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J. L. Wilson
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March 11, 1992

U.S. Nuclear Regulatory Commission
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Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 2 - DOCKET NO. 50-328 - FACILITY OPERATING LICENSE DPR-79 - LICENSEE EVENT REPORT (LER) 50-328/92001

The enclosed LER provides details concerning an automatic reactor trip during power operation and two subsequent reactor trip actuations, of which one was coincident with an auxiliary feedwater start and feedwater isolation, while shutdown. These events are being reported in accordance with 10 CFR 50.73(a)(2)(iv) as conditions that resulted in manual or automatic actuation of engineered safety features, including the reactor protection system.

Sincerely,

J. L. Wilson

J. L. Wilson

Enclosure
cc: See page 2

IE22

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NRC Form 366 (6-89) | U.S. NUCLEAR REGULATORY COMMISSION | Approved OMB No. 3150-0104 Expires 4/30/92

LICENSEE EVENT REPORT (LER)

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TITLE (4) Automatic reactor trip precipitated by a turbine trip at power, automatic and manual reactor trips during testing and startup while shutdown.

EVENT DAY (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)
										0 5 0 0 0
0 2	1 0	9 2	9 2	0 0 1	0 0	0 3	1 1	9 2		0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following)(11)			
POWER LEVEL (10)	0 0	20.402(b)	20.405(c)	XX 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)	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)	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)
Jan Bajraszewski, Compliance Licensing	6 1 5 8 4 3 - 7 7 4 9

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
X	T G	P S V	A 6 1 0	N					
X	A A	C T R	W 1 8 5	N					

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

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

On February 10, 1992, at 0528 Eastern standard time (EST), the Unit 2 reactor tripped as a result of a turbine trip because of low auto stop oil pressure. The unit was operating with no abnormal indications before the trip. The turbine trip occurred as a result of a malfunction with a solenoid valve in the auto stop oil portion of the turbine electro-hydraulic control system. The solenoid valve was replaced. On February 10, 1992, at 0949 EST, while in hot standby, the Unit 2 reactor trip breaker was inadvertently actuated during performance of a reactor trip breaker test. Coincident with this actuation, an unplanned engineered safety feature (ESF) feedwater isolation and auxiliary feedwater start occurred due to loss of electrical continuity of an installed jumper. The signal causing the reactor trip was cleared and the jumper was modified to use a gripper-type connector, and the test was successfully completed. On February 10, 1992, at 2110 EST, while in hot standby, during unit startup, the Unit 2 reactor was manually tripped due to a malfunction of the shutdown bank "D" demand counter. The demand counter was replaced and the unit was restarted. The control room staff responded as prescribed by emergency procedures. Safety systems performed as expected.

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

I. PLANT CONDITIONS

Event No. 1

Unit 2 was in power operations at approximately 89 percent reactor thermal power.

Event Nos. 2 and 3

Unit 2 was in Mode 3, hot standby, with the reactor coolant system at no-load temperature and pressure.

II. DESCRIPTION OF EVENT

A. Event:

1. Event No. 1 (Automatic Turbine and Reactor Trip)

On February 10, 1992, at 0528 EST, the Unit 2 reactor tripped as a result of a turbine trip. The operators received no prior indications that a turbine and/or reactor trip was imminent prior to the turbine first out "turbine overspeed" alarm annunciation. The turbine speed indicator was noted at 1800 revolutions per minute by the shift operations supervisor within a minute after the trip. Additionally, no grid anomaly was observed. The turbine trip precipitated the reactor trip.

2. Event No. 2 (Automatic Reactor Trip, Feedwater Isolation (FWI), and Auxiliary Feedwater (AFW) Start)

On February 10, 1992, at 0949 EST, the Unit 2 reactor trip breaker automatically opened and an engineered safety feature (ESF) signal occurred during performance of a reactor trip breaker (RTB) cycling test. In accordance with procedure requirements, a temporary jumper was installed across terminals in the solid state protection system (SSPS) cabinets to prevent FWI when cycling the RTB during the test. The temporary jumper consisted of a rubber-sleeved alligator clip, with a integral banana plug jack. This clip was connected to a lead with a banana plug on one end and a alligator clip on the other end. During installation of the rubber-sleeved alligator clip, the rubber sleeve was pulled back to facilitate positive attachment of the alligator clip to the terminal. It was not recognized that electrical separation of the banana plug had resulted. At the time of the test, the power range negative rate trip signal had not been cleared from the previous reactor trip (Event No. 1). The assistant shift operations supervisor (ASOS) assumed that procedurally-installed jumpers would prevent trip actuation as well as a FWI. The ASOS proceeded to perform the RTB test by closing the RTB. The RTB immediately reopened because of the uncleared trip signal and

simultaneously an unplanned ESF actuation was initiated (FWI and AFW start). Cycling of the RTB tripped the operating main feed pump (Pump "A") and started the steam-driven AFW pump; the motor-driven AFW pumps were in operation before this event. The trip signal was cleared and the temporary jumper lead, banana plug end, was connected to a gripper type connector. The test was completed the same day with no further complications or adverse actions.

3. Event No. 3 (Manually Initiated Reactor Trip)

On February 10, 1992, at 2110 EST, while in hot standby, the Unit 2 reactor was manually tripped. During unit startup, an operator was withdrawing each shutdown bank and comparing the rod position indicator (RPI) with the demand step counter for the respective bank. While withdrawing Shutdown Bank "D", the operator observed that the group demand step counter was reading significantly more than two steps out from the RPI. Technical specification Limiting Condition for Operation (LCO) 3.1.3.3 was entered. In accordance with the LCO action statement, the reactor trip breakers were immediately opened.

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

None.

C. Dates and Approximate Times of Major Occurrences:

1. February 10, 1992 at 0525 EST — The unit was stable at power operation at 89.3 percent power, Mode 1, it came down for the Unit 2 Cycle 5 refueling outage.

2. February 10, 1992 at 0528 EST — The turbine tripped followed by a reactor trip.

3. February 10, 1992 at 0757 EST — The unit was stable, maintained in hot standby, Mode 3.

4. February 10, 1992 at 0949 EST — A reactor trip and ESF actuation occurred during performance of a reactor trip breaker test.

5. February 10, 2992 at 2103 EST — Operator started withdrawing shutdown bank "D" in the process of unit startup.

6. February 10, 1992 at 2110 EST — Operators manually tripped the reactor in accordance with the action statement of LCO 3.1.3.3 after noting that the rod position indicators and the group demand counters deviated by more than two steps.

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D. Other Systems or Secondary Functions Affected:

1. Event Nos. 1 and 3

As designed, the reactor tripped in each event. Other systems performed as expected.

2. Event No. 2

A reactor trip, FWI, and an AFW start occurred while testing the RTBs. All control rods were already on the bottom at the time of the event. The FWI and AFW start occurred when a jumper, that had been placed to preclude a FWI signal, became disengaged before breaker cycling. The open RTBs combined with T_{avg} of less than 554 degrees Fahrenheit, completed the logic to initiate the signal. The main feed pump (Pump "A") tripped and the steam-driven AFW pump started. The motor-driven AFW pumps were in operation before the evert.

E. Method of Discovery:

1. The turbine and/or reactor trip was annunciated on the control room panels.

2. The trip signal, AFW start, and FWI were annunciated on the control room panels.

3. Operator initiated the trip during unit startup when withdrawing the shutdown bank "D" control rods.

F. Operator Actions:

1. Event No. 1

The control room staff responded as prescribed by emergency procedures. They promptly diagnosed the plant condition and took actions necessary to stabilize the unit in a safe condition and maintained the unit in hot standby.

2. Event No. 2

The control room staff restored feedwater operation, secured the steam-driven auxiliary feedwater pump, and reset the negative rate trip signal.

3. Event No. 3

Operators manually tripped the reactor.

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G. Safety System Responses:

1. Event Nos. 1 and 3

Safety systems and plant parameters performed as expected.

2. Event No. 2

The plant equipment associated with FWI responded in accordance with design. The plant was in a stable condition with main feed pump (MFP) "A" recirculating to the hotwell and motor driven AFW pumps were feeding the steam generators. The FWI tripped the MFP "A" and started the steam-driven AFW pump. The steam-driven AFW pump was secured shortly thereafter. The RTB opened as designed due to the rate trip already being present. Rods were already on bottom. The event did not result in any system transient or equipment anomalous operation.

III. CAUSE OF THE EVENT

A. Immediate Cause:

1. Automatic Turbine and Reactor Trip

The reactor trip was precipitated by a turbine trip. The turbine tripped because of low auto stop oil pressure.

2. Automatic Reactor Trip, FWI and AFW Start

The negative rate trip signal was not cleared before performance of the RTB test and loss of electrical continuity in the temporary jumper.

3. Manually Initiated Reactor Trip

Operator action as prescribed by technical specifications.

B. Root Cause:

1. Automatic Turbine and Reactor Trip

Malfunction of a solenoid valve in the auto stop oil portion of the turbine electro-hydraulic control system.

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2. Automatic Reactor Trip, FWI, and AFW Start

The assistant shift Operations supervisor proceeded with the RTB test without clearing the negative rate trip signal because of an assumption that the installed jumpers would bypass all trip signals.

The previous corrective action of placing the procedure on hold until it was revised to identify the type of jumper to be used was not implemented. This action resulted from the use of a jumper with alligator clip ends where one of the alligator clips became disengaged from the terminal prior to cycling the RTB.

3. Manually Initiated Reactor Trip

The demand step counter failed due to mechanical binding of the reset mechanism in the mid-travel position. No visible foreign material was found in the mechanism. Cause of the specific failure is unknown.

C. Contributing Factors:

1. Event No. 1

The solenoid failure is suspected to have resulted from pilot valve seat failure. This failure appears to be a result of material incompatibility with the working fluid (oil) and heat generated by the energized solenoid.

2. Event No. 2

The ASOS assumed that the jumpers installed for the RTB test bypassed all trip signals. The ASOS was aware that the negative rate trip signal was still present from the reactor trip earlier that morning (Event No. 1). Operators are trained to not close breakers with trip signals present; however, the ASOS believed the signal to be bypassed.

3. Event No. 3

None.

IV. ANALYSIS OF EVENT

Plant response during and after the trips was consistent with responses described in the final safety analysis report and accordingly, the events did not adversely affect the health and safety of the public.

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V. CORRECTIVE ACTION

A. Immediate Corrective Actions

1. Automatic Turbine and Reactor Trip

The control room staff responded as prescribed by emergency procedures. They promptly diagnosed the plant conditions and took actions necessary to stabilize the unit in a safe condition.

2. Automatic Reactor Trip, FWI and AFW Start

The control room staff restored feedwater operation and secured the steam-driven AFW pump.

3. Manually Initiated Turbine Trip

Operators manually tripped the reactor and verified all rods at the bottom by use of control room indicators.

B. Corrective Action to Prevent Recurrence

1. Automatic Turbine and Reactor Trip

a. The malfunctioned solenoid valve was replaced. Postmaintenance tests were performed on the replacement valve. The tests consisted of visual inspection for oil leaks under pressure and electrical functional test to verify operability.

b. An evaluation will be performed to determine the solenoid valve's failure mechanism. This evaluation will address generic applicability and determination of appropriate action to resolve the potential for solenoid valve failure.

2. Automatic Reactor Trip, FWI and AFW Start

a. The surveillance instruction (SI) used to perform the test was revised to ensure reactor trip signals have been cleared before test performance and to ensure appropriate jumpers are used.

b. Use of jumpers in Instrument Maintenance procedures will be evaluated to ensure actions are taken to provide good jumper connections. The intent is to identify locations for installation of banana lug terminals (or equivalent) to provide a positive means of jumpering the connections commonly used.

c. The operator was counseled about the event and the lessons learned will be reviewed for inclusion in operator training.

3. Manually Initiated Reactor Trip

The malfunctioned shutdown bank "D" group demand step counter was replaced. The replacement counter was verified as functional.

VI. ADDITIONAL INFORMATION

A. Failed Components

1. Automatic Turbine and/or Reactor Trip

Automatic Switch Company pilot operated solenoid valve, Model No. WPHCX8223A1011909, 1/2" national pipe thread end connections, 3/8" main orifice size and a 250V direct current coil.

2. Automatic Reactor Trip, FWI and AFW Start

None.

3. Manual Initiated Reactor Trip

Step counter manufactured by Whittaker Corp., Electronic Resources Division, Model No. 127FD100AS/S, Serial No. 20475.

B. Previous Similar Events

1. Turbine and/or Reactor Trip

This event is the first occurrence resulting from a malfunctioned EHC solenoid valve. There have been three LERs previously written as a result of EHC system problems (SQN 328/84015, 85004, and 91001), previous corrective actions would not prevent this event.

2. Automatic Reactor Trip, FWI and AFW Start

This is the second event as a result of jumper disengagement from a terminal during RTB posttrip testing. The previously written LER is SQN 327/89035. No previous events were identified where RTB cycling was attempted with an uncleared trip signal. Previous corrective actions may have prevented the ESF actuation if the test procedure was revised to ensure proper jumper use. However, previous corrective actions would not prevent RTB operation with an uncleared trip signal present.

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3. Manually Initiated Reactor Trip

This is the second event as a result of a malfunctioned demand step counter. The previous event described by LER SQN 328/88013 was caused by debris in the counter mechanism. Previous corrective actions would not prevent this event.

VII. COMMITMENTS

1. An evaluation will be performed to determine the solenoid valve's failure mechanism. This evaluation will address generic applicability and determination of appropriate action to resolve the potential for solenoid valve failure by May 11, 1992.

2. Event No. 2 will be reviewed by the operator training staff and Operations personnel will be informed of the lesson learned by March 25, 1992.