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Entergy

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January 30, 2008
BVY 08-002

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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USNRC

August 12, 2008 (11:00am)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

References:
1) Letter, Entergy to USNRC, "Vermont Yankee Nuclear Power Station, License No. DPR-28, License Renewal Application," BVY 06-009, dated January 25, 2006.
2) Letter, Entergy to USNRC, "Update of Aging Management Program Audit Q&A Database," BVY 07-079, dated November 14, 2007.
3) Letter, USNRC to Entergy, "Update on Extension of Schedule for the Conduct of Review of the Vermont Yankee Nuclear Power Station License Renewal Application," NVY 07-157, dated November 27, 2007.
4) Letter, Entergy to USNRC, "License Renewal Application, Amendment 33," BVY 07-082, dated December 11, 2007.
5) Letter, Entergy to USNRC, "License Renewal Application, Amendment 31," BVY 07-066, dated September 17, 2007.

Subject: **Vermont Yankee Nuclear Power Station**
License No. DPR-28 (Docket No. 50-271)
License Renewal Application, Amendment 34

On January 25, 2006, Entergy Nuclear Operations, Inc. and Entergy Nuclear Vermont Yankee, LLC (Entergy) submitted the License Renewal Application (LRA) for the Vermont Yankee Nuclear Power Station (Reference 1).

In Reference (2), Entergy provided an update to the Aging Management Program (AMP) Audit Q&A Database. In Reference (3), the NRC requested additional information relative to audit question number 387. This information was provided in Reference (4).

Subsequent to that submittal and a follow-up meeting with the NRC staff on January 8, 2008, Entergy agreed to perform additional analyses to support the original response. Attachment 1 to this letter provides the results of those analyses. Attachment 2 provides an update to the Cumulative Usage Factor for the Core Spray nozzle forging blend radius that was previously submitted with Reference (5).

This letter contains no new regulatory commitments.

Should you have any questions concerning this submittal, please contact Mr. David Mannai at (802) 451-3304.

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U.S. NUCLEAR REGULATORY COMMISSION

In the Matter of Entergy Nuclear Vermont Yankee LLC

Docket No. 50-271 Official Exhibit No. E2-28-VY

OFFERED by: Applicant/Licensee Intervenor ____________

NRC Staff Other ____________

IDENTIFIED on 7/21/08 Witness/Panel NEC 2

Action Taken: ADMITTED REJECTED WITHDRAWN

Reporter/Clerk MAC

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

Executed on January 30, 2008.

Sincerely,

Ted A. Sullivan
Site Vice President
Vermont Yankee Nuclear Power Station

Attachments

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Attachment 1

Vermont Yankee Nuclear Power Station
License No. DPR-28 (Docket No. 50-271)

License Renewal Application

Amendment 34

RAI 4.3.3-2 Additional Information

Vermont Yankee Feedwater Nozzle Confirmatory Analysis Results

On January 8, 2008, the Office of Nuclear Reactor Regulation (NRR) staff and Entergy Vermont Yankee (VY) met in a public meeting to discuss VY's response to RAI 4.3.3-2 on environmentally assisted fatigue (EAF). After a formal presentation and dialogue with NRC staff, VY agreed to perform a confirmatory EAF analysis on the reactor pressure vessel (RPV) feedwater nozzle. This analysis would confirm the VY fatigue analysis approach by performing an alternate confirmatory analysis using ASME Code, Section III, Subsection NB-3200 [1] methodology to demonstrate available nozzle margins and acceptability of the VY approach. Table 1 provides the results of the confirmatory analysis and demonstrates that the existing VY fatigue analysis approach is acceptable.

Discussion

The following items summarize the methods used in the VY confirmatory analysis [2],[3],[4]:

1. The feedwater nozzle was chosen for confirmation since it has the largest number and most complicated and severe transients, and the highest calculated fatigue usage of the three nozzles which used the VY fatigue analysis approach. The analysis of the feedwater nozzle is bounding for the core spray and recirculation outlet nozzles since the calculated usage factors are at least 70% less than those for the feedwater nozzle and the number and severity of thermal transients are less.

2. The confirmatory analysis performed a detailed ASME Code, Section III, Subsection NB-3200 [1] fatigue calculation. The same ANSYS finite element model (FEM) was used as for the current licensing basis fatigue analysis, and was also used in the existing environmental fatigue analysis. The same number and severity of design transients and the same water chemistry inputs were used as had been used in the existing environmental fatigue analysis. Thermal transient stresses were calculated directly using the FEM for all transients.

3. The same transient definitions and cycle counts for 60 years of operation, as defined in Reference [5] and used for the existing analysis [8], were used for computation of cumulative fatigue in the confirmatory analysis.

4. The limiting cross-sections previously evaluated for the feedwater nozzle (nozzle corner and safe end) were evaluated.

5. Primary plus secondary and total stress ranges for all events were calculated and a correction for elastic-plastic analysis (i.e., K_e) was applied, where appropriate. Total stress intensity for each transient pair based on stress component differences was calculated per ASME Code, Section III, Paragraph NB- 3216.2 [1]. Stress ranges for primary plus secondary and primary plus secondary plus peak stress were calculated using all six components of stress (3 direct and 3 shear stresses). When more than one load set was defined for either of the event pair loadings, the stress differences were determined for all of the possible loading combinations, and the pair producing the largest alternating total stress intensity (including the effects of K_e) was used.

6. For the fatigue usage calculation, stress intensities for the event pairs were re-ordered in order of decreasing primary plus secondary plus peak stress intensity, including a correction for the ratio of modulus of elasticity (E) from the fatigue curve divided by E from the analysis. A fatigue table was created to determine the number of cycles available for each of the events of an event pair, and to determine fatigue usage per ASME Code, Section III, Paragraph NB-3222.4e [1]. For each load set pair in the fatigue table, the allowable number of cycles was determined from the alternating stress, which is half of the corrected total stress intensity range, using the appropriate ASME Code, Section III [1] fatigue curve.

7. Per Section X.M1 of the GALL Report [6], environmental fatigue multipliers were calculated using the F_{en} relationships from NUREG/CR-6583 [7] for carbon and low alloy steels. The F_{en} factors are bounding for all transient pairs based on the highest temperature of each of the transient stress pairs.

The results of the confirmatory analysis and a comparison of the final CUF results from the existing EAF analysis are shown in Table 1 below.

Table 1 - VY Feedwater Nozzle 60 year EAF CUF

Location	Analysis	**EAF CUF / Allowable**
Safe End	EAF Analysis [8]	**0.2560 / 1.0000**
	Confirmatory Analysis [4]	**0.0994 / 1.0000**
Nozzle Corner (Blend Radius)	EAF Analysis [8]	**0.6392 / 1.0000**
	Confirmatory Analysis [4]	**0.3531 / 1.0000**

Conclusions:

The existing EAF analysis for the VY feedwater, recirculation outlet, and core spray nozzles used a simplified fatigue analysis approach to calculate CUFs, including bounding F_{en} relationships. The confirmatory analysis used ASME Code, Section III, Subsection NB [1] methods and included more refined but still conservative F_{en} relationships.

For the locations identified above, the EAF results, using either the existing or confirmatory analysis, show that the fatigue usage factors, including environmental effects, are well within allowable values for 60 years of operation.

The confirmatory analysis for the feedwater nozzle, which used ASME Section III [1] code methods, confirms the adequacy of the existing VY fatigue analysis approach for all three nozzles.

References:

1. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section III, Rules for Construction of Nuclear Power Plant Components, Division 1-Subsection NB, Class 1 Components, 1998 Edition including 2000 Addenda.

2. Structural Integrity Associates Calculation No. VY-19Q-301, Revision 0, "Design Inputs and Methodology for ASME Code Confirmatory Fatigue Usage Analysis of Reactor Feedwater Nozzle".

3. Structural Integrity Associates Calculation No. VY-19Q-302, Revision 0, "ASME Code Confirmatory Fatigue Evaluation of Reactor Feedwater Nozzle".

4. Structural Integrity Associates Calculation No. VY-19Q-303, Revision 0, "Feedwater Nozzle Environmental Fatigue Evaluation".

5. Entergy Design Input Record (DIR) Rev. 1, EC No. 1773, Rev. 0, "Environmental Fatigue Analysis for Vermont Yankee Nuclear Power Station," 7/26/07.

6. NUREG-1801, Revision 1, "Generic Aging Lessons Learned (GALL) Report," U.S. Nuclear Regulatory Commission, September 2005.

7. NUREG/CR-6583 (ANL-97/18), "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," March 1998.

8. Structural Integrity Associates Calculation No. VY-16Q-302, Revision 0, "Fatigue Analysis of Feedwater Nozzle".

Attachment 2

Vermont Yankee Nuclear Power Station
License No. DPR-28 (Docket No. 50-271)

License Renewal Application

Amendment 34

Update to Core Spray CUF

VERMONT YANKEE NUCLEAR POWER STATION
LICENSE RENEWAL APPLICATION AMENDMENT 34
ATTACHMENT 2

Update to Supplemental Information for Environmentally Assisted Fatigue

Vermont Yankee Nuclear Power Station (VYNPS) provided the following information with Amendment 31 in response to License Renewal Commitment 27. The commitment specified addressing environmentally assisted fatigue by refining fatigue analyses to include the effects of reactor water environment to verify that the cumulative usage factors (CUFs) are less than 1. Entergy completed refinement of the fatigue analyses as specified in Commitment 27 in accordance with the clarifying details provided in the letter of July 30, 2007. The results indicated that the CUFs of the most fatigue sensitive locations will be less than 1.0 through the period of extended operation, considering both mechanical and environmental effects. Subsequent to the Amendment 31submittal, the environmentally-adjusted CUF value for the Core Spray nozzle forging blend radius was updated to reflect new information, as shown in the revised table below. This table supersedes and replaces in its entirety the table submitted as part of Attachment 1 to BVY 07-066, dated September 17, 2007.

The following results of the refined fatigue analyses are the environmentally adjusted CUF values for 60 years of operation for the locations specified in NUREG/CR-6260.

VYNPS Cumulative Usage Factors for NUREG/CR-6260 Limiting Locations

	NUREG-6260 Location	Material	Overall* Environmental Multiplier (F_{en})	Environmentally Adjusted CUF
1	RPV vessel shell/ bottom head	Low alloy steel	9.51	0.08
2	RPV shell at shroud support	Low alloy steel	9.51	0.74
3	Feedwater nozzle forging blend radius	Low alloy steel	10.05	0.64
4	RR Class 1 piping (return tee)	Stainless steel	12.62	0.74
5	RR inlet nozzle forging	Low alloy steel	7.74	0.50
6	RR inlet nozzle safe end	Stainless steel	11.64	0.02
7	RR outlet nozzle forging	Low alloy steel	7.74	0.08
8	Core spray nozzle forging blend radius	Low alloy steel	10.05	~~0.0432~~ 0.1668
9	Feedwater piping riser to RPV nozzle	Carbon steel	1.74	0.29

* Effective multiplier for past and projected operating history, power level, and water chemistry.