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August 4, 1995
BVY 95-85

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 94-16, Supp. 1

Dear Sirs:

As defined by 10 CFR 50.73, we are reporting the attached Reportable Occurrence as LER 94-16, Supplement 1.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Robert J. Wanczyk
Plant Manager

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

IE22

NRC Form 366 U.S. NUCLEAR REGULATORY COMMISSION
(5-92)

LICENSEE EVENT REPORT (LER)

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
VERMONT YANKEE NUCLEAR POWER STATION	05000271	01 OF 07

TITLE (4) UNISOLABLE SERVICE WATER PIPING LEAKS RESULTING IN INOPERABILITY OF THE SW SUBSYSTEMS AND THE ALTERNATE COOLING SUBSYSTEM.

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) 05000
11	30	94	94	-	16	-	01	08	04	95	N/A	05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: CHECK ONE OR MORE (11)							
POWER LEVEL (10)	100%		20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
			20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
			20.405(a)(1)(ii)		50.36(c)(2)	X	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)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		(Specify in Abstract below and in Text, NRC Form 366A)
.....			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NO. (Include Area Code)
ROBERT J. WANCZYK, PLANT MANAGER	802-257-7711

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
B	BI	PSP	N/A	N						

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MO	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)		NO X				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On 11/30/94 at 2055, operators observed minor leakage from the Service Water (SW) discharge piping connected to the 'A' Reactor Building Closed Cooling Water heat exchanger. As this piping is not isolable from the main SW return header, both SW Subsystems were declared inoperable at 2055 on 11/30/94. The Alternate Cooling Subsystem had previously been declared inoperable due to maintenance activities. As a result of both the SW and Alternate Cooling Systems being inoperable, a 24 hour LCO was entered. While performing inspections of the leak area, another leak was identified in a different weld in the area. After incorporating inspection data into appropriate analyses, it was determined that the piping structural integrity was not impacted. Per Generic Letter 90-05, the SW Subsystems were declared operable at 1200 on 12/1/94. The Alternate Cooling Subsystem was declared operable at 1620 on 12/2/94 after completion of additional evaluations. ASME Code replacement of the piping was completed during the 1995 Outage. The root cause of one of the leaks was Microbiological Induced Corrosion (MIC) which initiated at a crevice due to fit-up problems. The root cause of the other leak was lack of fusion of the root of the weld which led to severe MIC attack.

DESCRIPTION OF EVENT

On 11/30/94 at 2055, while at 100% power, operators noticed water leaking from the Service Water (SW) (EIIS = BI) discharge piping of the 'A' Reactor Building Closed Cooling Water (RBCCW) (EIIS = BI) heat exchanger in a very fine mist/stream. The leakage occurred in the weld of a 4" branch line to a 12" header. Both pipes are carbon steel per ASTM (American Society for Testing and Materials) specification A106 Gr.B. As this is unisolable from the common SW return header, both SW Subsystems were declared inoperable at 2055 on 11/30/94. The Alternate Cooling Subsystem (ACS) (EIIS = BI) had previously been declared inoperable to accommodate maintenance activities. With SW and ACS inoperable, a 24 hour Limiting Conditions for Operation (LCO) was entered.

The requirements of Generic Letter 90-05 were reviewed and found to be applicable to this condition. Ultrasonic Thickness (UT) testing methods were utilized to characterize the flaw. While performing the UT's an additional through wall leak was identified on a 4" pipe weld approximately two feet beneath the original leak. This second leak was only discernible when additional pumps were operating and system pressure at this elevation was increased. When the additional pumps were secured, leakage was halted at the second location. Thorough UT's of the leaking welds and the surrounding piping was performed. No other flaws were identified and there was minimal pipe wall loss. Bounding analyses were performed of the flawed areas and it was determined that the structural integrity of the flawed piping was not impacted.

The SW Subsystems were declared operable at 1200 on 12/1/94 as the applicable requirements of Generic Letter 90-05 had been met. This left the plant in the pre-established 7 day LCO (established 11/27/94) for the ACS being inoperable. The ACS was declared operable at 1620 on 12/2/94 when required pump testing was completed and when an evaluation of coolant inventory acceptability was approved.

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.

CAUSE OF EVENT

The failed welds were analyzed to determine the cause of each failure. The failure analysis included radiography, macroscopic and microscopic examination of the failed areas. As expected, the first leak was due to Microbiologically Induced Corrosion (MIC). It was determined that the joint configuration of this branch connection created a crevice which allowed MIC to slowly remove weld material.

A detailed root cause evaluation was also performed for the second leak. The second failure was caused by localized lack of fusion of the root of the weld which led to an accelerated MIC attack. It was anticipated that a weld related defect was involved with this failure as the piping had only been installed for about two years. Corrective actions were likewise identified and implemented for this second failure.

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 4" SW bypass piping on the discharge of the 'A' RBCCW heat exchanger at 2055 on 11/30/94. As this resulted in an unisolable leak in the common SW discharge line (Safety Class 3), both SW Subsystems were declared inoperable at this time. The Alternate Cooling Subsystem had previously been declared inoperable at 1630 on 11/27/94 for maintenance activities. Therefore, per Technical Specification Section 3.5.D.3, a 24 hour LCO was entered.

A quick engineering walkdown of the leak area and a review of Generic Letter 90-05 indicated that it would be possible to declare the SW Subsystems operable within 12 hours which would still allow enough time to attain a cold shutdown if operability could not be declared. Per Generic Letter 90-05, the leak was characterized utilizing ultrasonic thickness testing and angle beam scanning. No other relevant flaws were identified in the weld or surrounding piping and there was very little wall loss identified. While performing these UT's an additional leak was identified on the 4" piping approximately two feet below the first leak. This second leak was only noticeable when additional pumps in the SW system were started for testing. When the pumps were secured, the second pinhole no longer leaked water. The second leak was also thoroughly UT'd as was the surrounding piping and additional accessible welds in the area. The UT data was incorporated into analyses and it was determined that the structural integrity of the piping system was not affected by the existence of these pinholes. The affects of flooding, spraying, system interactions and loss of flow were evaluated as per the requirements of Generic Letter 90-05 and found to not create any operability concerns. Therefore, as all applicable requirements of Generic Letter 90-05 had been met, the SW Subsystems were declared operable at 1200 on 12/1/94. Additional evaluations and system testing were completed and the ACS was declared operable at 1620 on 12/2/94.

Due to the very minor leakage occurring at the pinholes it was decided to not implement any temporary repairs of the areas. Per Generic Letter 90-05, augmented inspections had been completed, the leak(s) were qualitatively evaluated daily by the Operations group, the leak(s) were quantitatively evaluated weekly, and the flaws were non-destructively examined once per month. In addition, a relief request (BVY 94-130) was sent to the NRC on 12/30/94 to allow continued operation with the existing through wall flaws. As the exact root cause of both flaws was not known, the scope of the augmented inspection was increased from the minimum required 10 inspections (five for each flaw) to 23 inspection locations. These locations included all welds and adjacent piping on both 4" SW bypass lines on the discharge of the 'A' and 'B' RBCCW heat exchangers, as well as similar potentially susceptible locations

throughout the SW systems. As previously stated, no other relevant flaws or areas of concern were identified as a result of the inspections. In addition, vibration data was obtained on the SW piping in the area. This data was factored into analyses of the flawed welds and showed that there was extremely low potential for abrupt brittle failure of the connections.

During code replacement of the affected piping (during the 1995 outage), visual inspection of the internal diameter of the second leaking weld indicated missing weld material for approximately 1.25" on either side of the leak. The visual inspection was performed after the corrosion products trapped in the weld area had dried up and fallen out of the weld area. It was apparent that there was more wall loss than had been indicated by UT inspections. All material loss was confined to the weld area and it appeared that there had been a problem with the weld root in this area. Material failure analysis performed later confirmed that there was lack of fusion of the root of the weld which created an ideal environment for MIC attack. The MIC attack was confined only to that portion of the weld which had lack of fusion of the root.

At this time, Vermont Yankee is investigating the adequacy of current practices for ultrasonic thickness examination for determining the structural integrity of SW piping in weld areas. Preliminary review of previous analyses indicate that the actual as-found piping configuration was structurally adequate from the stand point of pressure, seismic, deadweight, thermal and system vibrational loading. This was due to essentially nominal wall thickness of 3/4 of the weld and due to the conservatisms built into the previous analysis. A formal analysis is planned to confirm these preliminary findings.

One of the safety objectives of the Station Service Water (SW) 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) (EIIS = 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 (EIIS = 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 the intake structure destroys all four service water pumps.

Although the SW Subsystems and the Alternate Cooling Subsystems were declared inoperable at the same time, either one of the SW Subsystems could have performed its intended design functions. As stated previously, analyses showed that the through wall flaws did not affect the structural integrity of the SW piping. These analyses considered the effects of pressure, seismic, deadweight, and thermal loading and also considered the affect of existing system vibration on the flawed welds. The analyses

showed that the structural integrity of the SW Subsystems was not impacted. Preliminary review of these analyses factoring in the actual condition of the piping confirm this conclusion was still valid. The leakage is downstream of all essential cooling loads so that the primary design function is not impacted. In addition, the Alternate Cooling Subsystem was not adversely impacted by the existence of the leakage. It was found that the leakage would result in coolant water inventory reduction which is bounded by existing margin above and beyond the required design volume. Therefore, there were no safety consequences related to this event.

CORRECTIVE ACTIONS

Short Term Corrective Actions -

1) UT inspections have been completed on similar piping in the SW system with no other problems identified.

2) A daily qualitative inspection of the leakage was established and remained in place until the leak was repaired.

3) A weekly quantitative inspection of the leakage was established and remained in place until the leak was repaired.

4) Leakage was directed to a drain as a housekeeping measure. This allowed easy monitoring of the leak rate and allowed easy inspection of the area around the leak.

Long Term Corrective Actions -

1) A Code replacement of the flawed welds was completed prior to startup from the 1995 Outage.

2) A thorough failure analysis was performed on the two flawed welds following implementation of the permanent fix.

3) A design change was implemented which reduces the potential for piping system vibration in this area. Additionally the new valves which were installed as part of the design change reduce the chances of any erosion resulting from cavitation. Materials were chosen which are not as susceptible to erosion or to MIC. This design change was implemented during the 1995 Outage.

4) Monthly NDE was performed on the flawed welds and surrounding areas to ensure there were no unexpected problems or further degradation.

5) A comprehensive review of the overall status of the SW system will be performed. This review will include development of a management plan to address ongoing corrosion and erosion of the SW system piping. It is expected that this review and plan will be completed by December 31, 1995.

6) The adequacy of current practices pertaining to ultrasonic examinations of SW piping is being evaluated. It is expected that this evaluation will be completed by 9/1/95.

7) A revision to the record analysis which evaluated the leaking SW piping will be performed using actual wall thickness values to further confirm structural integrity of the previous piping configuration. This is expected to be completed by 12/31/95.

ADDITIONAL INFORMATION

Leaks have previously occurred in this area of the SW system. The second pinhole flaw identified during this event was on a weld which had been completed in 1993. A portion of the 4" piping and the 4" bypass valve had been replaced due to erosion. The erosion was felt to be due to long term exposure to jetting action of the severely throttled Service Water flowing through the valve. In addition, through wall flaws have previously developed in the 12" valve bodies due to the same type of jetting action. The 12" valves have been replaced. None of these previous events have been reported as an LER. In addition, a drain connection on the 'B' RBCCW heat exchanger developed a crack due to vibration which was not anticipated in the design of the drain connection. This resulted in an unisolable leak. The SW Subsystems and the Alternate Cooling Subsystem were declared inoperable and a plant shutdown was initiated to isolate the leak. This event was reported as LER 94-13.

NRC Form 366 U.S. NUCLEAR REGULATORY COMMISSION
(5-92)

LICENSEE EVENT REPORT (LER)
FAILURE CONTINUATION

APPROVED OMB NO. 3150-0104
EXPIRES 5/31/95
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NO (2)	LER NUMBER (6) YEAR		SEQ #		REV #	PAGE (3)
VERMONT YANKEE NUCLEAR POWER CORPORATION	05000271		-		-		07 OF 07

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS