NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Sequoyah, Unit 1	0 5 0 0 0 3 2 7	1 OF 0 7

TITLE (4)
Improper Valve Alignment Caused By Poor Communications Results In A Loss Of Reactor Coolant Water Inventory, RHR Pump Cavitation, And Loss Of RHR Cooling

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
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0 5	2 3	8 8	8 8	0 2 1	0 0	0 6	0 9	8 8		0 5 0 0 0

OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
5	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)	20.405(a)(1)(i)	50.36(c)(1)	XX 50.73(a)(2)(v)	73.71(c)
0 0 0	20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
	20.405(a)(1)(iv)	XX 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 NUMBER
	AREA CODE
Tom Rogers	
J. A. Naik, Plant Operations Review Staff	6 1 5 8 7 0 - 6 8 6 2

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	

SUPPLEMENTAL REPORT EXPECTED (14)

	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)				
XX NO				

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

On May 23, 1988, at 1215 EDT, while unit 1 was in cold shutdown with the reactor coolant system (RCS) partially drained to support maintenance, when a loss of the operating train of the residual heat removal (RHR) system occurred. The "B" train of RHR was in operation when it was decided to place the "A" train RHR heat exchanger in service to enhance plant temperature control. To place the "A" train in service, an assistant unit operator (AUO) was dispatched to open two valves. The AUO, however, misunderstood his instruction and wrote down an incorrect valve number. The incorrect valve was a manual valve (1-HCV-74-34) used to align the discharge of the RHR pumps to the refueling water storage tank (RWST). Upon opening valve 1-HCV-74-34, the AUO heard unusual flow noise and subsequently telephoned the control room (CR) operator for further instructions. The assistant shift operation supervisor (ASOS) in the CR received an RHR mini flow alarm, and he noticed RHR pump amperage oscillating, unstable flow indication, and that the indicated RCS water level was off-scale low. The ASOS subsequently stopped the "B" train RHR pump and entered the applicable action statements of TSs for a loss of RHR. The RCS was then refilled above the top of the RCS loops by gravity feed from the RWST via the RHR system. Both trains of RHR were then placed in service. The root cause of this event is attributed to poor communications between the AUO and the reactor operator. To prevent recurrence of this event, plant administrative instructions have been revised to require the use of "read back cards," (cards to write down simple instructions to be read back to originator) to require CR notification immediately before changing equipment status, and to require operators to return equipment to their "as-found" condition, if unexpected occurrences are noted, before contacting the CR for instructions. Additionally, the system operating procedures will be revised to require a hold order tag be attached to 1-HCV-74-34 when the RCS is partially drained.

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

DESCRIPTION OF EVENT

On May 23, 1988, at approximately 1215 EDT with unit 1 in mode 5 (0 percent power, 0 psig, 122 degrees F), a loss of residual heat removal capability occurred. The following report provides a synopsis of the conditions and activities associated with this event.

Initial Conditions. Train "B" residual heat removal (RHR) (EIIS Code BP) loop was in service to provide decay heat removal. Train "A" RHR loop was out of service due to a recently completed train "A" RHR outage. Both "A" train and "B" train centrifugal charging pumps were tagged out of service to support work being performed on the chemical and volume control system (CVCS) (EIIS Code CB). The reactor coolant system (RCS) (EIIS Code AB) was partially drained to a point below the reactor coolant pump seals while seal flow was secured to support the CVCS outage. The water level in the RCS loop was being monitored in the control room through the use of a closed circuit camera focused on a sight glass connected to the RCS loop 1 cross under piping and via a recorded level (PR-68-69) from the output of a temporary transmitter located on the loop 1 hot leg. The RCS water level was being maintained above the top of the RCS loops. The top of the RCS hot leg is at elevation 696 feet 2.5 inches. The hot leg center line is at elevation 695 feet 0 inch. RHR pump cavitation is known to occur at the 695 feet 2 inch elevation. The sight glass visible scale ranges from the 694 feet 6 inch elevation to the 699 feet 5 inch elevation and requires camera scanning for full scale viewing. Surveillance of the RCS water level was being conducted every 30 minutes in accordance with Surveillance Instruction (SI)-673, "Reactor Coolant System Level Verification Using Sight Glass or Tygon Hose." A figure is attached to this report to provide a simplified RHR flow diagram for reference.

While the RHR system was in the stated configuration, Operations personnel were experiencing difficulty controlling the RCS temperature. Minor adjustments to the component cooling system (EIIS Code CC) flow, which provides the heat sink for the RHR heat exchangers, had resulted in excessive cooling or insufficient cooling. To remedy this condition, Operations personnel decided to place the "A" train RHR heat exchanger in service to control temperature with both heat exchangers. This lineup would allow a more "fine-tuned" means of temperature control because it would split RHR flow between two separate heat exchangers, which could then be flow adjusted independently.

A pre-job briefing was held between the reactor operator (RO) and the unit 1 Auxiliary Building assistant unit operator (AUO) in the control room. The RO pulled the RHR flow diagram (47W810-1) and explained to the AUO the desired alignment. He told the AUO that manual valves 1-HCV-74-36 and 1-HCV-74-37 needed to be opened to accomplish this. Opening valves 1-HCV-74-36 and 1-HCV-74-37 cross connects the train "A" and "B"

RHR pump discharge headers. The AUO indicated that he understood the assignment, but as he was leaving the control room, he incorrectly wrote down valve numbers 1-HCV-74-34 and 1-HCV-74-37 on his hand. Manual valve 1-HCV-74-34 is a normally locked closed valve that is opened to configure the RHR system to pump water from the refueling cavity into the refueling water storage tank (RWST) when restoring from a refueling outage. The AUO then checked out a key from the shift operations supervisor (SOS) clerk's office for unlocking 1-HCV-74-34 and proceeded to dressout in anticontamination clothing for entry into the 1B RHR heat exchanger room. He entered the contaminated (C)-zone where he located and opened 1-HCV-74-37 as requested. He then exited the C-zone and climbed a vertical ladder in the 1B RHR heat exchanger room. He located 1-HCV-74-34 unlocked it and opened it one to two turns. He stopped opening the valve when he heard what he thought to be abnormally high flow. He left the valve one to two turns open, went to a telephone, and called the control room to notify the operators of the high flow condition and to receive any additional instructions.

Meanwhile, the RO obtained temporary relief from the assistant shift operations supervisor (ASOS) and had left the control room area. At 1214 EDT, the ASOS acknowledged the RHR "mini-flow" alarm and noted train "B" RHR pump flow to be unsteady at approximately 2500 gpm and pump amperage to be unsteady at approximately 20 amps. Upon checking RCS level indications, the ASOS discovered that the sight glass and the recorded level indicated the RCS water level to be off scale low. He subsequently stopped the RHR pump by placing it in the "pull-to-lock" condition. At this time, the unit 1 Auxiliary Building AUO was told to immediately close 1-HCV-74-34 and -37.

To recover the RCS water inventory lost, the RHR system suction valve from the RCS, 1-FCV-74-1, was closed, and the RHR pump suction valve to the RWST, 1-FCV-63-1, was opened to provide alignment to gravity feed to the RCS from the RWST via the RHR system. (Inventory loss was judged to be approximately 6000 gallons). RCS water level was reestablished to the 699 feet elevation. Abnormal Operating Instruction (AOI)-14, "Loss of RHR Shutdown Cooling," was subsequently implemented to recover from loss of shutdown cooling. The RHR pumps 1A and 1B were subsequently filled and vented. Train "B" of RHR was started, and LCO 3.4.1.4 exited at 1535 EDT. Core exit thermocouples were monitored by the shift technical advisor during this transient, and indicated a rise from 122 degrees F to 124 degrees F.

CAUSE OF EVENT

The immediate cause of the loss of RHR capability was the opening of manual isolation valve 1-HCV-74-34. This action established a flow path that pumped water from the RCS hot leg into the RWST. This resulted in depleting the RCS inventory and the net positive suction head to the RHR pump. Pump cavitation and the concomitant oscillations in RHR flow resulted.

The root cause of this event is attributed to poor communications between the RO and the AUO. The AUO was instructed to open 1-HCV-74-36 and 1-HCV-74-37, and he incorrectly wrote down 1-HCV-74-34 and 1-HCV-74-37. Once this error was made, no means of verification transpired to ensure proper instructions were received or proper valve manipulations made. The condition was further aggravated when the AUO went to telephone the control room to report the unexpected flow noise while leaving the RHR system in the incorrect configuration.

ANALYSIS OF EVENT

This report is submitted pursuant to the requirements of 10 CFR 50.73, paragraph a.2.v.B, as a condition that alone could have prevented the RHR system from removing residual heat.

TSs Limiting Condition for Operation (LCO) 3.4.1.4 requires two RHR trains to be operable to meet single failure criteria and one of these two trains to be in operation to provide decay heat removal and to provide proper mixing of the boron in the RCS used to maintain the reactor in a subcritical condition. With no RHR trains in operation while in mode 5, TS LCO 3.4.1.4 requires immediate corrective actions to be taken to restore a train to operation and to suspend all operations involving a reduction in the RCS boron concentration. These requirements were complied with during this temporary loss of shutdown cooling. This loss of shutdown cooling did not result in an adverse rise in the RCS temperature as core exit thermocouples were monitored and indicated temperatures were maintained below 125 degrees F.

The transfer of water from the RWST to the RCS did not result in a reduction in the boron concentration since the RWST had a boron concentration of 2168 parts per million (ppm), and the RCS had a boron concentration of 2096 ppm before the transfer was made (0800 EDT sample). A sample from the RCS following the transfer (1400 EDT sample) was analyzed and corfirmed this with a 2102 ppm measured boron concentration.

This event is not considered to be credible when the unit is in modes 1, 2, or 3 because the RHR system is required by TSs and plant operating procedures to be aligned for its safety function, which is to provide low head safety injection. The system configuration to meet this requires the RHR pump suction header to be aligned to the RWST in lieu of the RCS hot leg. Additionally, there is an interlock to prevent opening of the RCS hot leg isolation valves to the RHR pump suction header whenever the RCS is greater than 700 psig. The RHR system is aligned to perform its shutdown cooling function when the RCS is less than 350 degrees F and less than 380 psig. Moreover, the plant is not significantly susceptible to this type of event unless the RCS is in a partially drained condition. Partial draining of the RCS, such as the case in this event, would only occur while the plant is in mode 5 or 6. If this event had occurred while

in mode 6, the consequences would have been similar to this event. The consequences of such an event, however, is more a function of core decay heat production and the temperature and pressure relationship in the RCS at the time of the event occurrence than it is the operational mode of the plant. The decay heat load during this event was minimal since the reactor had not been critical since August 1985. It is therefore concluded that the occurrence of this event had no adverse affect on the health and safety of the public.

CORRECTIVE ACTIONS

As immediate operator action, the ASOS stopped the "B" train RHR pump by placing it in the "pull-to-lock" condition and entered the action statements of LCO 3.4.1.4 for the loss of RHR cooling.

Subsequent operator actions were taken to restore shutdown cooling by closing valve 1-HCV-74-34, 1-HCV-74-37, and 1-FCV-74-1 and opening 1-FCV-63-1 to transfer water by gravity feed from the RWST to the RCS via the RHR system. The "A" and "B" trains of RHR were then placed in operation in accordance with AOI-14. This action was completed at 1338 EDT, and the action statements of LCO 3.4.1.4 were exited.

As corrective actions to address the root cause of this event, Administrative Instruction (AI)-30, "Nuclear Plant Conduct of Operation," was revised on May 25 and May 26, 1988, to require improved means of communications and additional guidance for the operators experiencing an unexpected condition. Specifically, AI-30 now requires the use of "read back cards." The read back cards will be used to record instructions and then will be read back to the originator to ensure proper instructions are recorded. AI-30 was also revised to require an operator to contact the control room immediately before performing equipment status changes to ensure the proper actions are being performed, and to instruct operators to return equipment to their as-found condition before contacting the control room operators if it is determined that something unexpected occurs during an equipment status change. System Operating Instruction (SOI)-68.1, "Reactor Coolant System," and SOI-74.1, "Residual Heat Removal System," will also be revised by July 6, 1988, to require a hold order tag be placed on 1-HCV-74-34 to prevent inadvertent valve repositioning whenever the RCS is in a partially drained condition.

COMMITMENTS

Revise SOI-74.1 and SOI-68.1 by July 6, 1988, to require a hold order tag be placed on 1-HCV-74-34 to provide administrative control of the valve when the RCS is in a partially drained condition.

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ADDITIONAL INFORMATION

This event was reported to the U. S. NRC Operation Center pursuant to the four hour reporting requirements of 10 CFR 50.72, paragraph b.2.iii.B, at 1447 EDT on May 23, 1988.

There have been three previously reported occurrences of a loss of the capability to remove decay heat - SQRO-50-327/85040, 87012, and 87041.

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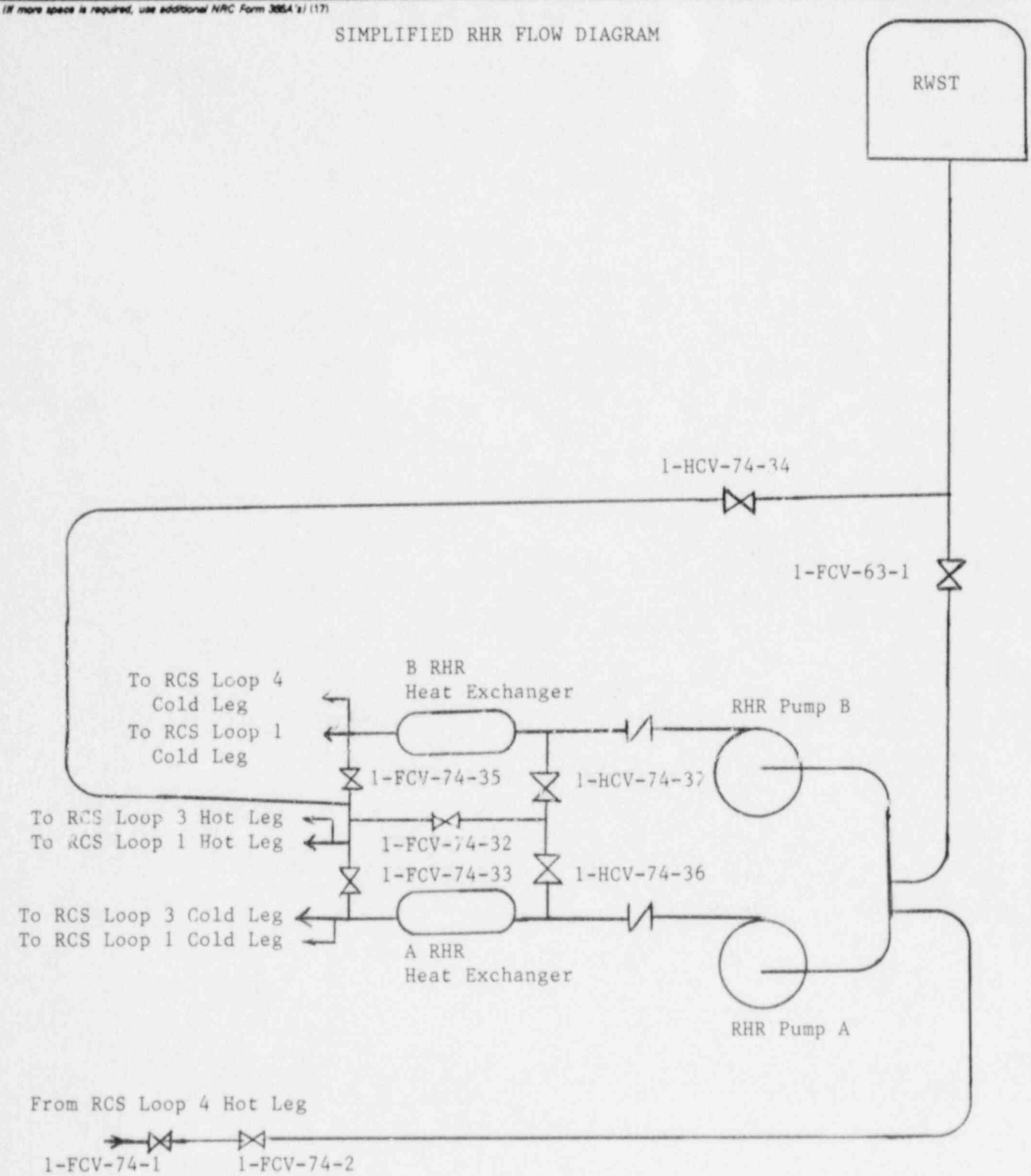
SIMPLIFIED RHR FLOW DIAGRAM



TENNESSEE VALLEY AUTHORITY
Sequoyah Nuclear Plant
Post Office Box 2000
Soddy-Daisy, Tennessee 37379

June 9, 1988

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

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 1 - DOCKET NO. 50-327 - FACILITY OPERATING LICENSE DPR-77 - REPORTABLE OCCURRENCE REPORT SQRO-50-327/88021

The enclosed licensee event report provides details concerning a loss of residual heat removal capability. This event is reported in accordance with 10 CFR 50.73, paragraph a.2.v.B.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

S. J. Smith
Plant Manager

Enclosure
cc (Enclosure):

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