

November 18, 2002

Mr. Jay K. Thayer  
Site Vice President - Vermont Yankee  
Entergy Nuclear Vermont Yankee, LLC  
P.O. Box 0500  
185 Old Ferry Road  
Brattleboro, VT 05302-0500

SUBJECT: COMPLETION OF LICENSING ACTIVITY FOR GENERIC LETTER 96-06,  
"ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY  
DURING DESIGN-BASIS ACCIDENT CONDITIONS," VERMONT YANKEE  
NUCLEAR POWER STATION (VY) (TAC NO. M96880)

Dear Mr. Thayer:

Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," was issued by the U.S. Nuclear Regulatory Commission (NRC) on September 30, 1996. The GL requested that licensees determine (1) if containment air cooler cooling water systems are susceptible to either water-hammer or two-phase flow conditions during postulated accident conditions, and (2) if piping systems that penetrate the containment are susceptible to thermal expansion of fluid so that over pressurization of piping could occur.

By letters dated January 28, 1997, October 30, 1998, July 27, 1999, September 16 and October 29, 1999, March 29, June 22 and October 17, 2000, and September 17, 2002, the Vermont Yankee Nuclear Power Corporation (now Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operation, Inc./the licensee) provided information in response to GL 96-06.

In the enclosed safety evaluation the NRC staff concluded that the occurrence of a water hammer event under the conditions postulated in GL 96-06 would be very unlikely at VY. The staff is satisfied with the licensee's response to GL 96-06, and consider the associated activities to be closed. If you have any questions, please call me at (301) 415-3016.

Sincerely,

*/RA/*

Robert M. Pulsifer, Project Manager, Section 2  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-271

Enclosure: Safety Evaluation

cc w/encl: See next page

Vermont Yankee Nuclear Power Station

cc:

Regional Administrator, Region I  
U. S. Nuclear Regulatory Commission  
475 Allendale Road  
King of Prussia, PA 19406

Mr. David R. Lewis  
Shaw, Pittman, Potts & Trowbridge  
2300 N Street, N.W.  
Washington, DC 20037-1128

Ms. Christine S. Salembier, Commissioner  
Vermont Department of Public Service  
112 State Street  
Montpelier, VT 05620-2601

Mr. Michael H. Dworkin, Chairman  
Public Service Board  
State of Vermont  
112 State Street  
Montpelier, VT 05620-2701

Chairman, Board of Selectmen  
Town of Vernon  
P.O. Box 116  
Vernon, VT 05354-0116

Mr. Michael Hamer  
Operating Experience Coordinator  
Entergy Nuclear Vermont Yankee, LLC  
P.O. Box 250  
Governor Hunt Road  
Vernon, VT 05354

G. Dana Bisbee, Esq.  
Deputy Attorney General  
33 Capitol Street  
Concord, NH 03301-6937

Chief, Safety Unit  
Office of the Attorney General  
One Ashburton Place, 19th Floor  
Boston, MA 02108

Ms. Deborah B. Katz  
Box 83  
Shelburne Falls, MA 01370

Mr. Raymond N. McCandless  
Vermont Department of Health  
Division of Occupational  
and Radiological Health  
108 Cherry Street  
Burlington, VT 05402

Mr. Gautam Sen  
Manager, Licensing  
Entergy Nuclear Vermont Yankee, LLC  
P.O. Box 0500  
185 Old Ferry Road  
Brattleboro, VT 05302-0500

Resident Inspector  
Vermont Yankee Nuclear Power Station  
U. S. Nuclear Regulatory Commission  
P.O. Box 176  
Vernon, VT 05354

Director, Massachusetts Emergency  
Management Agency  
ATTN: James Muckerheide  
400 Worcester Rd.  
Framingham, MA 01702-5399

Jonathan M. Block, Esq.  
Main Street  
P. O. Box 566  
Putney, VT 05346-0566

Mr. Michael R. Kansler  
Sr. Vice President and Chief Operating  
Officer  
Entergy Nuclear Operations, Inc.  
Mail Stop 12A  
440 Hamilton Ave.  
White Plains, NY 10601

Mr. John J. Kelly  
Director, Licensing  
Entergy Nuclear Operations, Inc.  
440 Hamilton Avenue  
White Plains, NY 10601

November 18, 2002

Mr. Jay K. Thayer  
Site Vice President - Vermont Yankee  
Entergy Nuclear Vermont Yankee, LLC  
P.O. Box 0500  
185 Old Ferry Road  
Brattleboro, VT 05302-0500

SUBJECT: COMPLETION OF LICENSING ACTIVITY FOR GENERIC LETTER 96-06,  
"ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY  
DURING DESIGN-BASIS ACCIDENT CONDITIONS," VERMONT YANKEE  
NUCLEAR POWER STATION (VY) (TAC NO. M96880)

Dear Mr. Thayer:

Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," was issued by the U.S. Nuclear Regulatory Commission (NRC) on September 30, 1996. The GL requested that licensees determine (1) if containment air cooler cooling water systems are susceptible to either water-hammer or two-phase flow conditions during postulated accident conditions, and (2) if piping systems that penetrate the containment are susceptible to thermal expansion of fluid so that over pressurization of piping could occur.

By letters dated January 28, 1997, October 30, 1998, July 27, 1999, September 16 and October 29, 1999, March 29, June 22 and October 17, 2000, and September 17, 2002, the Vermont Yankee Nuclear Power Corporation (now Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operation, Inc./the licensee) provided information in response to GL 96-06.

In the enclosed safety evaluation the NRC staff concluded that the occurrence of a water hammer event under the conditions postulated in GL 96-06 would be very unlikely at VY. The staff is satisfied with the licensee's response to GL 96-06, and consider the associated activities to be closed. If you have any questions, please call me at (301) 415-3016.

Sincerely,  
*/RA/*  
Robert M. Pulsifer, Project Manager, Section 2  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-271  
Enclosure: Safety Evaluation cc w/encl: See next page

DISTRIBUTION:

PUBLIC J. Andersen M. O'Brien W. Beckner  
PDI-2 R/F R. Pulsifer OGC ACRS  
SRichards(e-mail SAR) C. Anderson, RI CHammer DTerao  
RCaruso SWeerakkady WJensen

DOCUMENT NAME: **ML022760229** \* See previous concurrence

OFFICE	PDI-2/PM	PDI-2/LA	SRXB	SPLB	EMEB	PDI-2/SC
NAME	RPulsifer	LCox for MO'Brien	RCaruso*	SWeerakkady*	DTerao*	JAndersen
DATE	11/12/02	11/14/02	10/15/02	10/18/02	10/25/02	11/14/02

**OFFICIAL RECORD COPY**

SAFETY EVALUATION OF THE OFFICE OF NUCLEAR REACTOR REGULATION  
OF THE RESPONSE TO GL 96-06  
“ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING  
DESIGN-BASIS ACCIDENT CONDITIONS”  
ENTERGY NUCLEAR VERMONT YANKEE, LLC  
AND  
ENTERGY NUCLEAR OPERATIONS, INC.  
VERMONT YANKEE NUCLEAR POWER STATION

## 1.0 INTRODUCTION

Generic Letter (GL) 96-06, “Assurance of Equipment Operability and Containment Integrity during Design-Basis Accident Conditions,” issued on September 30, 1996, requires among other considerations that licensees provide evaluations of containment air cooling water systems to determine susceptibility to thermally induced pressurization of piping runs penetrating the containment, water hammer and two-phase flow during postulated design-basis accidents. If systems are found to be susceptible to these conditions, licensees are expected to assess the operability of affected systems and take corrective action as appropriate. The Vermont Yankee Nuclear Power Corporation and subsequently Entergy Nuclear Vermont Yankee, LLC (the licensee) provided the required evaluations for the Vermont Yankee Nuclear Power Station (VY) as described in the following discussions.

## 2.0 EVALUATION

### 2.1 Water Hammer

Water hammer occurrence has been postulated within containment cooling systems following a loss of offsite power (LOOP) causing the cooling water to drain. Water hammer could occur either, (1) as part of the draining process as steam condensation causes water slugs to converge in horizontal pipes or (2) as steam voids collapse following the restart of pumps supplying water to the containment coolers. A loss-of-coolant accident (LOCA) could increase the possibility of steam formation and hence water hammer occurrence by causing boiling to occur within the fan cooler units or connecting piping.

The containment structure at VY is the General Electric Mark I design. The design includes a drywell containing the reactor vessel and recirculation loops and a suppression pool. Drywell cooling is provided by four fan-coil air cooling units. The drywell air cooling system is a

Enclosure

nonsafety-related system, and is therefore, not relied upon to mitigate any design-basis transient or accident at VY. Cooling water is provided to the drywell air coolers by the Reactor Building Closed Cooling Water (RBCCW) system. The RBCCW system at VY is not relied upon for post-accident heat removal. The sole safety-related function is to remain structurally sound following design-basis accidents so that containment integrity will not be compromised.

Following a LOOP, the RBCCW pumps will stop. The pumps may auto-start in 73 seconds or they may be manually restarted at some later time. The RBCCW is a closed-loop system, equipped with a surge tank that maintains a head of water even after power is lost so that system draining is not expected following a LOOP event. The consequences of a LOCA concurrent with a LOOP were evaluated by the licensee as required by GL 96-06. The increased containment temperature and moisture content was determined to be capable of causing voiding within the RBCCW piping. The licensee evaluated the water hammer that might occur from the restart of the RBCCW pumps, using method of characteristics methodology developed by the Altran Corporation. At the time of the VY submittal, the U.S. Nuclear Regulatory Commission (NRC) staff was reviewing essentially identical methodology submitted by the Electric Power Research Institute (EPRI). This review was completed and the methodology was approved for generic use on April 3, 2002. Following the approval of the EPRI methodology, the NRC staff requested that the licensee provide a comparison of their methodology with that which had been approved. Specific questions were raised relative to 1) the heat transfer coefficient used in the VY analysis, 2) the amount of non-condensable gas that was assumed to be released, and 3) the specific risk associated with the event for VY. The licensee's responses in all these areas indicate that the assumptions used in the VY analyses are conservative in comparison with the approved methodology. The staff, therefore, concludes that the VY methodology is acceptable. The staff further agrees with the licensee that the RBCCW system at VY is within the range of the systems evaluated for use using the EPRI methodology.

One conclusion from the EPRI review is that any condensation-induced water hammer that would occur during system draining would be bounded by that from column closure following pump restart. This conclusion also applies to VY.

As part of the review of the piping loads analysis, the NRC staff requested a summary of considerations used in these calculations. The licensee responded that stresses from the combination of loads due to dead weight, internal pressure and seismic excitation were considered concurrent with those from water hammer. Thermal expansion of the piping resulting from elevated temperature within the containment was also considered. The staff concludes that the licensee's methodology is acceptable and agrees that failure of the RBCCW system such that containment integrity will be compromised is extremely unlikely at VY.

## 2.2 Two-Phase Flow

In addition to water hammer, GL 96-06 is concerned with the occurrence of two-phase flow conditions within containment air coolers that might affect the assumptions used for heat removal during design-basis accidents. The containment air coolers at VY are not relied on to mitigate design-basis accidents and are designed to trip if such accidents occur, therefore this aspect of the GL does not apply to the containment air coolers at VY.

### 2.3 Thermally-Induced Pressurization

The licensee identified five systems potentially vulnerable to a water solid volume that may be subjected to an increase in pressure due to heating of trapped fluid. The affected systems are: RBCCW; radwaste system; main steam drain system; residual heat removal (RHR) shutdown cooling system; and nuclear boiler system. The licensee, for its long term corrective actions, installed pressure relief valves in the RBCCW and the radwaste systems lines. The licensee also installed check valves in the main steam drain lines and the RHR shutdown cooling and nuclear boiler (Sample) systems during the Fall 1996 refueling outage. The NRC staff finds that these corrective actions provide acceptable resolution for the issue of thermally induced pressurization of piping runs penetrating the containment.

### 3.0 CONCLUSIONS

Based on the forgoing considerations, the NRC staff concludes that the occurrence of a water hammer event such as will affect plant safety as postulated in GL 96-06 is highly unlikely at VY. Furthermore, the staff concludes that the licensee has provided the required evaluations and modifications where appropriate and has adequately addressed the issues raised in GL 96-06 regarding the potential for a water hammer, two-phase flow, and thermally induced pressurization of piping runs penetrating the containment. This closes TAC No. M96880.

Principal Contributors: C. Hammer  
W. Jensen