October 10, 2006

Mr. Michael Kansler
President
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601-1839

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF VERMONT YANKEE NUCLEAR POWER STATION LICENSE RENEWAL APPLICATION

Dear Mr. Kansler:

By letter dated January 25, 2006, the U.S. Nuclear Regulatory Commission (NRC) received the Entergy Nuclear Operations, Inc., application for renewal of Operating License No. DPR-28 for the Vermont Yankee Nuclear Power Station (VYNPS). The NRC staff is reviewing the information contained in the license renewal application and has identified, in the enclosure, areas where additional information is needed to complete the review. Specifically, the enclosed requests for additional information are from the NRC Project Team that performed the aging management program, aging management review, and time-limited aging analysis (TLAA) audits at VYNPS, and Section 4.2, "Reactor Vessel Neutron Embrittlement," and Section 4.7.2, "TLAA in BWRVIP Documents," of the VYNPS license renewal application.

Based on discussions with Mr. Jim DeVincentis of your staff, a mutually agreeable date for your response is within 30 days of the date of this letter. If you have any questions regarding this letter or if circumstances result in your need to revise the response date, please contact me at 301-415-4053 or by e-mail at jgr@nrc.gov.

Sincerely,

**/RA/**

Jonathan Rowley, Project Manager
License Renewal Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-271

Enclosure:
Requests for Additional Information

cc w/encl: See next page

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Letter to Michael Kansler from Jonathan Rowley dated October 10, 2006

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF VERMONT YANKEE NUCLEAR POWER STATION LICENSE RENEWAL APPLICATION

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Vermont Yankee Nuclear Power Station

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**VERMONT YANKEE NUCLEAR POWER STATION**
**LICENSE RENEWAL APPLICATION**
**REQUESTS FOR ADDITIONAL INFORMATION (RAIs)**

**RAI 3.6.2.2-N-01-1**

In RAI 3.6.2.2-N-01, issued byletter dated June 7, 2006, the staff requested the applicant to provide a basis document including an aging management program (AMP) for cable connections with the ten elements of an AMP or provide a justification for why an AMP is not necessary.

In its response, in a letter dated July 14, 2006, the applicant stated that electrical cable connections at Vermont Yankee Nuclear Power Station (VYNPS) are inspected under the maintenance rule program as directed by Entergy Nuclear Operations, Inc., procedures and therefore no AMP for license renewal is required at VYNPS.

It should be noted that the current licensing basis (CLB) for all power plants requires compliance with the requirements of the maintenance rule in Title 10 *of the Code of Federal Regulations* Section 50.65 (10 CFR 50.65). The Statements of Consideration for the license renewal rule state: The license renewal rule excludes "active, short-lived structures and components" from an aging management review because of the existing regulatory process, existing licensee programs and activities, and the maintenance rule. The staff's understanding has been that under the license renewal rule, existing programs are not, without some explanation or modification, automatically considered adequate to manage aging effects for license renewal by virtue of being part of the CLB. The Commission formulated the following two principles of license renewal: (1) With the possible exception of the detrimental effects of aging on the functionality of certain plant systems, structures, and components in the period of extended operation and possibly a few other issues related to safety only during extended operation, the regulatory process is adequate to ensure that the licensing bases of all currently operating plants provides and maintains an acceptable level of safety so that operation will not be inimical to public health and safety or common defense and security; and (2) The plant-specific licensing basis must be maintained during the renewal term in the same manner and to the same extent as during the original licensing term.

10 CFR 54.21(a)(3) requires an applicant to demonstrate that the effects of aging, of components such as cable connections defined in 10 CFR 54.21(a)(1), will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. To demonstrate that the effects of aging will be adequately managed for license renewal, the staff has asked applicants to identify the program relied upon to manage certain aging effects for cable connections. An AMP for cable connections acceptable to the staff is described in Generic Aging Lessens Learned Report (GALL) AMP XI.E6. The AMP states that "this aging management program for electrical cable connections (metallic parts) account for the following aging stressors: thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation."

Therefore, the staff requests that the applicant either provide a plant-specific AMP with the AMP elements found in the Standard Review Plan for Review of License Renewal Applications

for Nuclear Power Plants (SRP-LR), Appendix A.1, Section A.1.2.3 and SRP-LR Table A.1-1, or an AMP consistent with GALL AMP XI.E6. If the applicant maintains that an AMP is not required, the applicant is requested to explain in detail how the existing program will address the above aging effects and provide a detailed discussion of how each of the ten elements of aging management, as described in the SRP-LR sections mentioned above, is met by the current program. Also, the applicant is requested to provide supporting documentation to show that the aging management program elements, including appropriate tests, are implemented currently and will be continued for the extended period of operation.

**RAI 4.2.2-1**

Section 4.2.2 of the VYNPS License Renewal Application (LRA), "Pressure/Temperature Limits," discusses the bases for the current pressure-temperature (P-T) limit curves (neutron fluence and adjusted reference temperature (ART) values at the 1/4T and 3/4T locations), which are valid to 32 effective full power years (EFPY), and the projected neutron fluence and ART values for the extended period of operation (54 EFPY). The P-T limit curve bases at 32 EFPY and 54 EFPY are summarized in LRA Table 4.2-1. It is unclear to the staff why the projected neutron fluence and ART values for 54 EFPY are substantially less than the corresponding values for 32 EFPY.

Section 4.2.2 of the VYNPS LRA states that "conservative values" were used for determining the 32 EFPY P-T limits. Please discuss the conservative assumptions that resulted in the 32 EFPY neutron fluence and ART values, and, based on these assumptions, explain why the corresponding 54 EFPY values are less.

**RAI 4.2.2-2**

Please discuss whether the 32 EFPY and 54 EFPY P-T limit curve bases summarized in LRA Table 4.2-1 take into consideration the VYNPS extended power uprate (EPU) conditions.

**RAI 4.2.2-3**

The P-T limit curves for the extended period of operation do not need to be submitted as part of the applicant's LRA for this time-limited aging analysis (TLAA). In accordance with 10 CFR Part 50, Appendix G, the applicant will need to submit new P-T limit curves for staff review and approval prior to the expiration of the unit's current P-T limit curves for 32 EFPY. Section 4.2.2 of the VYNPS LRA states that the P-T limit curve bases for 54 EFPY are bounded by the bases for the current (32 EFPY) P-T limit curves, and, as such, the TLAA for the P-T limits remains valid in accordance with 10 CFR 54.21(c)(1)(i). Please state when VYNPS intends to submit P-T limit curves for NRC approval for the extended period of operation (54 EFPY).

**RAI 4.2.3-1**

Table 4.2-3 of the LRA shows a value of "4.49E+16" for both the surveillance plate fluence and the surveillance weld fluence. This value is stated as being in exponential units of $10^{19}$ n/cm$^2$ for both surveillance materials. Please state the correct fluence values for these surveillance materials, consistent with appropriate exponential units.

**RAI 4.2.4-1**

Please explain why Table 4.2-4 of the VYNPS LRA lists the same 1/4T neutron fluence value ($0.0398 \times 10^{19}$ n/cm$^2$) for all VYNPS reactor vessel (RV) beltline materials.

**RAI 4.2.4-2**

Table 4.2-4 of the VYNPS LRA lists initial reference nil ductility transition temperature ($RT_{NDT}$) values that are less conservative than those currently established in the NRC staff's Reactor Vessel Integrity Database (RVID). Footnote 1 to Table 4.2-4 states that "the initial $RT_{NDT}$ values supersede RVID2, as agreed to by the NRC in their SER [safety evaluation report] (Reference 4.2-9)." Reference 4.2-9 points to the NRC staff's SER on Boiling Water Reactor Vessel and Internals Project (BWRVIP)-05, dated July 28, 1998. Section 4.2.4 of the VYNPS LRA states that initial $RT_{NDT}$ values and standard deviations were taken from VYNPS NEDC-33090P, "Safety Analysis Report for Vermont Yankee Nuclear Power Station Constant Pressure Power Uprate," Table 3-2a. This document was submitted in support of Technical Specification Proposed Change No. 263 for the VYNPS EPU, dated September 10, 2003. Please explain this discrepancy.

It is unclear to the staff whether the initial $RT_{NDT}$ values listed in Table 4.2-4 are currently authorized for use in determining the ART values for the RV beltline materials. Please provide information that points to where the NRC staff authorized the use of the specific initial $RT_{NDT}$ values listed in Table 4.2-4 for determining the ART values for the VYNPS RV beltline materials.

**RAI 4.2.5-1**

BWRVIP-74, Section A.4.5, "Circumferential Weld Inspection Relief," states that in order to obtain relief from circumferential weld examination requirements, each licensee must submit a plant-specific relief request. In that submittal, a licensee must demonstrate that (1) at the expiration of the license, the circumferential welds satisfy the limiting conditional failure probability for circumferential welds in the staff's SER on BWRVIP-05, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations," dated July 28, 1998, and (2) a licensee has implemented operator training and established procedures that limit the frequency of cold overpressure events to the frequency specified in the staff's July 28, 1998 SER. The LRA addressed condition 1 for this TLAA. However, the LRA did not address condition 2. Please address condition 2 as it relates to the proposed extended period of operation.

**RAI 4.2.5-2**

In accordance with 10 CFR 50.55a, the applicant would have to reapply for relief from American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) RV circumferential shell weld inspection requirements upon, or prior to, entering the first inspection interval in the extended period of operation. Please state if and when VYNPS intends to apply for relief from the ASME Code RV circumferential weld examination requirements for the extended period of operation.

**RAI 4.2.5-3**

In the July 28, 1998 SER on BWRVIP-05, the NRC staff concluded that examination of the RV circumferential shell welds would need to be performed if the corresponding volumetric examinations of the RV axial shell welds revealed the presence of an age-related degradation mechanism. Confirm whether or not previous volumetric examinations of the RV axial shell welds have shown any indication of cracking or other age-related degradation mechanisms in the welds.

**RAI 4.2.6-1**

Section 4.2.6 of the VYNPS LRA states that the mean $RT_{NDT}$ value for the limiting RV axial shell weld at the end of the extended period of operation (54 EFPY) is significantly less than the NRC limiting plant-specific mean $RT_{NDT}$ value established in Table 1 of the staff's SER on BWRVIP-74, and therefore, the VYNPS axial weld failure probability is well below the acceptable limit of $5 \times 10^{-6}$ per reactor-year. However, the limiting axial weld failure probability calculated by the NRC is based on the assumption that "essentially 100 percent" (i.e., greater than 90 percent) examination coverage of all RV axial welds can be achieved in accordance with ASME Code, Section XI requirements.

State whether the inservice inspection (ISI) examinations achieve "essentially 100 percent" (i.e., greater than 90 percent) overall examination coverage for the RV axial welds for the duration of the current licensed operating period. If they do not, reference the NRC staff's SER granting relief for limited scope axial weld examination coverage. If less than 90 percent overall examination coverage is achieved for the RV axial welds, revise this TLAA to account for the effects of the limited scope examination coverage.

**RAI 4.7.2.1-1**

Section 4.7.2.1 of the VYNPS LRA is titled "BWRVIP-05, Reactor Vessel Axial Welds." However, this section addresses the elimination of RV circumferential welds from examination for the period of extended operation, as discussed in Section 4.2.5 of the VYNPS LRA. Please address whether there is any additional TLAA for the RV axial welds, other than what is addressed in Section 4.2.6.

**RAI 4.7.2.2-1**

Section 4.7.2.2 of the VYNPS LRA addresses the recommendations of BWRVIP-25, "BWR Core Plate Inspection and Flaw Evaluation Guidelines," pertaining to the TLAA for the RV core plate hold-down bolts. The relevant degradation mechanisms for this TLAA include the loss of preload and cracking of the core plate rim hold-down bolts. Section 4.7.2.2 of the VYNPS LRA indicated that BWRVIP-25 calculated the loss of preload for these bolts for the original 40-year licensed operating period and that Appendix B to BWRVIP-25, "BWR Core Plate Demonstration of Compliance with the Technical Information Requirements of the License Renewal Rule (10 CFR 54.21)," projected this calculation to 60 years, demonstrating that the VYNPS core plate rim hold-down bolts would experience only a 5 to 19 percent loss of preload for the extended period of operation.

In order for the staff to understand the data and analyses that were used to determine that the loss of preload due to stress relaxation at the end of the period of extended operation would be less than 20 percent, the staff requests that the applicant provide additional information demonstrating that BWRVIP-25 and BWRVIP-25, Appendix B are applicable to VYNPS, based on the following:

a. configuration and geometry of the VYNPS core plate rim hold-down bolts,

b. the temperature of the core plate rim hold-down bolts during normal operation, taking into consideration EPU conditions, and

c. projected bolt neutron fluence at the end of the period of extended operation, taking into consideration EPU conditions.

Please include the actual values for bolt temperature and projected bolt neutron fluence in the above discussion, and explain how it was determined that the effects of temperature and neutron fluence at the end of the period of extended operation would result in less than a 20 percent loss of bolt preload. Provide a detailed description of the methodology and data used at VYNPS to perform the above analyses, and include the basis for the stress relaxation curves.

The staff requests the applicant demonstrate that the axial and bending stresses for the hold-down bolts with the mean and highest loading will not exceed the allowable stresses for primary membrane and primary membrane plus bending of ASME Code, Section III, as a result of a 20 percent reduction in the specified bolt pre-load. Clearly state the assumptions on which this analysis is based, taking into consideration the fact that the approach recommended in Appendix A of BWRVIP-25 is based on an elastic finite element analysis of the core plate and hold-down bolts.