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July 14, 2006

Docket No. 50-271  
BVY 06-063  
TAC No. MC 8634

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

- Reference:
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, USNRC to Entergy, "Request for Additional Information for the Review of Vermont Yankee Nuclear Power Station License Renewal Application", dated June 7, 2006.
  3. Letter, Vermont Yankee Nuclear Power Corporation to USNRC, "Request for Exemption from 10 CFR Part 50, Appendix R, Section III.L, "Alternative and Dedicated Shutdown Capability". BVY 96-43, dated April 4, 1996.
  4. Letter, Vermont Yankee Nuclear Power Corporation to USNRC, "Clarification Regarding Use of Vernon Tie for Appendix R Compliance", BVY 97-25, dated February 19, 1997

**Subject: Vermont Yankee Nuclear Power Station  
License No. DPR-28 (Docket No. 50-271)  
License Renewal Application, Amendment 4**

On January 25, 2006, Entergy Nuclear Operations, Inc. and Entergy Nuclear Vermont Yankee, LLC (Entergy) submitted the License Renewal Application for the Vermont Yankee Nuclear Power Station (VYNPS) as indicated by Reference 1. Attachment 1 transmits the VYNPS response to a Request for Additional Information as described in Reference 2.

Should you have any questions concerning this letter, please contact Mr. James DeVincentis at (802) 258-4236.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 14, 2006.

Sincerely,

A handwritten signature in black ink, appearing to read "Ted A. Sullivan", written over a horizontal line.

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

Attachment 1  
cc: See next page.

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**Attachment 1**

**Vermont Yankee Nuclear Power Station**

**License Renewal Application - Amendment 4**

**Request for Additional Information**

**RAI 3.6.2.2-N-08**

**RAI 3.6.2.2-N-01**

**ATTACHEMENT 1  
LICENSE RENEWAL RAI RESPONSES**

**RAI 3.6.2.2-N-08**

10 CFR 54.4 (a)(3) requires, in part, that all systems, structures, and components (SSCs) relied on in safety analyses or plant evaluation to perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63) are within the scope of license renewal. Vernon Hydroelectric Station (VHS) has been designated as the station blackout (SBO) alternate alternating current source and is used to meet SBO requirements of 10 CFR 50.63.

Are all SSCs (including electrical, mechanical, structural, and civil) associated with the VHS included in the scope of license renewal? If they are not, please explain why not.

If they are, please provide an aging management review for long-lived, passive SSCs associated with the hydroelectric station.

**VYNPS Response to RAI 3.6.2.2-N-08**

Equipment in the Scope of License Renewal

The Vernon Hydroelectric Station (VHS) is the alternate alternating current (AAC) source credited for Vermont Yankee Nuclear Power Station (VYNPS) to demonstrate compliance with 10CFR 50.63, Loss of all alternating current power (the station blackout rule). As such, all VHS structures, systems, and components (SSCs) are in the scope of license renewal.

Aging Management Review

The following discussion provides the aging management review for long-lived, passive SSCs associated with the Vernon hydroelectric station.

A. Background

Of the plants that have applied for license renewal in the United States, Peach Bottom is the only other plant that credits an offsite hydroelectric station as its AAC source for station blackout. Peach Bottom received its renewed operating license in May 2003. For the Peach Bottom plant license renewal, the only aging management program credited for the AAC hydroelectric station was the Federal Energy Regulatory Commission (FERC) dam inspection and maintenance program requirements, provided in 18 CFR 12. This is appropriate considering the mechanical and electrical equipment associated with the turbine generator constitute an active assembly that is routinely confirmed available through normal operation.

Entergy, consistent with the Peach Bottom precedent, credited the FERC dam inspection program to manage the effects of aging on civil and structural elements of the VHS. In accordance with NUREG-1801, for dam inspection and maintenance, programs under the regulatory jurisdiction of FERC or the U.S. Army Corps of Engineers, continued through the period of extended operation, will be adequate for the purpose of aging management.

Notwithstanding the previously approved staff position regarding the alternate AC source for the Peach Bottom plant, Entergy performed an integrated plant assessment (IPA) for passive, long-lived electrical, mechanical, civil and structural SSCs of the VHS.

B. Integrated Plant Assessment for the Vernon Hydroelectric Station

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To perform the IPA, Entergy reviewed the current licensing basis to identify the license renewal intended function of the VHS. For each discipline, the review then considered the aging effects, if any, that could prevent satisfactory accomplishment of the intended function for the VHS as a whole. The review also identified appropriate programs or activities to effectively manage the effects of aging to ensure that the VHS will continue to perform its intended function in accordance with the current licensing basis (CLB) through the period of extended operation.

### C. License Renewal Intended Function for the VYNPS Alternate AC (AAC) Source

As described in UFSAR Section 8.5.5.1, VYNPS uses an AAC source approach for coping with a station blackout (SBO) using the methodology of RG 1.155, "Station Blackout," dated August 1988. VYNPS relies on the Vernon Hydroelectric Station (VHS) to provide power to an emergency bus until offsite or onsite AC power is available.

For an alternate AC source, NUMARC 87-00 specifies that a licensee provide assurance that the AAC source is available at least 95% of the time. Therefore, the license renewal intended function of the VHS for the purposes of demonstrating compliance with the SBO rule is to be available to VYNPS at least 95% of the time the reactor is operating.

### D. Integrated Plant Assessment for Civil and Structural SSCs

Civil and structural SSCs that support the intended function of the VHS are the structural steel and concrete elements of the dam. In license renewal application (LRA) Table 3.5.2-5, consistent with the Peach Bottom precedent and with NUREG-1801, VYNPS credited the FERC dam inspection program to manage the effects of aging on civil and structural elements of the VHS. In accordance with NUREG-1801, for dam inspection and maintenance, programs under the regulatory jurisdiction of FERC or the U.S. Army Corps of Engineers, continued through the period of extended operation, will be adequate for the purpose of aging management.

### E. Integrated Plant Assessment for Mechanical SSCs

#### Description

Mechanical SSCs that support the intended function of the VHS are multiple turbine generator units and the mechanical support systems that provide cooling and lubrication for the turbines and generators. Two turbine generator units have black start capability each with its own independent cooling and lubrication subsystems. The turbines are cooled by natural circulation within the Vernon Dam structure. Mechanical sluice gates control the flow of water.

A skid-mounted diesel engine-driven generator provides backup power for turbine generator field flashing, an air compressor, and the lubricating oil support systems. A fiberglass coated underground tank supplies fuel via carbon steel piping to the skid-mounted diesel generator. A double wall day tank at the diesel engine is equipped with alarms to indicate fuel oil leakage.

#### VHS Components Subject to Aging Management Review

Passive, long-lived mechanical components of the turbine generator units and support equipment are subject to aging management review.

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The skid-mounted diesel engine-driven generator is an active assembly that is tested monthly to ensure continued reliability. This testing is analogous to testing credited under the maintenance rule to ensure continued reliability of active equipment in nuclear power plants.

### Aging Effects Requiring Management

Aging effects requiring management are those that can prevent accomplishment of the VHS intended function. Because of the multiple independent generating units and associated support systems within the VHS, no single mechanical component failure due to the effects of aging can prevent accomplishment of the VHS intended function. Therefore, no aging effects require management for the mechanical equipment of the VHS.

### F. Integrated Plant Assessment for Electrical SSCs

#### Description

Electrical SSCs for the VHS include the generators associated with each turbine, cables and bus for power transmission, instrumentation and control components and their associated cables and connections. Power from the generators is supplied to the VHS switchyard via two medium-voltage (13.8 kV) underground cables to two independent step-up transformers in the switchyard. Switchyard bus downstream of each step-up transformer feeds the 69kV to 13.2 kV transformer that feeds the Vernon tie breaker. The Vernon tie breaker connects power from the transformer to the 13.2 kV underground cable going to the VYNPS. Passive, long-lived components from the breakers feeding the 69 kV to 13.2 kV transformer to and including the 13.2 kV underground cable are included in the aging management review for plant electrical and instrument and control systems as described in LRA Sections 2.5 and 3.6.

The Vernon tie is a highly reliable connection between the VHS and either of the two VYNPS 4160 V emergency buses and is capable of supplying power to required loads under postulated SBO conditions. Loss of the Vernon tie is annunciated and its voltage is monitored in the VYNPS control room. Surveillance testing of the Vernon tie demonstrated the ability to energize an emergency bus and supply required SBO loads in less than 10 minutes. Additionally, the plant is able to safely cope with a total loss of AC power for a minimum of 2 hours from the onset of the SBO to the restoration of offsite AC power.

The VHS is designated as a "black-start" facility under arrangements with the regional grid operator. TransCanada has affirmed that they are committed under tariff to provide black-start capability of the VHS to ISO-NE. Both the NEPOOL and REMVEC procedures state that "the most critical power requirement after a blackout is the assurance of reliable shutdowns of nuclear generators, and that expeditious restoration of alternative off-site power sources to nuclear units is imperative to promote the continued reliability of shutdown operations." TransCanada conducts and documents the black-start of the VHS annually.

As a backup to local indication available to grid operators of a regional blackout, VYNPS procedures direct operators to immediately contact the regional grid control center to initiate a black start of the VHS if the Vernon tie is unavailable due to a regional grid blackout. The regional grid control center procedures direct hydro-station operators (including the VHS operators) to initiate black start procedures, and upon notification that the units are started, provide instructions to align power to VYNPS and to communicate when these actions are

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complete to the VYNPS control room. The owner of the VHS has a procedure for the actual black start.

The combination of the periodic testing of the AAC source together with the test of the emergency bus that is conducted every operating cycle encompasses the condition of the SBO event, and provides added assurance of VHS availability to meet the requirement of 10 CFR 50.63.

Based on the designation of the TransCanada VHS units as black start units by ISO-NE, the procedural requirements for achieving black start, and the operating history of the VHS units, there is reasonable assurance that a VHS unit will be available within the SBO coping timeframe.

### VHS Commodities Subject to Aging Management Review

Consistent with the approach described in LRA Section 2.1.2.3, Screening of Electrical and Instrumentation and Control Systems, the commodity groups that perform an intended function without moving parts or without a change in configuration) are;

- high voltage insulators, and
- cables, connections and electrical busses.

Other electrical and I&C commodity groups, including transformers, are active and do not require aging management review.

### Aging Effects Requiring Management

Aging effects requiring management are those that can prevent accomplishment of the VHS intended function. Because of the multiple independent generators and power transmission circuits within the VHS, no single component failure due to the effects of aging can prevent accomplishment of the VHS intended function. Therefore, no aging effects require management for electrical and instrumentation and control commodity groups within the VHS.

Within the VHS switchyard (owned by National Grid), two circuits provide power to the 69 kV to 13.2 kV transformer that feeds through the Vernon tie breaker to the underground 13.2 kV cable routed to VYNPS. The switchyard bus and associated connections involved with this circuit are subject to aging management review. Aging management review of this portion of the switchyard was addressed in the VYNPS LRA, Section 3.6, for the SSCs described in Section 2.5 under Evaluation Boundaries on Page 2.5-2. Specifically, the path includes the switchyard circuit breakers near the Vernon Dam that feed the Vernon tie transformer, switchyard bus and insulators, and cables and connections in the circuit to the emergency bus and structures.

Two independent paths constitute the remainder of the circuit that provides power from the VHS to the VHS switchyard. Because of the two independent power transmission circuits, no single component failure due to the effects of aging can prevent accomplishment of the VHS intended function. Therefore, there are no aging effects requiring management for this portion of the circuit.

Availability of the Vernon tie line is tracked on a three year rolling basis. Over the last 4 years the line has been available 99.32% of the time. Approximately 60% of the unavailability was due to the planned replacement of the 4kV underground cable between the 13.2 kV / 4.16kV transformer and the VYNPS 4.16 kV buses. This operating experience indicates the

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effectiveness of routine switchyard maintenance in achieving acceptable performance of the switchyard circuit between VHS and VYNPS.

### G. Quality Assurance

Although the VHS is not under the VYNPS QA program, it consists of multiple generating sources and connections to the switchyard. The system, taken as a whole, exhibits a high reliability even though individual components are not operated under the VYNPS QA program. From 1965 through 1989, VHS demonstrated very high reliability (e.g. 99.9% availability). On this basis, the staff concluded in 1991 [NVY 91-98], that the QA issue has been satisfactorily considered. As previously discussed, availability data for the Vernon tie line indicate that very high reliability continues today.

VYNPS Technical Specifications credit the Vernon tie as an alternate electrical power source for a standby gas treatment system during certain shutdown operations. In addition during reactor operation, VYNPS commitments made in BVY 96-43 and BVY 97-25, assure continued availability of power from the Vernon tie line. The reactor must be shut down within 15 days unless the Vernon tie is returned to service or the basis for maintaining continued operation is written and approved. If the Vernon tie cannot be returned to service within 15 days, within the next 24 hours VYNPS must submit a report to the NRC in accordance with 10CFR50.4 outlining the reason for the unavailability, corrective actions being taken to restore the Vernon tie, compensatory actions in place to provide AC power for Appendix R alternative shutdown fire scenarios, and the time required to make the Vernon tie available. This commitment carries forward into the period of extended operation.

Based on the above, the appropriate controls for VHS and the Vernon tie are in place to provide reasonable assurance of continued acceptable performance through the period of extended operation. Unavailability of the Vernon tie is cause for entry into the VYNPS corrective action program, which invokes associated elements of the QA program. The corrective action program requires evaluation and appropriate corrective action to correct the nonconforming condition. Therefore, QA attributes are adequate for license renewal.

### H. Operating Experience

Per BVY 94-33, dated March 11, 1994, the "Vernon Hydro Station with multiple units, has demonstrated reliability far in excess of an auxiliary generator (99.9% compared to 95%)." Subsequent to SBO communications between NRC and VY in the mid 1990's, Vernon Dam has continued to demonstrate high availability. The VHS remained on line throughout the Northeast blackout of August 14, 2003.

Entergy recently held discussions with TransCanada, the owner/operator of the VHS, and the regional grid control center regarding procedural requirements and communication protocols for a postulated SBO event. These communications resulted in system restoration procedure improvements and served to promote a better understanding of the expectations relative to Entergy's reliance on the VHS during an SBO.

Entergy has established administrative controls to assure performance of a once per operating cycle tabletop review of the procedures that complete the actions to re-power a VYNPS 4KV bus from the VHS. This review discussed interfaces with the operator of VHS and the regional



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grid operator to verify that roles and responsibilities and timelines are understood and that there have been no changes that would impact the assumption in the VYNPS SBO coping strategy. Entergy provides the participants with insights regarding offsite power issues for nuclear power stations including plant response to and consequences of an SBO.

Similar to experience at VYNPS, VHS has experienced microbiological and conventional corrosion attack on carbon steel lines exposed to river water (e.g. turbine seal cooling). VHS replaced these lines with copper and stainless steel lines to eliminate loss of material caused by these mechanisms. This experience indicates the effectiveness of the routine maintenance of the VHS in managing the effects of aging. In addition, maintaining high availability in light of this degradation further supports that the multiple independent systems associated with the VHS can be maintained through routine maintenance without impacting the overall intended function of the VHS.

**I. Conclusion**

In accordance with NUREG-1801, FERC dam inspection and maintenance programs are credited with managing the effects of aging on civil and structural components of the VHS. Consistent with the current licensing basis (CLB), because of the multiple generating sources and connections to the switchyard, the effects of aging on other components associated with the VHS cannot cause loss of the intended function and have no aging effects requiring management. VHS switchyard passive, long-lived commodity groups that do not involve multiple independent circuits are effectively maintained through routine maintenance by the switchyard owner. Nevertheless, VYNPS will monitor the availability of the VHS to ensure continued conformance with the availability specified in NUMARC 87-00. If availability falls below the acceptable level, VYNPS will respond to the condition through the corrective action program. The corrective action program requires evaluation and appropriate corrective action to correct the nonconforming condition.

Per BVY 94-33, dated March 11, 1994, the "Vernon Hydro Station with multiple units, has demonstrated reliability far in excess of an auxiliary generator (99.9% compared to 95%)." Subsequent to 1994, the VHS has continued to demonstrate very high availability. The VHS remained on line throughout the Northeast blackout of August 14, 2003.

This recent operating experience indicates that existing commitments and maintenance practices provide reasonable assurance that the VHS will remain capable of performing its intended function in accordance with the current licensing basis throughout the period of extended operation.

**RAI 3.6.2.2-N-01**

In the license renewal application (LRA) Table 3.6.2-1, under cable connections (metallic parts), you have stated that there are no aging effects requiring management and no aging management program (AMP) is required. Further, in LRA Table 3.6-1, under discussion of cable connection metallic parts, you have stated that cable connections outside of active devices are taped or sleeved for protection; and operating experience with metallic parts of electrical cable connections at VYNPS indicated no aging effects requiring management. Electrical cable connections (metallic parts) are subject to the following aging stressors: thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. NUREG-1801, Revision 1, AMP XI.E6, "Electrical Cable Connection not Subject to 10 CFR 50.49 Environmental Qualification Requirements," specifies that connections

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associated with cables within the scope of license renewal are part of this program, regardless of their association with active or passive components. Please provide a basis document including an AMP with the ten elements for cable connections or provide a justification for why an AMP is not necessary.

### **VYNPS Response to RAI 3.6.2.2-N-01**

Electrical cable connections at VYNPS are inspected under the maintenance rule program as directed by Entergy procedures. The maintenance rule program is in compliance with 10 CFR 50.65. The maintenance rule program is based on industry guidance provided in NUMARC 93-01 and Reg. Guide 1.160.

The maintenance rule program scope includes the following.

- Safety-related structure, systems and components (SSCs)
- Non-safety related SSCs that mitigate accidents or transients
- Non-safety related SSCs used in emergency operating procedures
- Non-safety related SSCs whose failure could prevent safety-related SSCs from fulfilling their safety function.
- Non-safety related SSCs whose failure could cause a scram or safety system actuation.

Electrical cable connections are subcomponents of SSCs that are in the scope of the maintenance rule.

The maintenance rule program includes performance monitoring and trending for SSCs that are in scope. Monitoring and trending is:

- Performed frequently enough to detect and correct degrading equipment performance
- Used to evaluate equipment performance following maintenance or modification
- Based on manufacturer's recommendations, operational or industry experiences with plant equipment or plant specific information
- Subject to the corrective action and work order programs
- Subject to management review and oversight

Monitoring and trending includes normal plant maintenance activities. Maintenance includes activities associated with identifying and correcting actual or potential degraded conditions (e.g., repair, surveillance, diagnostic examinations, and preventive measures) as well as support functions for the conduct of these activities.

Thermography is used to detect potential degraded conditions. Thermography can detect "hot spots" in cable connections that are indicative of a high resistance connection.

As a part of the maintenance rule program, periodic assessments are performed. A periodic assessment is performed to evaluate the effectiveness of maintenance activities. This assessment is performed at least every operating cycle, not to exceed 24 months.

Plant operating experience has shown that the maintenance rule program has been effective at detecting, evaluating and repairing electrical cable connection degradation.

Since the maintenance rule program includes scoping, performance monitoring, trending and periodic assessments, this program provides reasonable assurance that electrical cable

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connections will remain capable of performing their intended functions through the period of extended operation. No aging management program (AMP) for license renewal is required at VYNPS since the regulatory mandated maintenance rule program effectively maintains electrical cable connections.