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June 30, 1994
BVY 94-70

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Reference: Operating License DPR-28
Docket No. 50-271
Reportable Occurrence No. LER 94-02, Supplement 1

Dear Sirs,

As defined by 10 CFR 50.73, we are reporting the attached Reportable Occurrence as LER 94-02, Supplement 1. Additionally, this Supplement includes reporting of Event Number 27332, reported on 06/01/94 per 10 CFR 50.72.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Robert J. Wanczyk
Plant Manager

cc: Regional Administrator
USNRC
Region I
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NRC Form 366 U.S. NUCLEAR REGULATORY COMMISSION
(6-89)

APPROVED OMS NO. 3150-0104
EXPIRES 4/30/92
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-350), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3160-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20603.

FACILITY NAME (1)	DOCKET NO. (2)	PAGE (3)
VERMONT YANKEE NUCLEAR POWER STATION	0 5 0 0 0 2 7 1	0 1 OF 0 5

TITLE (4) Alternate Cooling System Water Temperature Greater Than Design Basis During Warm Weather Circ Water System Operation Due to Inadequate Analysis of the Alternate Cooling System

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQ #	REV #	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NO. (S)
0 2	0 9	9 4	9 4	- 0 0 2	- 0 1	0 6	3 0	9 4		0 5 0 0 0
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OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO REQ'MTS OF 10 CFR §: CHECK ONE OR MORE (11)							
			20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
POWER LEVEL (10)	1 0 0		20.405(a)(1)(i)		50.36(c)(1)	X	50.73(a)(2)(v)		73.71(c)
			20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER:
.....			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
.....			20.405(a)(1)(iv)	X	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
.....			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NO.
ROBERT J. WANCZYK, PLANT MANAGER	CODE 8 0 2 2 5 7 - 7 7 1 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYST	COMPONENT	MFR	REPORTABLE TO NPRDS		CAUSE	SYST	COMPONENT	MFR	REPORTABLE TO NPRDS	
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SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MO	DAY	YR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approx. fifteen single-space typewritten lines) (16)

During a Self Assessment of the Service Water System and as a result of evaluations conducted to respond to issues identified by this assessment, several design conditions were identified which may have precluded the Alternate Cooling System from performing its intended design basis functions.

The root cause of this event has been determined to be an inadequate analysis of the Alternate Cooling System to ensure that it could achieve its design basis function to remove sensible and decay heat from the reactor under all postulated design basis events.

Corrective actions included procedure changes, the documentation of a Basis for Maintaining Operability (BMO) and an update to the FSAR under 10CFR50.59 to ensure that the FSAR accurately describes required parameters.

TEXT (If more space is required, use additional NRC Form 366A) (17)

DESCRIPTION OF EVENT

BACKGROUND INFORMATION

On November 30, 1966 Vermont Yankee Nuclear Power Corporation (VYNPC) filed with the Atomic Energy Commission (AEC) an application for an AEC license to construct and operate the Vermont Yankee Nuclear Power Station (VYNPS). The information contained in the application, which included the original Plant Design and Analysis Report (PDAR, 1966), was evaluated by the AEC regulatory staff and the Advisory Committee for Reactor Safeguards (ACRS).

On April 12, 1967, in Amendment 3 of the PDAR, Vermont Yankee responded to the following question: 'Please state the sea level elevation of the station service water intake. If this is higher than the Connecticut River low-flow elevation at this point without the Vernon Dam, please provide the justification.' The VYNPS response to this question was that consistent with the design criteria for the structures and equipment required for a safe shutdown of the VYNPS, the Vernon Dam was analyzed for the maximum 0.14g earthquake and found to be stable.

On May 19, 1967, in Amendment 5 of the PDAR the following information was transmitted to the AEC by VYNPC: 'The loss of water from the Vernon Pond would result in uncovering the station service water pump suction and would preclude the normal functions of the Residual Heat Removal System heat exchangers. Although the dewatering of the Vernon Pond is considered to be a most remote possibility, an alternate means of providing for reactor decay heat removal will be included in the plant design.'

On July 7, 1967, the AEC Safety Evaluation Report (SER) discusses and further summarizes the basis for alternate cooling. It states, 'The station service water intake is at a higher elevation than would exist for the Connecticut River if the Vernon Dam, which is approximately 2500 feet downstream from the site, were to fail. Although it appears to our consultant, Dr. N.M. Newmark, that the dam can probably accommodate the maximum (no loss of safety function) earthquake, we have required that in the event of a dam failure, service water (or its equivalent in cooling capacity) always be available for shutdown cooling. The applicant has responded by assuring us that an alternate scheme for removing decay heat from the Reactor Shutdown Cooling System will be provided (Amendment 5). Our acceptance criteria for this system will include: (1) conformance to Class I design standards, (2) power requirements within the capability of emergency on-site power source, and (3) heat removal capability equivalent to what is provided for shutdown when the normal river-water source is available.'

On December 31, 1969, VYNPC filed a revised application along with the FSAR and requested an operating license. In the FSAR, Section 2.4.3.4, it states that the "Standard Project Flood" at Vernon results in a Vernon Pond Elevation of 235.1 ft MSL, some 15 feet below plant grade of 250 feet MSL.

On June 19, 1970, the AEC requested the probable maximum flood (PMF) at the plant be estimated using a method consistent with the U.S Corps of Engineers Probable Maximum Flood calculation. On October 23, 1970, VYNPC submitted Amendment 16 of the FSAR. This document shows that the PMF river stage is 252.5 feet MSL at the plant when using a method consistent with the U.S. Corps of Engineers.

On February 5, 1971, VYNPC submitted a Supplement to Amendment 16 of the FSAR. Because the new PMF affects the intake structure it is discussed in this Supplement. In particular, 'Service water pumps would provide for normal reactor cooling. When their service is terminated due to river water leakage into the intake structure, the alternate cooling water system would be put into service from within the station to provide for reactor cooling.

On June 1, 1971, VYNPC received the Safety Evaluation Report on flooding and service water system.

As can be seen from the above, the Alternate Cooling System was originally designed to accommodate a loss of the Vernon Dam, and later to provide shutdown cooling in the case of a Probable Maximum Flood. There were no requirements for redundancy, and the system was not designed for accident mitigation, nor was it ever intended or designed to be single failure proof. There is no Safety Design Basis for the Alternate Cooling System in the FSAR.

BACKGROUND (CONT.)

In 1983, Vermont Yankee completed a Safe Shutdown Capability Analysis to address 10CFR50 Appendix R, to ensure the capability to achieve safe shutdown if a fire were to occur in any given area of the plant. For a fire in the intake structure, the Service Water Pumps are assumed to be lost, and the Alternate Cooling System would be used. No detailed analysis of system operation was performed to support this conclusion.

In January/February 1994, Vermont Yankee conducted a Self Assessment of the Service Water and Alternate Cooling Systems. In order to address the open issues identified as a result of this Self Assessment, a project team was established. The issues identified below are a result of the Self Assessment and evaluations conducted in response to this assessment.

DESCRIPTION

On February 9, 1994 while operating at 100% power, it was identified that the Alternate Cooling System (EIIS=BI) could be operated in a manner inconsistent with the supporting design information described in the FSAR during certain periods of plant operation. The supporting design information contained in Section 10.8 of the FSAR states that the Alternate Cooling System is designed to supply 85 degree cooling water to three Residual Heat Removal (RHR) Service Water (EIIS=BI) pumps. During certain periods of warm weather operation the initial temperature of water in the Alternate Cooling System storage reservoir (deep basin) was greater than 85 degrees. This was considered operation outside the design basis of the plant, and operation in an unanalyzed condition for those periods.

The water supply for the Alternate Cooling System is contained in a deep basin located under one of the two eleven cell cooling towers which are used in conjunction with the Circulating Water System. The cooling towers are normally used to ensure water discharge temperatures from the plant remain within limits of the NPDES permit. During operation of the cooling towers the water in the deep basin can reach temperatures above 85 degrees. The Alternate Cooling System uses the number one cell of the west cooling tower.

An engineering evaluation was initiated to assess the ability of the Alternate Cooling System to provide the required cooling if the deep basin temperature was above 85 degrees. Each of the components included in the Alternate Cooling System was evaluated, and the entire system was incorporated in a computer model to ensure that required flows could be provided to each component with elevated water temperatures.

On June 1, 1994, it was determined that existing operating procedures were insufficient to ensure that adequate cooling could be provided by the Alternate Cooling System. In reviewing the design of the Alternate Cooling tower cell, it was determined that a minimum of 8000 gpm water would be required to ensure that significant channeling within the cooling tower (uneven flow distribution) would not impact the heat removal capability of the cooling tower. Based on our recently completed flow model, with RHR heat exchanger flow restrictions contained in the operating procedure, 8000 gpm to the cooling tower would not be obtained. In order to obtain 8000 gpm to the cooling tower, four RHRSW pumps would need to be operated through two RHR heat exchangers with the flow through each heat exchanger above that normally permitted by the operating procedures.

Additionally, with high initial temperatures in the deep basin, if the Alternate Cooling System was required to provide Torus Cooling, required flow through the RHR heat exchangers would exceed the flow limitations contained in the operating procedures. These conditions were also contrary to the description contained in the FSAR. Based on this conclusion, the Alternate Cooling System was declared inoperable. Reactor operation is allowed for 7 days with the Alternate Cooling System inoperable.

CAUSE OF EVENT

The root cause has been determined to be an inadequate analysis of the Alternate Cooling System to ensure it could achieve the design basis function to remove sensible and decay heat from the reactor during all postulated design basis events. Although the Alternate Cooling Tower System had been designed to provide 85 degree cooling water, insufficient analysis was performed to assess the effects of a high initial deep basin temperature, and to ensure the required flow to the cooling tower could be provided under the operating restrictions contained in the procedures. Additionally, when the Alternate Cooling System was assumed to be available in the unlikely event of a fire in the intake structure which disables all four Service Water Pumps, no analysis was conducted to ensure the heat removal requirements of the system could be met.

ANALYSIS OF EVENT

The Alternate Cooling System provides for the removal of shutdown heat loads in the event of: (1) a loss of the Vernon Dam; (2) during the postulated Probable Maximum Flood; and (3) in the event a fire in the intake structure destroys all four service water pumps. If the Alternate Cooling System had been required to provide cooling in any of the above situations, the heat removal capability of the system may have been below the design levels. If extensive channeling exists in the cooling tower, it is difficult to predict with any confidence the amount of heat that would be removed. With channeling, the hot water return temperature would be increased, which in turn increases the actual heat removal performance of the cooling tower. The system is designed to remove decay heat at three hours after shutdown, when the reactor is depressurized to allow Shutdown Cooling to be placed in service. For this to occur within three hours, the cooldown rate during depressurization would have to be approximately one hundred degrees per hour (the upper limit of technical specifications), which is not likely. A normal cooldown rate would rarely exceed fifty degrees per hour, thus depressurization would take considerably longer than three hours, and the decay heat rate would be significantly lower than design. The net effect of a reduced heat removal capability would be to extend the time required to obtain cold shutdown conditions.

The Appendix R fire in the intake structure is the most severe of these three postulated events, as it is assumed to occur instantaneously while the plant is at 100% power along with a simultaneous loss of offsite power. During this scenario, there is a period of time when no cooling water is available to remove decay heat. Operation of HPCI, RCIC, and SRV's will transfer heat to the torus, resulting in increasing torus temperature until the Alternate Cooling System can be placed in service. Although the Appendix R rules require assuming the loss of all four service water pumps due to a fire in the intake structure instantaneously, this is not realistic for postulated fire scenarios. The power supply to each service water pump is in separate conduit and the routing is separated such that a credible fire could not reasonably affect all four pumps simultaneously. It is highly unlikely that a fire would affect more than two pumps. The intake structure is a fire control area which ensures transient combustibles and transient ignition sources are minimized. Also, due to the lack of continuity of insitu combustible loading, it is unlikely that a major fire will develop in the room. A smoke detector is located in the room, thus the control room would be quickly alerted to a fire in the service water pump room. The fire brigade would respond quickly upon receipt of a fire alarm.

The loss of the Vernon Dam scenario includes approximately 1.6 hours of continued service water operation until the level of the Vernon Pond drops below the level of the intake necessary for Service Water pump operation. In this scenario, the service water pumps can provide for containment (torus) cooling, and the total heat load on Alternate Cooling is reduced since the torus temperature will not be as high as the Appendix R fire scenario. Failure of the Vernon dam is highly unlikely. The seismic capability of the dam is well in excess of the Vermont Yankee Safe Shutdown Earthquake design of 0.14g.

The flooding scenario is by far the least limiting scenario. This is due to the fact that the Probable Maximum Flood would occur with significant warning over a period of days. With the amount of rainfall required to produce flooding to a level where the Service Water Pumps would be unable to operate, sufficient advance warning is available to shut the plant down and cool down long before Alternate Cooling would be needed. Thus the heat load on the system would be the least of the three scenarios described. In addition, in accordance with the Vermont Yankee Technical Specifications, the Alternate Cooling System is not required to be operable once the reactor coolant temperature is below 212 degrees F. Per FSAR Chapter 2.4.3.4, the flood of March 19, 1936, which was the greatest and most destructive flood on this portion of the Connecticut River, resulted in a

ANALYSIS OF EVENT (CONT.)

stillwater level of 231'4" which is approximately six feet below the intake structure elevation. Thus, Alternate Cooling System operation would not be required for a repeat of this worst historical flood.

Based on the above, this event had minimal safety significance.

CORRECTIVE ACTIONS

Extensive engineering evaluations of Alternate Cooling System operation have been conducted. The procedure for Alternate Cooling System operation was revised on June 8, 1994 to ensure that the system will be operated in a manner consistent with these evaluations. A Basis for Maintaining Operability (BMO) was documented and reviewed by the Plant Operations Review Committee. The Alternate Cooling System was declared operable at 1630 on June 8, 1994. A change to the FSAR has been made under 10CFR50.59 to recognize the current analysis and procedural requirements to operate four RHRSW pumps and two RHR Heat Exchangers at increased flows. Evaluations were performed assuming a maximum initial deep basin temperature of 105 degrees. Deep basin temperatures rarely exceed 95 degrees. A peak circulating water return temperature of 102 degrees was recorded over a 2 hour period in 1988. Based on our current analysis, even if the initial temperature were 105 degrees, it would be reduced to less than 85 degrees within 12 hours of Alternate Cooling System operation.

Vermont Yankee is continuing to assess the requirements of the Alternate Cooling System. Required pump flows are based on conservative assumptions and analyses, which may be reduced with further evaluations and/or planned testing of the Alternate Cooling Tower. Any future changes would be conducted in accordance with 10CFR50.59 and included in the next updated FSAR submittal to the NRC.