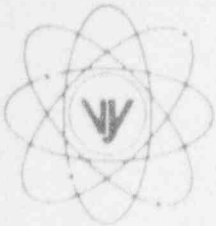


VERMONT YANKEE NUCLEAR POWER CORPORATION



P.O. Box 157, Governor Hunt Road
Vernon, Vermont 05354-0157
(802) 257-7711

BVY 94-112

November 10, 1994

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

REFERENCE: Operating License DPR-28
Docket No. 50-271
Reportable Occurrence No. LER 94-13

Dear Sirs:

As defined by 10 CFR 50.73, we are reporting the attached Reportable Occurrence as LER 94-13.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Robert J. Wanczyk
Robert J. Wanczyk
Plant Manager

cc: Regional Administrator
USNRC
Region I
475 Allendale Road
King of Prussia, PA 19406

150048

9411170068 941110
PDR ADDCK 05000271
S PDR

JE22

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) VERMONT YANKEE NUCLEAR POWER STATION										DOCKET NO. (2) 0 5 0 0 0 2 7 1					PAGE (3) 0 1 OF 0 5									
TITLE (4) Initiation of Technical Specification Required Shutdown Due to Unisolable Service Water Leak Resulting in Inoperability of Both Service Water Subsystems and the Alternate Cooling Subsystem.																								
EVENT DATE (5) MONTH DAY YEAR 1 0 1 3 9 4						LER NUMBER (6) YEAR SEQ # REV # 9 4 - 0 1 3 - 0 0						REPORT DATE (7) MONTH DAY YEAR 1 1 1 0 9 4						OTHER FACILITIES INVOLVED (8) FACILITY NAMES DOCKET NO. (5) 0 5 0 0 0 0						
OPERATING MODE (9) N		THIS REPORT IS SUBMITTED PURSUANT TO REQ'TS OF 10 CFR §: CHECK ONE OR MORE (11)																						
POWER LEVEL (10) 1 0 0		20.402(b)				20.405(c)				50.73(a)(2)(iv)				73.71(b)										
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)				X 50.73(a)(2)(vi)				OTHER:														
20.405(a)(1)(iii)		50.73(a)(2)(i)				50.73(a)(2)(viii)(A)				50.73(a)(2)(viii)(B)														
20.405(a)(1)(iv)		X 50.73(a)(2)(ii)				50.73(a)(2)(iii)				50.73(a)(2)(x)														
20.405(a)(1)(v)		50.73(a)(2)(iii)				50.73(a)(2)(x)				50.73(a)(2)(x)														
LICENSEE CONTACT FOR THIS LER (12)																								
NAME ROBERT J. WANCZYK, PLANT MANAGER															TELEPHONE NO. AREA 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	CAUSE	SYST	COMPONENT	MFR	REPORTABLE TO NPRDS	CAUSE	SYST	COMPONENT	MFR	REPORTABLE TO NPRDS					
B	I	H X	F 1 7 5	Y																				
B	I	V	C 6 8 4	N																				
SUPPLEMENTAL REPORT EXPECTED (14)															EXPECTED SUBMISSION DATE (15)					MO DAY YR				
X YES (If yes, complete EXPECTED SUBMISSION DATE)															NO					0 1 1 5 9 5				

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

On 10/13/94, at 1635, operators observed a leak from the bottom of the 'B' Reactor Building Closed Cooling Water Heat Exchanger due to flow induced vibration fatigue on a drain line. Closing the Service Water inlet valve stopped the leak, but outlet valve V70-92C could not be closed due to an obstruction in the seat area. At 2345 both Service Water Subsystems were declared inoperable due to the unisolable leak and a 7 day LCO was entered. After further analysis, the Alternate Cooling Subsystem was also declared inoperable due to the leak and a 24 hour LCO was entered at 1512 on 10/14/94. A shutdown was initiated at 1935 on 10/14. Installation of blind flanges in place of the failed V70-92C valve completely isolated the leak and the Service Water Subsystems and the Alternate Cooling Subsystem were declared operable at 0815 on 10/15. A permanent fix for the cracked drain connection is being designed and is expected to be implemented by 1/31/95.

NRC Form 366A 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.	
LICENSEE EVENT REPORT (LER) TEXT CONTINUATION			
FACILITY NAME (1)	DOCKET NO (2)	LER NUMBER (6)	PAGE (3)
		YEAR	SEQ #
			REV #
VERMONT YANKEE NUCLEAR POWER CORPORATION	05000271	9 4 - 0 1 3 - 0 0	0 2 OF 0 5

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

DESCRIPTION OF EVENT

On 10/13/94 at 1635, while at 100% power, operators noticed water dripping from the bottom of the 'B' Reactor Building Closed Cooling Water (RBCCW) (EIS = BI) heat exchanger. Due to the existing insulation, it was impossible to identify the exact location of the leak. Isolating the Service Water (SW) (EIS = BI) inlet to the heat exchanger resulted in stopping the leak. At 2345 on 10/13/94, the next operating shift reviewed the situation and determined that the leak left the SW system in a degraded condition because, although leakage had been essentially stopped, the leak could not be totally isolated due to failure of the outlet bypass valve, V70-92C, to close. Therefore, the SW return header was still pressurizing the leak area but not enough to allow leakage through the weld. As this results in a leak from the common return header for both SW system trains, both SW subsystems were declared inoperable at this time and a 7 day LCO was entered.

Later analyses showed this unisolable leak could also affect the operability of the Alternate Cooling Subsystem (EIS = BI) as the leakage (assuming total failure of the 4" drain connection) would result in reducing the inventory available for long term cooling. Therefore, the Alternate Cooling Subsystem was declared inoperable at 1512 on 10/14/94. At this time a 24 hour LCO was entered. An orderly shutdown was started at 1935 with the subsequent declaration of an Unusual Event. The plant was in hot standby at 0457 on 10/15/94. At 0815 on 10/15/94, blind flanges were installed in place of V70-92C, isolating the leak. Both SW Subsystems and the Alternate Cooling Subsystem were declared operable at this time; prior to the 24 hour LCO period being exceeded.

It should be noted that the RBCCW heat exchangers are each designed for 100% capacity. Therefore, operation of either unit provides the required cooling capability for the system and there was never a need to declare the RBCCW system inoperable. Also, the leak was characterized as coming from a crack at the interface of the connection weld and the base material of the heat exchanger. The crack is approximately 6" long but as stated previously this resulted in minor dripping only.

CAUSE OF EVENT

A preliminary review has shown that the root cause of this event was inadequate design. This may have been coupled with another crack initiating mechanism (weld flaw or base metal flaw) to develop the through wall crack. The design of the drain connection did not address the flow induced vibration which led to fatigue of the heat exchanger drain connection. The design of the drain connection met all the requirements of ASME Section VIII for a pressure vessel connection, but did not anticipate the vibration induced fatigue which caused the failure. A contributing cause was that the plant design change procedure did not specifically require the design engineer to inspect the completed installation for adverse vibrations. Also, the design of the original SW to RBCCW heat exchanger piping system is responsible for some vibration in the system. Future evaluations will determine the need for further changes to the piping system to alleviate flow induced vibrations. When the permanent fix is made to the drain connection, examination may show that other items such as poor weld, poor weld prep and

NRC Form 366A 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.	
LICENSEE EVENT REPORT (LER) TEXT CONTINUATION			
FACILITY NAME (1)	DOCKET NO (2)	LER NUMBER (6)	
		YEAR	SEQ #
			REV #
VERMONT YANKEE NUCLEAR POWER CORPORATION	05000271	9 4 -	0 1 3 - 0 0
		0 3	OF 0 5

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

laminations of the base material in the area of the weld may have contributed to the failure.

A contributing cause to having to declare SW and Alternate Cooling inoperable was the existence of a piece of metal lodged in valve V70-92C which prevented isolation of the leak. The source of this metal (mild steel round stock - 6" x 1") has not been identified. Further investigation will be performed to attempt to identify the source. Due to either poor housekeeping or equipment failure elsewhere in the system; this metal bar prevented closure of V70-92C. Had this valve been able to close, operability of the SW and Alternate Cooling Subsystems would have been maintained upon valve closure.

ANALYSIS OF EVENT

Technical Specification 3.5.D.1 requires both Station SW Subsystem loops to be operable whenever irradiated fuel is in the reactor vessel and reactor coolant temperature is greater than 212 degrees F. Per Technical Specification 3.5.D.3, reactor operation is allowed for seven days after the Alternate Cooling Tower Subsystem or both Station SW Subsystems are made or found to be inoperable provided all other active components of the other subsystem are operable. In addition, if the above cannot be met, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 24 hours.

Operators identified leakage from the bottom of the RBCCW heat exchanger at 1635 on 10/13/94. They closed the SW inlet valve to the heat exchanger and attempted to close the SW outlet valves. As stated previously, outlet valve V70-92C would not close. However, closure of the SW inlet valve adequately reduced the pressure on the SW side of the RBCCW heat exchanger so that the leak had stopped. The stoppage of the leak satisfied the operators that operability of the SW Subsystems was not affected. The next operating shift reviewed the situation and declared both SW Subsystems inoperable at 2345 on 10/13/94 due to the existence of an unisolable leak on the common return header. This determination of inoperability was based on experience with a SW leak in a similar location. Per Technical Specifications section 3.5.D.3 a 7 day LCO was entered at this time.

One of the safety objectives of the Station Service Water System is to provide cooling water to systems and equipment required to operate under accident conditions. This objective is met through the following two safety design bases: 1) To provide a source of cooling water, both individually and in conjunction with the Residual Heat Removal (RHR) (EIS = BO) service water pumps, for core standby cooling system equipment required during accident conditions and 2) To supply a source of cooling water for the station standby diesel generators (EIS = EK). The Station SW System is a dual header system using two parallel headers to supply both the turbine and reactor auxiliary equipment. Each SW header supplies cooling water to a reactor building closed cooling water (RBCCW) heat exchanger, RHR-core spray room ventilation coolers, a diesel-generator cooler, and a set of RHR SW pumps which supply water to the RHR heat exchangers.

The Alternate Cooling Subsystem 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

NRC Form 366A 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.	
LICENSEE EVENT REPORT (LER) TEXT CONTINUATION			
FACILITY NAME (1)	DOCKET NO (2)	LER NUMBER (6)	
		YEAR	SEQ #
VERMONT YANKEE NUCLEAR POWER CORPORATION	05000271	9 4 -	0 1 3 -
		REV #	
		0 0	0 4 OF 0 5

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

the intake structure destroys all four service water pumps.

The Alternate Cooling Subsystem was declared inoperable at 1512 on 10/14/94 as a result of further analysis of the unisolable leak. Therefore, a 24 hour LCO was entered as per Technical Specifications Section 3.5.D.4. An orderly shutdown was started at 1935 on 10/14/94 and hot standby was attained at 0457 on 10/15/94. At 0815 an approved temporary modification (TM) installation was completed whereby blank flanges were installed in place of the failed valve, V70-92C. The SW Subsystems and the Alternate Cooling Subsystem were declared operable at this time.

Although the SW Subsystems and the Alternate Cooling Subsystems were declared inoperable at the same time, both systems could have performed their safety functions under all design conditions with the exception of cooling after a design basis earthquake. As stated previously, leakage from the cracked drain connection (and therefore from the common SW return header) had been stopped by closure of the SW inlet valve to the 'B' RBCCW heat exchanger. Therefore, the SW Subsystems and the Alternate Cooling Subsystem were not impacted in their ability to supply cooling water. However, during a Design Basis Earthquake, the capability of the cracked connection to maintain its structural integrity is questionable. Had the drain connection completely fallen off, the Alternate Cooling Subsystem would not have been able to perform its design function, as available cooling inventory would have been depleted in less than one week.

In addition, it is probable that the SW Subsystems could have continued to perform their designed safety functions, in that the leak would be in the common return header. The cooling capability of the SW system would not be significantly impacted as the required cooling has already been performed prior to flow getting to this leak location. However, flooding could result in eventual damage not previously addressed in flooding analyses. Compensatory action could have been taken if the break were to have occurred at the drain connection, blind flanges could have been installed to replace valve V70-92C (completion of this effort took less than 10 minutes) or plugging the drain connection could have been performed. Plugging the drain connection may not have resulted in complete isolation but it would have slowed the leakage to an acceptable level where flooding would not be a concern and where SW would still perform its design functions.

CORRECTIVE ACTIONS

Short Term Corrective Actions -

A temporary modification was installed on 10/15/94 so that the leak has been isolated. The similar drain connection on the 'A' RBCCW heat exchanger was magnetic particle inspected and determined to not have similar cracking of the weld/heat exchanger base metal interface. In addition, operators stroked a number of valves in the SW system with no problems found; indicating that the metal preventing closure of V70-92C did not come from any of these valves.

NRC Form 366A 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.	
LICENSEE EVENT REPORT (LER) TEXT, CONTINUATION			
FACILITY NAME (1)	DOCKET NO (2)	LER NUMBER (6)	
		YEAR	SEQ #
			REV #
VERMONT YANKEE NUCLEAR POWER CORPORATION	05000271	94	013
			00
			05 OF 05

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

Long Term Corrective Actions -

- 1) A permanent fix for the cracked drain connection is expected to be implemented by 1/31/95.
- 2) A more thorough failure analysis will be performed on the 'B' RBCCW heat exchanger drain connection following implementation of the permanent fix. This is expected to be completed by 2/28/95. The need for implementation of a similar fix on the 'A' RBCCW heat exchanger will be determined at that time.
- 3) Changes to plant procedures AP6000, AP6001, and AP6004 will be incorporated during their next revision to require the engineer to review the final installation of new piping configurations/components for vibrational concerns and to take appropriate measures as necessary.
- 4) Valve V70-92C will be replaced prior to startup from the 1995 refueling outage. In addition, a new style of valve minimizing piping system vibration is being evaluated.
- 5) Ongoing investigations and a root cause analysis are expected to be completed by 12/31/94 to determine the origin of the metal bar lodged in V70-92C.

Depending on the results of the failure mechanism evaluations and the origin of the metal bar investigation, a supplemental report may be submitted at a later date.

ADDITIONAL INFORMATION

The failed drain connection on the 'B' RBCCW heat exchanger was installed in 1992. It is a 4" schedule 80 carbon steel connection meeting all the requirements of ASME Section VIII. There is a similar connection on the 'A' RBCCW heat exchanger. As noted previously, this connection was magnetic particle examined and found to be acceptable. In addition, the connection on the 'A' heat exchanger does not have a cantilevered isolation valve and is not as susceptible to vibrational fatigue. The heat exchanger is a four pass Foster-Wheeler carbon steel shell heat exchanger designed and built per ASME Section VIII. Valve V70-92C is a 4" Crane-Aloyco stainless steel globe valve, Figure 317FF. The valve and heat exchanger did not fail as a result of any work performed by the original equipment manufacturers.

The probability of a design basis earthquake is small. The drain connection still had much sound weld metal in place to prevent complete breakage of the connection. In addition, either implementation of the Temporary Modification or other similar actions could have been performed to adequately isolate the leak. Based on the above, there was minimal impact on the health and safety of the public.

This event was not previously identified or reported in any other LER.