Entergy

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Christopher J. Wamser
Site Vice President

BVY 11-082

January 5, 2012

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

SUBJECT: Response to Request for Additional Information Regarding Core Plate Hold Down Bolt Inspection Plan and Analysis
Vermont Yankee Nuclear Power Station
Docket No. 50-271
License No. DPR-28

REFERENCES:
1. Letter, Entergy to USNRC, "License Renewal Application, Amendment 11," BVY 06-079, dated August 22, 2006
2. Letter, Entergy to USNRC, "License Renewal Application Annual Update," BVY 10-069, dated December 30, 2010
3. Letter, Entergy to USNRC, "Core Plate Hold Down Bolt Inspection Plan and Analysis," BVY 11-021, dated March 18, 2011
4. Letter, USNRC to Entergy, "Request for Additional Information Regarding Core Plate Hold Down Bolt Inspection Plan and Analysis (TAC No. ME6248)," NVY 11-093, dated November 17, 2011

Dear Sir or Madam:

In Amendment 11 to the Vermont Yankee Nuclear Power Station License Renewal Application, Entergy Nuclear Operations, Inc. (ENO) committed to either install core plate wedges or complete a plant-specific analysis to determine the acceptance criteria for continued inspection of the core plate hold down bolts in accordance with BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25) and submit the inspection plan and analysis to the NRC two years prior to the period of extended operation (PEO) for NRC review and approval (Reference 1). In Reference 2, ENO provided an update to the commitment to indicate that the inspection plan and analysis would be provided one year prior to the PEO. ENO submitted the inspection plan and analysis in Reference 3.

This letter contains the responses to the NRC's Request for Additional Information in Reference 4 regarding the plant-specific analysis. These responses contain information that is considered proprietary information by General Electric, as defined by 10CFR2.390. In accordance with 10CFR2.390(b)(1), an affidavit attesting to the proprietary nature of the enclosed information and requesting withholding from public disclosure is included with Attachment 1. Attachment 2 provides responses with the proprietary information removed and is provided for public disclosure.

A117
NRR

This letter contains no new regulatory commitments.

Should you have any questions or require additional information concerning this submittal, please contact Mr. Robert Wanczyk at 802-451-3166.

Sincerely,

[CJW/PLC]

Attachments:
1. Response to Request for Additional Information (Proprietary Version)
2. Response to Request for Additional Information (Non-proprietary Version)

cc: Mr. William M. Dean, Regional Administrator
U.S. Nuclear Regulatory Commission, Region 1
475 Allendale Road
King of Prussia, PA 19406-1415

Mr. James S. Kim, Project Manager
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop O8C2A
Washington, DC 20555

USNRC Resident Inspector (w/o Attachments)
Vermont Yankee Nuclear Power Station
320 Governor Hunt Rd
Vernon, VT 05354

Ms. Elizabeth Miller, Commissioner (w/o Attachment 1)
VT Department of Public Service
112 State Street – Drawer 20
Montpelier, Vermont 05620-2601

ENCLOSURE 2

GEH Letter 2Q9W47-6

GEH Revised Responses to Vermont Yankee Core Plate Bolt Set 2 RAIs

Non-Proprietary Information – Class I (Public)

IMPORTANT NOTICE

This is a non-proprietary version of Enclosure 1 to GEH Letter 2Q9W47-6, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space with an open and closed set of double brackets as shown here [[ ]].

RAI-1

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GEH Response

The references for the first four entries in Table 6-1 are:

- Deadweight: Core plate assembly drawing 729E957.
- Seismic inertia (SSE), Fuel shear, and Guide tube shear: MPR Seismic Data Calculation #319-002-01 for Task #319-9701-002-0: Vermont Yankee Core Shroud Repair, "Seismic Analysis Results – Selected Forces, Moments, and Accelerations," 1997.

RAI-2

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GEH Response

In the 1970s and early 1980s, containment hydrodynamic loads evaluations were performed and are referred to as the "new loads" evaluations. These were an extensive evaluation of the containment structural response to the hydrodynamic loads generated during a postulated Loss-of-Coolant Accident (LOCA). From this "new loads" evaluation, relatively minor modifications were made to existing structures and components in order to satisfy the structural acceptance criteria when considering the revised design load definitions. Mainly, it resulted in design changes to future reactors.

During this evaluation, the annulus pressurization (AP) load was highlighted. [[

]] It is true that an AP load is physically realistic in Mark I as well as Mark II and III containments. [[

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The "new loads" (including AP) were able to be incorporated into the design of Mark II and Mark III plants. Mark I plants were built or being built by the time this load was defined. Two Mark I plants (Fermi 2 and Hope Creek) were able to be incorporated and are deemed "new loads plants." Whether or not AP loads are part of a plant's licensing basis is mainly a result of the timing of these new load definitions in relation to the plant's design/construction dates.

Therefore, the AP load does not need to be considered for two main reasons: First, Vermont Yankee Nuclear Power Station (VYNPS) is not a "new loads plant" and is therefore exempt from the AP load requirement for reactor internals. It is not part of VYNPS's design basis. [[

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References

2-1. GE Nuclear Energy, "Evaluation of Acoustic Pressure Loads on BWR/6 Internal Components," NEDO-24048, September 1978.

2-2. GE Nuclear Energy, "Recirculation Pipe Displacements for Annulus Pressurization Analyses," NEDE-23533, March 1977.

RAI-3

Section 6.0 Loads and Load combinations: General Electric Hitachi (GEH) safety communication (SC) 09-03 issued on August 3, 2009, addresses the acoustic load (AC) load acting on the shroud in a postulated recirculation suction line break event, and its omission from shroud loads may be non-conservative. The core plate is attached to the shroud, and the AC load may have an impact on the stress analysis of core plate bolts. It is noted that Boiling Water Reactor Vessel and Internals Project (BWRVIP)-25 Appendix-A calculation for core plate hold down bolt stress analysis does not address AC load because it was issued prior to SC 09-03. The licensee is requested to either re-compute the faulted stress in core plate bolts or provide a justification for not considering the AC loading in the faulted load combination in Table 6-2.

GEH Response

Safety Communication (SC) 09-03 (Reference 3-1) discusses consideration of postulated Recirculation Line Break (RLB) loads in BWR shroud screening criteria reports and shroud repair evaluations. Specifically, this SC discusses acoustic loads, although annulus pressurization (AP) loads occur with the same pipe break. [[

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The transient portion of the acoustic load occurs over a very short duration [[

]] This is explained in the shroud repair evaluation, as discussed in Vermont Yankee Nuclear Power Station (VYNPS) Updated Final Safety Analysis Report (UFSAR) Appendix K.4.1:

> "The initial acoustic phase of the transient is very abrupt relative to the shroud inertia and frequencies, and does not have a significant effect on the shroud. The remainder of the transient extends over a relatively long period of time and, as such, is considered a static pressure."

The steady-state portion has an effect on the shroud (as stated in the quote above it is considered a static pressure on the shroud). However, the steady-state load has a negligible effect on the core plate. [[

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References

3-1. GE Hitachi Nuclear Energy, "Shroud Screening Criteria Reports," SC 09-03, August 3, 2009.

RAI-4

Sections 6.6 and 8.1 Friction: Entergy takes credit for friction between the core plate rim and shroud ledge using a friction factor of 0.2 in VY core plate bolt stress analysis while BWRVIP-25 Appendix-A core analysis does not take credit for friction. It is noted that for the bounding case without any friction, all the lateral loads on the core plate will be resisted by the core plate bolts by bending and shear. When friction is considered, a portion of the lateral loads are resisted by friction at the rim and shroud ledge interface resulting in lower lateral loads on the core plate bolts. (a) The licensee is requested to quantify the impact on the core plate stresses for the bounding case without friction and (b) The licensee is also requested to quantify the impact of the additional load on the qualification of core plate when friction is considered.

GEH Response

(a) and (b):

BWRVIP-25 Appendix A (Reference 4-1) is an example core plate bolt evaluation. For the plant considered, the example analysis was able to show that the core plate bolts analyzed met the American Society of Mechanical Engineers (ASME) allowable limits without the consideration of friction. This is very conservative. This bolted connection was designed with friction in mind. With a large clamping force, the frictional resistance at the interface of the core plate rim and shroud ledge is quite large and is the main method to resist horizontal core plate motion (aligner pin shear and bolt bending and shear being the other methods).

Completely ignoring friction is overly conservative. [[

]] Additionally, with the inclusion of friction, it should be noted that stresses in the rim and core plate (due to the rim supporting a portion of the load) are low compared to the stresses of the bolts with or without some of the load being resisted by the friction.

References

4-1. Electric Power Research Institute, "BWR Vessel and Internals Project: BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25)," TR-107284, December 1996.

4-2. GE Hitachi Nuclear Energy, "Vermont Yankee Core Plate Bolt Stress Analysis Report," NEDC-33618P, Revision 0, March 2011.

RAI-5

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GEH Response

(a) Vermont Yankee Nuclear Power Station (VYNPS) has four vertically-oriented aligner pins in their core plate design.

(b) [[

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However, because friction is included, the horizontal load experienced by the aligner pins for VYNPS is lower, and therefore the maximum shear stress seen in one of the three aligner pins is reduced. This explanation applies to Scenario 2, where all horizontal loads are taken by the aligner pins and the bolts provide clamping force and resist vertical loads only.

(c) [[

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(d) [[

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References

5-1. Electric Power Research Institute, "BWR Vessel and Internals Project: BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25)," TR-107284, December 1996.

5-2. GE Hitachi Nuclear Energy, "Vermont Yankee Core Plate Bolt Stress Analysis Report," NEDC-33618P, Revision 0, March 2011.

RAI-6

Sections 1.0 and 8.1 Finite Element (FE) Model differences : In Section 1.0, it was stated that GEH performed a plant-specific core plate hold down bolt stress analysis for VY, and in Section 8.1 it is mentioned that the analysis does not have a plant-specific FE model, and some calculations use scaled values from BWRVIP-25 data. (a) The licensee is requested to elaborate what items are scaled values from BWRVIP-25 data and (b) The licensee is also requested to provide a table of differences between BWRVIP-25 core plate FE model and VY core plate analysis model along with justification for not having a VY plant-specific FE model.

GEH Response

The BWRVIP-25 Appendix A (Reference 6-1) calculation used a finite element (FE) model. Because the analysis is linear, it is simplest and most cost-effective to scale results (where appropriate) from the BWRVIP-25 Appendix A calculation to fit the Vermont Yankee Nuclear Power Station (VYNPS)-specific conditions. A plant-specific FE model for VYNPS was not necessary.

(a) Items scaled from BWRVIP-25 Appendix A data:

- The BWRVIP-25 analysis determined the maximum horizontal load on any aligner pin (with three pins included in the model), without friction. [[

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(b) VYNPS-Specific Items:

- All geometry (e.g., number of bolts, size of bolts, size of aligner pins, size of core plate components)
- All loads (see Table 6-1 of Reference 6-2)
- Relaxation due to fluence (which includes thermal creep) and thermal loosening (due to change in elastic modulus)

References

6-1. Electric Power Research Institute, "BWR Vessel and Internals Project: BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25)," TR-107284, December 1996.

6-2. GE Hitachi Nuclear Energy, "Vermont Yankee Core Plate Bolt Stress Analysis Report," NEDC-33618P, Revision 0, March 2011.