entergy that is "inexcusably late." They have not properly addressed this issue in each of their license renewal applications. Specifically, Entergy has made a habit out of filing license renewal applications with cumulative usage factors exceeding (1) – Arkansas Until 1 and Unit 2, Vermont Yankee, Pilgrim, Oyster Creek, and Indian Point. At each one of these reactors, Entergy filed essentially the same license renewal application and then waited to see if there is any objection before negotiating commitments with NRC.

3. Let us not forget the fact that it has taken citizen intervention at each reactor site to bring this issue to the attention of the NRC. If it were not for citizen intervention in Entergy's Vermont Yankee site, followed by Entergy's Oyster Creek and Indian Point sites the issue would have gone unnoticed by NRC and the public. Again it is not Pilgrim Watch but Entergy and NRC that are "inexcusably late" in properly addressing and fixing this important public safety concern.

B. Issue of Law

The LRA does not include an adequate plan to monitor and manage the effects of aging due to metal fatigue on key reactor components that are subject to an aging management review, pursuant to 10 C.F.R. § 54.21(a), and an evaluation of time limited aging analysis, pursuant to 10 C.F.R. § 54.21(c).

C. Basis

1. The cumulative usage factor (CUF) is a number used to assess the possibility of fatigue failure. It is the ratio of the number of cycles experienced by a structure or component divided by the number of allowable cycles for that structure or component. At a nuclear power plant, the maximum number of cycles that should be experienced by any structure or component should always result in a CUF of less than 1.0. In other words, the number of actual cycles experienced should always be less than the number of allowable cycles.

2. The data that Entergy provided in the LRA and reviewed in NUREG-1891 (the SER) indicates that key components have a CUF value of greater than 1.0; and thus they will have a greater potential to crack and/or fail due to metal fatigue during the proposed license renewal term. This could potentially result in catastrophic failure during day-to-day operation, or more likely during anticipated or unanticipated transients. The commitments agreed to by Entergy [No. 31 and No. 35][2] do not provide reasonable assurance to the public that the issue is resolved, discussed below.

C. The Issue Raised is within the Scope of the Proceeding

1. Pilgrim Watch filed the Motion, more as a place card, to assure that the record would be held open to allow time for public participation regarding this "new and significant" issue that has the potential to severely impact public safety at Pilgrim Station where certain plant systems, structures, and components suffer the effects of metal fatigue.

2. Specifically, the applicant's own data demonstrates that (a) the reactor vessel shell and lower head, (b) reactor vessel feedwater nozzles, (c) reactor recirculation system piping (including inlet and outlet nozzles), and (d) feedwater piping have an environmentally adjusted CUF greater than 1.0 [3] and thus are at a higher risk for failure due to metal fatigue. These systems were identified by NUREG/CR-6260 Section 5.7 to be among the nine systems most sensitive to environmental effects for PNPS vintage General Electric plants.[4]

3. Because the issue of metal fatigue of plant systems requires aging management review this issue is within the scope of this license renewal proceeding.

D. The Issue Raised Is Material

The issue of metal fatigue is material to this relicensing proceeding. The commitments made by Entergy to NRC do not provide reasonable assurance that public safety will be protected. Therefore the NRC must make certain findings to protect the public health and safety, and the

[2] NUREG-1891, Appendix A, Commitments 31 and 35; ADAMS ML073241016; Attachment
[3] Ibid, 4.3.3.1 *Summary of Technical Information in the Application*
[4] Ibid

environment, and either deny the license extension, or impose significant modifications to the commitments.

E. Concise Statement of the Facts

1. Entergy must comply with the following requirements of 10 C.F.R. § 54.21(c) (1):

   Each application must contain the following information:
   (c) An evaluation of time-limited aging analyses.
   (1) A list of time-limited aging analyses, as defined in § 54.3, must be provided.
   The applicant shall demonstrate that--
   (i) The analyses remain valid for the period of extended operation;
   (ii) The analyses have been projected to the end of the period of extended operation; or
   (iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation [10 C.F.R. § 54.21(c)(1)].

2. Data in the SER indicates that some key reactor components will have a greater potential for cracking due to metal fatigue before the year 2032, during the period of extended plant operation

3. **PNPS's data is summarized as follows:**
Component Plant Environmentally Adjusted CUF (Entergy's data) that exceeds 1.0 CUF criterion includes [NUREG-1891, SER 4.3.3.1 at 4-44]:

   Reactor vessel shell and lower head
   Reactor vessel feedwater nozzles
   Reactor recirculation system piping (including inlet and outlet nozzles); and
   Feedwater piping

4. Component fatigue, which can lead to ultimate failure, is an aging phenomenon that results from cyclic mechanical and thermal stresses. Failure from fatigue can result in dangerous pipe

ruptures, component malfunction, or the migration of loose pieces of metal through the reactor system, which can interfere with safe operation of a plant.

5. Data in NUREG-1891, referred to above, indicates that the requirements of 10 C.F.R. §§ 54.21(c)(1)(I) and (ii) are not satisfied because they exceed the CUF on their face.

6. **Commitments**

To satisfy section 54.21(c)(1)(iii) – that "the effect of aging on the intended functions(s) will be adequately managed for the period of extended operation" – Entergy agreed to License Renewal Commitments 31 and 35 (NUREG-1891, SER, Appendix A, A-10 thru A-13].

Commitment 31 says that: At least 2 years prior to entering the period of extended operation, for the locations identified in NUREG/CR-6260,for BWRs of the PNPS vintage, PNPS *will* [emphasis added] refine our current fatigue analyses to include the effects of reactor water environment and verify that the cumulative usage factors (CUFs) are less than 1. This includes applying the appropriate Fen [sic] factors to valid CUFs determined in accordance with one of the following:

1. For locations, including NUREG/CR-6260 locations, with existing fatigue analysis valid for the period of extended operation, use the existing CUF to determine the environmentally adjusted CUF.

2. More limiting PNPS-specific locations with a valid **CUF** may be added in addition to the NUREG/CR-6260 locations.

3. Representative CUF values from other plants, adjusted to or enveloping the PNPS plant specific external loads may be used if demonstrated applicable to PNPS.

4. An analysis using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case) may be performed to determine a valid CUF.

During the period of extended operation, PNPS *may* also use one of the following options for fatigue management *if ongoing monitoring indicates a potential for a condition outside the analysis bounds noted above*: [emphasis added]

1. Update and/or refine the affected analyses described above.

2. Implement an inspection program that has been reviewed and approved by the NRC (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined **by** a method acceptable to the NRC).

3. Repair or replace the affected locations before exceeding a CUF of 1.0.

Enhancement or Implementation Schedule: June 8, 2012; June 8, 2010 for submitting the AMP *if* [emphasis added] PNPS selects the option of managing the effects of aging due to environmentally assisted fatigue

Commitment 35 says that: At least 2 years prior to entering the period of extended operation, for reactor vessel components, including the feedwater nozzles, PNPS *will* implement *one or more* of the following [emphasis added]:

(1) Refine the fatigue analyses to determine valid CUFs less than 1. Determine valid CUFs based on numbers of transient cycles projected to be valid for the period of extended operation. Determine CUFs in accordance with an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC- approved code case).

(2) Manage the effects of aging due to fatigue at the affected locations by an inspection program that has been reviewed and approved by the NRC (e.g., periodic non-destructive examination of the affected locations at inspection intervals to be determined by a method acceptable to the NRC).

(3) Repair or replace the affected locations before exceeding a CUF of 1.0. Should PNPS select the option to manage the aging effects due to fatigue during the period of extended operation, details of the AMP such as scope, qualification, method, and frequency will be submitted to the NRC at least 2 years prior to the period of extended operation.

Should [emphasis added] PNPS select the option to manage the aging effects due to fatigue during the period of extended operation, details of the AMP such as scope, qualification, method, and frequency will be submitted to the NRC at least 2 years prior to the period of extended operation.

Enhancement or Implementation Schedule: June 8, 2012; June 8, 2010 for submitting the AMP *if* [emphasis added] PNPS selects the option of managing the effects of aging due to environmentally assisted fatigue

7. **What's wrong?**

a) The Commitments are vague, incomplete, and lacking in transparency. The commitment says they will "refine the current fatigue analyses to include the effects of reactor water environment and verify that the cumulative usage factors (CUFs) are less than 1." We note that "verify that the cumulative usage factors (CUFs) are less than 1" appears to suggest doing the math to get the "right" answer. Further they "may" choose to do more inspections or fix or replace the component. Then again, they may not choose to do so.

b) In Appendix A's *PNPS License Renewal Commitments* [Nureg-1891, A-10-13] under "Enhancements or Implementation Schedule" for Commitment 31 it says, "Enhancement or Implementation Schedule: June 8, 2012; June 8, 2010 for submitting the AMP if PNPS selects the option of managing the effects of aging due to environmentally assisted fatigue;" and for Commitment 35 it says, "Enhancement or Implementation Schedule: June 8, 2012; June 8, 2010 for submitting the AMP if PNPS selects the option of managing the effects of aging due to environmentally assisted fatigue."

Both say "*if*" PNPS selects the option..." not PNPS *shall* select..." In effect, it is no commitment, without a requirement.

c) To make our point, consider Commitment 35. It offers Entergy the following "options"- choose from a menu 1, 2 or 3.

First, Entergy "may" choose to refine the fatigue analyses to determine valid CUF's less than 1 – redo the math. The commitment allows Entergy to simply do the computation again to get the "right" answer – that is a number < 1. We all know enough about computations that you can start with the answer and then work backwards. It is the equivalent of torture – if you cause the prisoner enough pain he or she will say anything. Because the license will be approved by the time the option is taken, if Entergy chooses to take the option, the public will not have the opportunity to review the numbers and check Entergy's math. It is clear that the commitment does not provide reasonable assurance. For example, Entergy got the "wrong" answer in the feedwater nozzle CUF numbers that were placed in the LRA – not simply wrong but indefensible. NUREG-1891, 4.3.1.2.1 says that in LRA Section 4.3.1.4 the applicant projected the 60-year feedwater nozzle CUF to be less than 0.899. The NRC Staff independently calculated the 60-year feedwater nozzle CUF value to be 1.217 on the same operational data and assumptions. Entergy withdrew their numbers. Now NRC gives Entergy an out in the Commitment – an opportunity to recalculate the numbers.

Second, NRC gives Entergy another "option" in the Commitment. Entergy "may" manage the effects of aging due to fatigue at certain locations by an inspection program that has been reviewed by and approved by NRC. No specifics are provided to the public prior to license approval – there is no clear inspection schedule - it simply asks the public to take a leap of faith that NRC will assure the adequacy of a yet-to-be-determined program that might or might not occur.

Third, NRC gives Entergy yet another "option" in the Commitment. Entergy "may" choose to repair or replace the affected locations before exceeding a CUF of 1.0. Therefore, the public is provided no assurance that the affected components will not break before Entergy gets around to

replacing them. The components that are now known to exceed the CUF factor of 1.0 should be replaced immediately. Indeed, it is telling that Entergy admits it has known of these conditions and has failed to make the necessary repairs and replacements.

This does not constitute an adequate aging management plan consistent with the intent of 10 C.F.R. §§ 54.21(c)(1)(iii) and 54.21(a)(3).

F. Conclusion

1. Pilgrim Watch has demonstrated above that NRC identified, and Entergy admitted, that four key components exceed the CUF criterion of 1.0. Entergy agreed to (2) commitments that upon closer inspection do not provide reasonable assurance to the public. If they choose to follow an option they may repair or replace these components or they may not; certainly if they do, it seems clear that it will be only as a last resort, not the most obvious and prudent first resort. Entergy may choose to "rework the numbers" (or, in Entergy's words, "refine the fatigue analyses") to "determine valid CUFs less than 1 when accounting for the effects of reactor water environment." By the Commitment's words ("determine valid CUFs"), NRC and Entergy have prejudged the outcome - gamed the licensing renewal process. Indeed, Entergy did just this after it filed its license renewal application for the Vermont Yankee Nuclear Power Station. This reworking of the numbers prompted the filing of an additional contention on metal fatigue, which the ASLB admitted in the license renewal proceeding. *See Mtr. of Entergy Nuclear Vermont Yankee, LLC (Vermont Yankee Nuclear Power Station)*, ASLBP No. 06-849-03-LR (Nov. 7, 2007). Here at Pilgrim, Entergy will not get caught - unless the ASLB steps in and this contention is allowed; or in the alternative the ASLB chooses to appoint an outside, independent expert to examine the issue under full and open public scrutiny – a process that I believe is within the board's authority.

2. The integrity of these safety components has serious safety implications for the public – that goes without saying. Because Pilgrim's safety depends on proper resolution of the metal fatigue issue (among other issues), the Commission cannot honestly make the required findings that

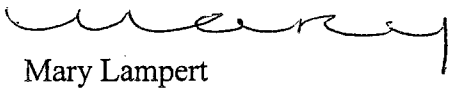
there is reasonable assurance that Pilgrim can operate within NRC requirements another 20 years.

3. The motion and this response to Entergy and NRC serves to further illustrate that, as previously alleged in Citizen's Petition, dated January 3, 2007, the license renewal safety reviews conducted by NRC Staff have failed to identify and fully resolve safety issues associated with operating degraded nuclear plants for 20 years beyond their initial 40 year life. The commitments themselves tell the story that the NRC Staff is unwilling to *require* the licensee to take specific and meaningful steps to provide real assurance. Further review is required at Pilgrim by the ASLB to assure that it will satisfy the AEA requirements to protect public health and safety and also to ensure that there will be meaningful opportunity for public participation in this important aspect of the licensing decision.

The Vermont Yankee proceeding has now confirmed that vigorous citizen involvement can lead to needed scrutiny and that inevitably leads to better decision-making.

Thank you for your consideration.

Respectfully submitted,



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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the matter of — Docket # 50-293-LR

Entergy Corporation

Pilgrim Nuclear Power Station

License Renewal Application — April 30, 2008

CERTIFICATE OF SERVICE

I hereby certify that the following was served April 21, 2008 by electronic mail and by U.S. Mail, First Class to the Service List: Pilgrim Watch Reply to Entergy's and NRC's Responses Opposing Pilgrim Watch's Motion Requesting that The record be Held Open for Sua Sponte Consideration of Cumulative Usage Factors

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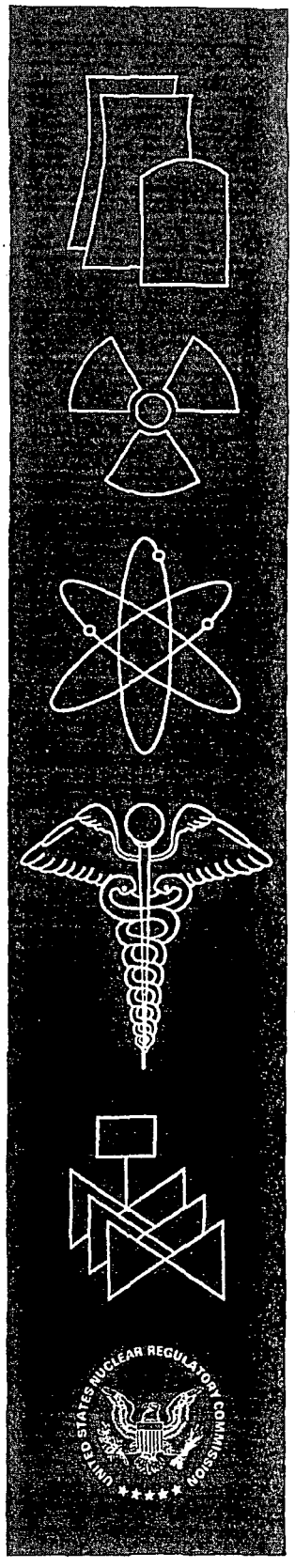
ATTACHMENT



NUREG-1891

Safety Evaluation Report Related to the License Renewal of Pilgrim Nuclear Power Station

Docket No. 50-293

Entergy Nuclear Operations, Inc.

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

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
28	Enhance System Walkdown Program guidance documents to perform periodic system engineer inspections of systems in-scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in-scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(2).	B.1.30	June 8, 2012	Letters 2.06.003 and 2.06.057
29	Implement the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as described in LRA Section B.1.31.	B.1.31	June 8, 2012	Letters 2.06.003 and 2.06.057
30	Perform a code repair of the CRD return line nozzle to cap weld if the installed weld repair is not approved via accepted code cases, revised codes, or an approved relief request for subsequent inspection intervals.	B.1.3	June 30, 2015	Letter 2.06.057
31	At least 2 years prior to entering the period of extended operation, for the locations identified in NUREG/CR-6260 for BWRs of the PNPS vintage, PNPS will refine our current fatigue analyses to include the effects of reactor water environment and verify that the cumulative usage factors (CUFs) are less than 1. This includes applying the appropriate Fen [sic] factors to valid CUFs	4.3.3	June 8, 2012 June 8, 2010 for submitting the AMP if PNPS selects the option of managing the	Letters 2.06.057, 2.06.064, 2.06.081, 2.07.005, 2.007.064

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
	determined in accordance with one of the following: 1. For locations, including NUREG/CR-6260 locations, with existing fatigue analysis valid for the period of extended operation, use the existing CUF to determine the environmentally adjusted CUF. 2. More limiting PNPS-specific locations with a valid CUF may be added in addition to the NUREG/CR-6260 locations. 3. Representative CUF values from other plants, adjusted to or enveloping the PNPS plant specific external loads may be used if demonstrated applicable to PNPS. 4. An analysis using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case) may be performed to determine a valid CUF. During the period of extended operation, PNPS may also use one of the following options for fatigue management if ongoing monitoring indicates a potential for a condition outside the analysis bounds noted above: 1. Update and/or refine the affected analyses described above.		affects of aging due to environmentally assisted fatigue	

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
	2. Implement an inspection program that has been reviewed and approved by the NRC (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined by a method acceptable to the NRC). 3. Repair or replace the affected locations before exceeding a CUF of 1.0.			
32	Implement the enhanced Bolting Integrity Program described in Attachment C of Pilgrim License Renewal Application Amendment 5 (Letter 2.06.064).		June 8, 2012	Letters 2.06.057, 2.06.064, and 2.06.081
33	PNPS will inspect the inaccessible jet pump thermal sleeve and core spray thermal sleeve welds if and when the necessary technique and equipment become available and the technique is demonstrated by the vendor, including delivery system.		As stated in the commitment	Letter 2.06.057
34	Within the first 6 years of the period of extended operation and every 12 years thereafter, PNPS will inspect the access hole covers with UT methods. Alternatively, PNPS will inspect the access hole covers in accordance with BWRVIP guidelines should such guidance become available.		June 8, 2018	Letter 2.06.057 and 2.06.089
35	At least 2 years prior to entering the period of extended		June 8, 2012	Letters

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	**Commitment**	**LRA Section(s)**	**Enhancement or Implementation Schedule**	**Source**
	operation, for reactor vessel components, including the feedwater nozzles, PNPS will implement one or more of the following: (1) Refine the fatigue analyses to determine valid CUFs less than 1. Determine valid CUFs based on numbers of transient cycles projected to be valid for the period of extended operation. Determine CUFs in accordance with an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). (2) Manage the effects of aging due to fatigue at the affected locations by an inspection program that has been reviewed and approved by the NRC (e.g., periodic non-destructive examination of the affected locations at inspection intervals to be determined by a method acceptable to the NRC). (3) Repair of replace the affected locations before exceeding a CUF of 1.0. Should PNPS select the option to manage the aging effects due to fatigue during the period of extended operation, details of the AMP such as scope, qualification, method, and frequency will be submitted to the NRC at least 2 years prior to the period of extended operation.		June 8, 2010 for submitting the AMP if PNPS selects the option of managing the affects of aging	2.06.057, 2.06.064, and 2.06.081

fatigue-induced cracking without implementation of the CUF updates recommended in NUREG-1801, Revision 1, Volume 2, "Generic Aging Lessons Learned (GALL) Report," AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary."

The staff reviewed LRA Table 4.3-2 and the PNPS program evaluation report and determined that both documents projected the total number of cycles for more than half of the operational transients analyzed in LRA Table 4.3-2 to exceed the maximum number of cycles for these transients allowed by the current design basis. The applicant addressed this issue along with Commitment No. 35 in a letter dated September 13, 2006. As discussed in the following paragraphs, the staff evaluated whether the TLAA on Class 1 component metal fatigue, coupled to the activities proposed in Commitment No. 35, complies with 10 CFR 54.21(c)(1) requirements.

The applicant stated that all RPV components were designed to Section III.

In a letter dated July 5, 2006, the applicant stated that LRA Table 4.3-1 should include the 40-year CUF value for the RPV recirculation outlet nozzle and that this table would be amended accordingly to include it. In a letter dated September 13, 2006, the applicant amended LRA Table 4.3-1 to include the 40-year CUF value for the RPV recirculation outlet nozzle as 0.747.

The staff also reviewed LRA Section 4.3.1.4, "Feedwater Nozzle Fatigue," to verify (1) pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation, (2) pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation, or (3) pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

LRA Section 4.3.1.4 that the RPV feedwater nozzle as the limiting Class 1 component for CUF. The applicant stated that it had projected the feedwater nozzle CUF for 60 years, considering both the currently analyzed system design transients and rapid cycling through the period of extended operation. The applicant projected the 60-year feedwater nozzle CUF to be less than 0.899. The staff independently calculated the 60-year feedwater nozzle CUF value to be 1.217 on the same operational data and assumptions. During the audit, the staff requested that the applicant clarify how it had calculated the 60-year RPV feedwater nozzle CUF value, particularly as LRA Table 4.3-2 indicates that the number of cycles projected at 60 years for more than half of the design basis transients has exceeded the design basis allowables for the thermal transients.

In its response dated September 13, 2006, the applicant stated that the 60-year extrapolation of the CUF value for the feedwater nozzles in LRA Section 4.3.1.4 is no longer valid and that this section is not required and can be deleted. The applicant stated that it would manage fatigue-induced damage of the RPV components, including the RPV feedwater nozzles, in accordance with the specific aging management details in LRA Commitment No. 35.

Commitment No. 35 will require the applicant to (1) update 60-year CUF calculations for the RVP components (including RPV feedwater nozzles and other RPV appurtenances), (2) manage the aging effect of fatigue-induced damage by an inspection-based program approved by the NRC, or (3) repair or replace the affected RPV location before a 1.0 CUF value is exceeded. The activities within the scope of Commitment No. 35 will ensure that the TLAA on metal fatigue of the