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APR 30 2002

10 CFR 50.73

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

Gentlemen:

TENNESSEE VALLEY AUTHORITY - WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - DOCKET NO. 50-390 - FACILITY OPERATING LICENSE NPF-90 - LICENSEE EVENT REPORT (LER) 50-390/2002-001 - LOSS OF RESIDUAL HEAT REMOVAL (RHR) - VOLUNTARY REPORT

The enclosed report provides details concerning a brief loss of RHR flow during Mode 6. Although TVA concluded this condition did not meet reporting criteria, a voluntary report is appropriate.

If you should have any questions, please contact P. L. Pace at (423) 365-1824.

Sincerely,

Larry S Bryant
for W. R. Lagergren

Enclosure
cc: See page 2

IE22

Enclosure
cc (Enclosure):

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NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE Loss of RHR Flow Path in Mode 6 with Reduced RCS Level

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
03	01	2002	2002	001	00	04	29	2002	NA	05000
				–	–				FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	6
10. POWER LEVEL	000

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

	20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
	20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
	20.2203(a)(1)		50.36(c)(1)(i)(A)		50.73(a)(2)(iv)(A)		73.71(a)(4)
	20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)	X	OTHER Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		Voluntary Report
	20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)		
	20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)		
	20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
	20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Jerry Hatcher, Licensing Engineer	(423) 365-1875

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

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

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

On March 1, 2002 at approximately 0258 hours, with Watts Bar Unit 1 in Mode 6 (Refueling) and RCS temperature at 100 degrees F, while attempting to realign the RHR system from RWST supply to RCS loop operation, operators isolated the common suction to the Residual Heat Removal (RHR) pumps on two occasions over a three minute span. At the time of the event, operators were performing full flow testing of ECCS lines in conjunction with reactor cavity fill. The crew had not been briefed during shift turnover of other work activities which removed power from a rack which provided a permissive pressure switch signal to two valves which required manipulation during the realignment. The root cause of this event was inadequate work review and scheduling coupled with less than expected transfer of information, pre-job brief, and response to an emergent operating condition. Corrective actions to include: Counsel/coach individuals/groups involved, include this event in training, refine the scheduling and planning process by which work activities are tied to specific plant conditions or milestones and impacts are evaluated based on plant conditions and scheduled activities. (Voluntary Report)

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

Voluntary Report

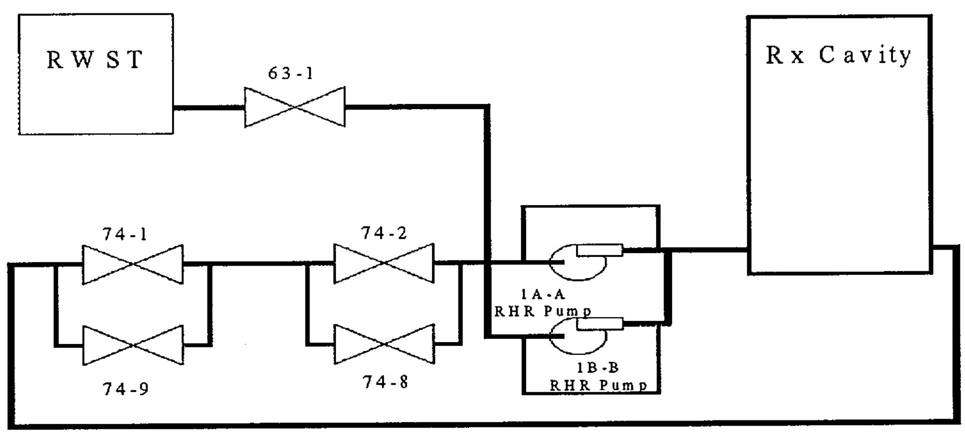
I. PLANT CONDITION(S)

The unit was in Mode 6 (Refueling) and RCS temperature at 100 degrees F.

II. DESCRIPTION OF EVENT

A. Event:

Simplified RHR Flow Path



Background: Both trains of the RHR system (EIIS code BP) are supplied by a common suction line that can take suction from the Refueling Water Storage Tank (RWST) through valve 1-FCV-63-1 (EIIS code BQ), or from Reactor Coolant System loop 4 hot leg via series valves 1-FCV-74-1 and 1-FCV-74-2. Valve 1-FCV-74-9 is provided as a bypass valve around 1-FCV-74-1, and 1-FCV-74-8 as a bypass around 1-FCV-74-2. Valves 74-1 and 74-2 are interlocked with 63-1 to prevent their being opened if 63-1 is open. However, 63-1 has no interlocks, and can be opened regardless of the position of 74-1 and -2. Additionally, valves 74-1 and 74-8 have a common pressure switch permissive that will prevent either from opening if RCS pressure is too high. Valves 74-2 and 74-9 share a similar common pressure switch permissive.

Immediately prior to the event, the Unit 1 refueling cavity was being flooded to the control rod unlatching elevation using the RWST flow path from valve 63-1, through the RHR 1A-A pump, to the cavity. An RHR full flow surveillance test was scheduled in parallel with the flood up activity. The water level in the cavity was less than 23 feet above the top of the reactor core, for which LCO 3.9.6 requires that two trains of RHR are operable with one train in operation.

The full flow test and cavity flood up activity required the normal RHR suction flow path valves (74-1 and -2, and their bypass valves 74-8 and -9) to be closed to establish the RWST flow path via 63-1 (74-8 and -9 are not interlocked with 63-1). An operator, in communications with the test director, was stationed in the vicinity of the breakers for valves 74-1, -2, -8 and -9. (Note: Valves 74-1 and -2 can be operated from the main control room, their breaker control switches, or the auxiliary control room. Valves 74-8 and -9 can only be operated from their breaker control switches.)

When the cavity level approached the unlatching elevation (738 feet), the full flow test procedure directed the bypass valves 74-8 and -9 to be opened, 63-1 to be closed (satisfying the logic to allow 74-1 and -2 to open), 74-1 and -2 to be opened, and then 74-8 and -9 to be closed. When the operator attempted to open valves 74-8 and -9 to begin the above sequence, 74-9 opened but 74-8 did not. The test crew did not recognize that another outage activity had deenergized the pressure switch open permissive for 74-1 and -8, preventing opening of 74-1 from the main control room (although it still could have been operated from its breaker controls or from the auxiliary control room).

At this point, recognizing a problem with being able to establish a flow path from the hot leg through 74-8, and with cavity level still increasing, the crew was trying to get 74-1 and 74-2 open while attempting to determine why 74-8 would not open. Not knowing why 74-8 would not open, and realizing 74-2 would not open due to its interlock with 63-1 being open, the crew decided to close 63-1, which isolated suction to the RHR pumps. The crew concluded that the mini flow line would provide sufficient flow to protect the running RHR pump. As soon as 63-1 shut, the crew attempted to open 74-1 and 74-2 but only 74-2 opened. At this point 74-9 was open and 74-2 was open establishing a flow path from the hot leg through the core.

The crew proceeded to restore the normal alignment, which required opening 74-1 and closing 74-9. The crew attempted to open 74-1 but it would not open (74-1 shares the open permissive with 74-8, which prevented either valve from opening). The crew inappropriately decided that closing 74-9 would allow 74-1 to open. This was incorrect as there is no interlock between these two valves. The crew closed 74-9 from the breaker, again briefly isolating the RHR pump suction from the hot leg. The crew waited until the 74-9 valve was full closed (there is no way to stop it once moving unless you open the breaker) thinking that the valve had to be full closed to make up any interlock. They tried to open the 74-1 valve at that point and when it did not respond, they immediately opened 74-9 and restored flow.

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B. **Inoperable Structures, Components, or Systems that Contributed to the Event:**

An Eagle 21 power supply change out and additional modification work in the rack disabled operation of valves 1-FCV-74-1 (Loop 4 Hot Leg to RHR Suction) and 1-FCV-74-8 (1-FCV-74-2 Bypass RHR Suction).

C. **Dates and Approximate Times of Major Occurrences:**

Date/Time (EDT)	Activity
3/1/02 (0120)	Commenced Rx cavity flood up to 726 elevation.
3/1/02 (0225)	Initiated fill to 736 El using RHR from RWST IAW 1-SI-63-907, (RHR Hot and Cold Leg Injection Check Valve Testing During Refueling Outages).
3/1/02 (0253)	OAC requested the AUO at the switch gear to open valves 74-8 and 74-9 per SI steps 30 and 31.
3/1/02 (0253:56)	74-9 open, AUO reports to the TD in the MCR that 74-8 did not open.
3/1/02 (0254)	OAC requests AUO to open the breaker and check the thermals
3/1/02	AUO reports to the MCR that the thermals are OK.
3/1/02	MCR sends individuals immediately to the switch gear (with fuses and fuse tester) to determine why 74-8 did not open.
3/1/02 (0257:42)	Crew decided to close 63-1 to allow 74-1 & -2 to open.
3/1/02 (0258:42)	OAC opens 74-2 but 74-1 would not open. RHR pump suction reestablished thru 74-2 and 74-9.
3/1/02 (0259:33)	Crew tells the AUO to shut 74-9 isolating RHR pump suction based on crew discussion.
3/1/02 (0300:26)	On seeing that 74-1 does not open with 74-9 closed, SM directs that 74-9 be immediately reopened to establish RHR suction.

D. **Other Systems or Secondary Functions Affected:**

None.

E. **Method of Discovery:**

Recognized by operations personnel during the evolution.

F. **Operator Actions:**

See sequence of events.

G. **Safety System Responses:**

None

III. CAUSE OF THE EVENT

A. **Immediate Cause:**

The Eagle 21 power supply replacement disabled valves 1-FCV-74-1 and 1-FCV-74-8, by not providing a permissive pressure switch signal.

B. **Root Cause:**

The root cause of this event was inadequate work review and scheduling coupled with less than expected shift turnover of information, pre-job brief, and response to an emergent operating condition.

C. **Contributing Factor:**

The review of the Eagle 21 power supply change out failed to ensure the impact of this modification on the operation of the RHR suction valves was clear to the operating crews. The Eagle 21 power supply change out information was not relayed to on coming shifts.

IV & V. ANALYSIS OF THE EVENT - ASSESSMENT OF SAFETY CONSEQUENCES

Required valves in the flow path could be and were opened promptly to reestablish a flow path. Additionally, the flow path from the RWST was available for realignment if needed. The brief interruption of RHR suction flow during realignments of the suction valves did not impact the continued operability of either RHR pump or the flow path components on realignment.

VI. CORRECTIVE ACTIONS

A. **Immediate Corrective Actions:**

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- Stopped the test, and verified all pump parameters were normal
- Brought the crew together in order to refocus
- Reviewed the event with all operating crews

B. **Corrective Actions to Prevent Recurrence:**

The following actions are tracked under TVA's corrective action program and are not considered to be regulatory commitments.

1. Counseled/coached individuals involved; emphasized management expectations for the content of pre-job briefings, pre-test preparation, the use of contingency planning, thorough review of plant conditions and interfaces, conditions for test termination and restoration of systems and components, command and control deficiencies, importance of ensuring that a complete and thorough turnover (including a thorough board walkdown) is performed prior to the turnover meeting, conservative decision making, and procedure compliance.

2. Cover this event in licensed operator retraining (LOR) training. Discuss command and control, conservative decision making, procedure compliance, contingency planning, pre-job briefings, the importance of providing a complete and thorough turnover at shift change.

3. Cover this event in non-licensed operator retraining NLOR) training. Discuss command and control, conservative decision making, procedure compliance, the importance of providing a complete and thorough turnover at shift change, pre-job briefings (including the use of contingency planning and assigning roles and responsibilities).

4. Refine the process by which work activities are tied to specific plant conditions or milestones and impacts are evaluated based on these conditions and other scheduled activities.

5. Provide coaching to the package reviewers. Discuss this event and the management expectations for the review process. Emphasize the fact that determining when this activity would be performed during the outage may have influenced the placing of caution orders on the impacted valves or some other means of flagging components affected by the activity based on expected plant conditions at the time the activity is scheduled.

VII. ADDITIONAL INFORMATION

A. Failed Components:

None.

B. Previous LERs on Similar Events:

A review of previous reportable events from 1995 to present was performed.

No similar events impacting the RHR flow path were identified.

C. Additional Information:

None

D. Safety System Functional Failure:

This event is not considered a safety system functional failure in accordance with NEI 99-02 as discussed below:

Technical Specification and Bases Considerations: The Bases for LCO 3.9.6 "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (water level < 23 ft above the top of the reactor vessel flange) indicates that operation of the RHR System for normal cooldown decay heat removal is manually accomplished from the control room. The heat removal rate is adjusted by controlling the flow of reactor coolant through the RHR heat exchanger(s) and the bypass lines. Mixing of the reactor coolant is maintained by this continuous circulation of reactor coolant through the RHR System.

An operable RHR loop consists of an RHR pump, a heat exchanger, valves, piping, instruments and controls to ensure an OPERABLE flow path and to determine the low end temperature. Both RHR pumps may be aligned to the RWST to support filling the refueling cavity or to perform RHR injection testing.

During RHR hot leg injection testing with suction from the RWST, the other RHR train must be operable and in operation with discharge to the RCS cold legs. In this alignment, both RHR trains are operable provided that the RHR train injecting into the RHR hot legs is capable of being realigned to discharge to the RCS cold legs in the event a failure occurs of the RHR train supplying the cold legs.

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NUREG 1022, Rev. 2 Considerations: 10CFR 50.72(b)(3)(v)(B) requires reporting "Any event or condition that at the time of discovery could have prevented the fulfillment of the safety function of structures or systems that are needed to: ...Remove residual heat..."

The NUREG guidance provides that "The level of judgment for reporting an event or condition under this criterion is a reasonable expectation of preventing fulfillment of a safety function... The event must be reported regardless of whether or not an alternate safety system could have been used to perform the safety function."

The NUREG continues that "...if a single RHR suction line valve should fail in such a way that RHR cooling cannot be initiated, the event would be reportable."

However, "...removal of a system or part of a system from service as part of a planned evolution for maintenance or surveillance testing when done in accordance with an approved procedure and the plant's TS (unless a condition is discovered that could have prevented the system from performing its function)"...is generally not reportable under these criteria:

Several examples in the NUREG provide applicable guidance as follows:

Example (5) Procedure Error Prevents Reactor Shutdown Function

"The unit was in mode 5 (cold and depressurized; before initial criticality) and a post-modification test was in progress on the train A reactor protection system (RPS), when the operator observed that both train A and B source range detectors were disabled. During post-modification testing on train A RPS, instrumentation personnel placed the train B input error inhibit switch in the inhibit position. With both trains' input error inhibit switches in the inhibit position, source range detector voltage was disabled. The input error inhibit switch was immediately returned to the normal position and a caution was added to appropriate plant instructions.

This event is reportable because disabling the source range detectors could have prevented fulfillment of the safety function to shut down the reactor."

Example (11) Single Failures

"Question: Suppose you have one pump in a cooling water system (e.g., chilled water) supplying water to both trains of a safety system, but there is another pump in standby; is the loss of the one operating pump reportable?

Answer: No. Single, independent (i.e., random) component failures are not reportable if the redundant component in the same system did or would have fulfilled the safety function."

NUREG 1022 Rev. 1 also provided some important guidance to address this reporting criteria (page 68). This section was not carried forward into the rev-strikeout version of Rev. 2.

"The staff believes that the conditions necessary to consider the redundant train operable and available, for this purpose, should include the following:
(1) in cases where the redundant train should operate automatically, it is capable of timely and correct automatic operation, or in cases where the redundant train should be operated manually, the operators would detect ... the need for its operation and initiate such operation, using established procedures for which they are trained, within the needed time frame, without the need for trouble shooting and repair, and; (2) the redundant train is capable of performing its safety function for the duration required, and; (3) there is not a reasonable expectation of preventing fulfillment of the safety function by the redundant train."

Reportability Analysis: The key to the reportability analysis for this issue is the difference in Mode 6 system operability from higher modes and power operations. The tech spec bases sections shown above indicate that operability of RHR in Mode 6 allows for loop manual realignment. For example, the bases for the hot leg injection mode which was in place at the time of the event, indicates that a loop is operable if it can be realigned to a different configuration. The LCO bases also uses the phrase "...controls to ensure an OPERABLE flow path..." to clearly indicate that the unrestricted flowpaths required in higher modes are not an expectation for RHR in the refueling mode as long as the controls can accomplish the function. In the actual event, controls were available to realign the system and personnel had been stationed where necessary to do the realignment.

It is also clear from the discussion above, that if a RHR valve had failed and blocked flow, a report would be required. In the actual event, however, required valves in the flowpath could be and were opened promptly to realign the flowpath.

Example 11, above, provides guidance for the acceptable use of standby systems to fulfill safety functions. In the event under consideration, not only was the A train of RHR available to be realigned to accomplish the function, but also the flowpath from the RWST was available for realignment if needed. Although portions of another system (Safety Injection) besides RHR are included in the RWST flowpath, the bases are clear that this alignment is an acceptable flowpath to meet the RHR LCO conditions and therefore the safety function.

Example 5, above, was also reviewed but determined not to provide guidance in this case. The source range monitors in Mode 5 were out of service and that loss appeared to be unknown to the operating crew for some time. Accordingly, the safety function of reactivity monitoring was not available. Contrary to that case, the RHR issue under consideration occurred during a directed system alignment and the plant staff immediately took action to realign the required flowpath.

Finally, although the text from NUREG 1022, Rev. 1 was not carried forward as a strike out in Rev. 2, it provides reasonable guidance on the acceptability of manually realigning "redundant" trains to meet the safety function. The "train" from the RWST through FCV 63-1 was available for realignment and, as shown by the event itself, the flowpath through FCV's 74-9 and 2 was quickly aligned to restore the flowpath.

The brief interruption of RHR suction flow during the realignments did not impact the continued operability of either RHR pump or the flowpath components upon realignment.

Conclusion: During the March 1, 2002 event described above, there was no "reasonable expectation of preventing fulfillment of the safety function" to remove residual heat.

E. Loss Of Normal Heat Removal Consideration:

This event was not a scram with loss of normal heat removal.

VIII. COMMITMENTS

None.