Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

William R. Lagergren, Jr.
Site Vice President, Watts Bar Nuclear Plant

MAY 0 9 2003

10 CFR 50.73

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

Gentlemen:

In the Matter of) Docket No.50-390
Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - DOCKET NO. 50-390 - FACILITY OPERATING LICENSE NPF-90 - LICENSEE EVENT REPORT (LER) 50-390/2003-001

This submittal provides Licensee Event Report 390/2003-001. This LER addresses an event that occurred on March 10, 2003, which resulted in an automatic actuation of engineered safety features which included the reactor protection system and auxiliary feedwater system. This event is being reported under 10 CFR 50.73(a)(2)(iv)(A).

There are no regulatory commitments in this submittal. If you have any questions about this change, please contact P. L. Pace at (423) 365-1824.

Sincerely,

for W. R. Lagergren

Enclosure
cc: See page 2

IE22

MAY 0 9 2003

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004
Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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 Automatic Reactor Trip Due to Moisture Intrusion into an Electrical Connector

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
										05000
03	10	2003	2003	- 001 -	00	05	09	2003	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	1
10. POWER LEVEL	100

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)	X 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)	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)	
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)
Rickey Stockton, Licensing Engineer	(423) 365-1818

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 10, 2003, at 0012 Eastern Standard Time, with Watts Bar 1 at 100 percent power, a Generator Backup Relay unexpectedly actuated causing an automatic turbine/reactor trip. The relay actuated due to a ground fault caused by a broken o-ring in the C phase main transformer's high side bushing capacitance tap connector. Plant safety equipment performed as designed which included the auto-start of the auxiliary feedwater system.

The root cause of this event was inadequate preventive maintenance procedure. Corrective actions include repairing the connector, revising preventative maintenance (PM) procedures, and a design change to the affected single point vulnerability relay scheme.

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

I. PLANT CONDITION(S)

On March 10, 2003, at approximately 0012 Eastern Standard Time, Unit 1 was in Mode 1, steady state operation at 100 percent power. The Reactor Coolant System (RCS) (Energy Industry Identification System (EIIS) Code AB) pressure was 2235 psig and RCS Tavg was 588 degrees F.

II. DESCRIPTION OF EVENT

A. Event

At 0012 on 3/10/03, the Main Generator Breaker (EIIS Code BKR) opened unexpectedly, which initiated an automatic turbine/reactor (EIIS Code RCT/TRB) trip. Plant safety equipment functioned as designed in response to the trip including auto-start of the auxiliary feedwater system (EIIS Code BA). Control room indication showed the event was initiated by generator backup relay 121GB (EIIS Code RLY), an impedance type relay that uses both current and voltage potential to detect faults. This relay is connected to a current transformer (CT) (EIIS Code XCT) and a potential device (PD) (EIIS Code FD) on the high side bushing of each 500 kV main transformer (EIIS Code XFMR) (3 – one per phase), and provides backup protection for the generator (EIIS Code GEN) and the transformers.

Meggar testing showed C phase of the PD was shorted to ground. Further troubleshooting found evidence of arcing on the C phase main transformer's high side bushing capacitance tap connector, damage to its o-ring seal, cracks in the external RTV sealant, and blackening of the petrolatum insulating grease inside the bushing well, all of which indicated this was the faulted component. This was confirmed following an evaluation of the operational characteristics of the 121GB relay and other generator protective relays. The A phase potential connection was also found to have a damaged o-ring. An analysis is being performed on the o-rings to substantiate the failure mechanism.

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

There were no inoperable systems that contributed to this event.

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C. Dates and Approximate Times of Major Occurrences:

Time	Event
00:12:45.516	Generator Breaker open.
00:12:45.570	Turbine auto stop oil pressure low
00:12:45.738	Turbine trip electrical trouble
00:12:45.738	Generator 1 backup and transformer 1 feeder differential relay operation
00:12:45.758	500 kV PCB 5088 operation
00:12:45.759	500 kV PCB 5044 operation
00:12:45.793	Turbine Trip-Auto Stop oil pressure low
00:12:45.798	Generator 1 exciter power supply abnormal
00:12:45.809	Reactor trip/Turbine trip
00:12:45.840	Generator 1 voltage regulator trip
00:12:45:939	Turbine Throttle Valves Closed
00:12:47.917	Rods at Bottom
00:12	Control room crew entered E-0 (Reactor Trip / SI)
00:13:00.603	Lo Tavg with Reactor trip Main Feedwater (MFW) Isolation
00:13:00.750	Turbine Trip-MFPT A and B tripped
00:40	Transitioned from ES-0.1 to GO-5.
01:14	Started Standby MFW pump
01:20	Established normal feedwater flow to Steam Generator
01:22	Removed AFW from service
01:25	Completed balance of Plant (BOP) realignment
01:40	Main Turbine did not go on turning gear
02:00	Restored Raw Cooling Water (RCW) to SBMFP

D. Other Systems or Secondary Functions Affected:

There were no other systems affected other than equipment required for plant shutdown.

E. Method of Discovery:

The operators were first alerted of the event by the annunciation of Window 75-C, "Electrical Trouble."

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F. Operator Actions:

Operations crew performance for the Reactor/Turbine Trip on March 10, 2003, at 0012 hours was satisfactory. However, some procedural challenges were encountered, but these issues did not adversely impact the crew's response to the transient or the plant's stabilization in Mode 3. These procedural issues have been entered into the corrective action program.

G. Safety System Responses:

Plant safety systems operated as designed which included the auto start of the auxiliary feedwater system.

III. CAUSE OF THE EVENT

A. Immediate Cause:

The initial indication was that the turbine trip was initiated by the generator backup relay 121GB (impedance type relay that uses both current and voltage potential to detect faults). This relay is connected to a current transformer (CT) and a potential device (PD) on the high side of the 500KV main transformers and provides backup protection for the generator and the transformer. The operation of the 121GB relay will cause the operation of auxiliary relay 186GB (auxiliary tripping device) after a time delay of 10 cycles. Operation of the 186GB relay results in opening of the main generator breakers, and closure of the steam supply to the turbine.

B. Root Cause:

The root cause of this event was inadequate preventive maintenance (PM) because of the failure to incorporate vendor recommendations into the applicable PM procedure.

The PM procedure was inadequate in that it contained improper guidance for filling the connector with the insulating compound and for tightening the connector cap. Over filling these connectors may produce high internal pressures, increasing the potential for the petrolatum to leak out . The vendor recommended insulating compound is heavy insulating oil. Following this event, it was learned that petrolatum becomes fluid above 54 degrees C (129.2 degrees F) and can absorb moisture. The use of RTV sealant, although not required per the PM, was an additional barrier incorporated from a 1997 event. (Refer to Section VI.B, "Previous LERs on Similar Events.")

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IV. ANALYSIS OF THE EVENT

The plant responded as designed to the initiating condition. This event is compared to the LOSS OF EXTERNAL ELECTRICAL LOAD AND/OR TURBINE TRIP as described in Final Safety Analysis Report (FSAR) Section 15.2.7. The complete loss of load/turbine trip from full power is examined to show the adequacy of the pressure relieving devices and also to demonstrate protection and the departure from nucleate boiling (DNBR). The plant trip on March 10, 2003 was less challenging than and bounded by the event described in the FSAR. The following plant conditions were bounded by the event described in the FSAR:

1. Reactor power was at 100% and less than the FSAR value of 102%.
2. The anticipatory reactor trip occurred on turbine trip versus the reactor protection system trip setpoints.
3. Reactor control was in automatic versus manual assumed in the FSAR.
4. Steam dumps operated as designed. The FSAR design basis does not credit the operation of the steam dump system or steam generator power operated relief valves (SG-PORVs).

The reactor trip occurred as designed from a turbine trip and since station power was not lost during the event, the plant response remained within the FSAR boundary analysis. The main condenser steam dump valves opened per design and as a result it was not necessary for the SG-PORVs to operate. Pressurizer level and pressure did not increase to challenge the pressurizer PORVs and safeties to limit RCS pressure. RCS pressure and loop average temperatures decreased during the transient rather than increasing as predicted by the conservative FSAR assumptions and the DNBR was not challenged. The differences between the FSAR and the plant event are associated with the conservatism assumed in the FSAR analysis and the benign nature of the actual plant event which was quickly brought to a stable condition.

The UFSAR discussion on Turbine Trip has been recently impacted by Westinghouse letter WAT-D-11111 issued February 12, 2003. This letter transmits Nuclear Safety Advisory Letter (NSAL)-03-1 on "Safety Analysis Modeling Loss of Load/Turbine Trip." The NSAL determined that the assumption of a lower reactor vessel coolant average temperature at full power could result in a 3 psig higher peak RCS pressure for this analysis with a peak pressure of 2655 psia. During this trip event, the peak RCS pressure remained at approximately 2235 psig and the RCS Tavg was approximately 588 degrees F prior to the trip. Therefore, the NSAL issue was not an issue for the event.

V. ASSESSMENT OF SAFETY CONSEQUENCES

Based on the discussion in Section IV above, there was no safety significance to this event.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions:

The immediate corrective actions included repairing the connector (cleaning; o-ring replacement; filling with the proper insulating compound), replacing cables, and changing the position of an existing transfer switch to make the 121GB relay voltage potential source a switchyard bus section versus the main transformer high side bushings. The latter action removed these potential device connectors from any protective relaying function.

B. Corrective Actions to Prevent Recurrence:

The following actions are tracked under TVA's Corrective action program and therefore not consider to be regulatory commitments:

WBN supervisory personnel are to be briefed on the importance of identifying the cause of an equipment failure versus just treating the symptom(s) to prevent an event from recurring.

Applicable PM procedures are being revised to incorporate vendor recommendations for maintaining a one-quarter inch expansion space when filling the tap well with either GE A13A1B heavy oil or GE A13A3A1 transformer insulating oil, and to tighten the cap only snug tight.

GE Instruction (GEI) 79087D is being added to the applicable vendor manual.

A design change will be made to improve the reliability of Generator Backup relay 121GB by installing redundant trip logic (e.g., 2/2 or 2/3), or a loss of relay function to detect a blown fuse or loss of potential to block the possible incorrect tripping of the protective relays.

VII. ADDITIONAL INFORMATION

A. Failed Components:

As previously discussed, the root cause of this event was inadequate preventive maintenance because of the failure to incorporate vendor recommendations into the applicable PM procedure, which was also not identified as the cause of the similar 1997 event. (Refer to Section VI.B, "Previous LERs on Similar Events.") This resulted in a short to ground of C phase of the PD (GE Type KA-108). Troubleshooting found evidence of arcing on the C phase main transformer's high side bushing capacitance tap connector, damage to its o-ring seal, cracks in the external RTV sealant, and blackening of the petrolatum insulating grease inside the bushing well, all of which indicated this was the faulted component. This was confirmed following an evaluation of the operational characteristics of the 121GB relay and other generator protective relays. The A phase potential connection was also found to have a damaged o-ring. An analysis is being performed on the o-rings to substantiate the failure mechanism.

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B. Previous LERs on Similar Events:

At 0125 Eastern Daylight Time (EDT) on April 20, 1997, the WBN Unit 1 main generator PCB opened initiating a turbine trip and a subsequent automatic reactor trip. Investigations found that the turbine trip was initiated by operation of the generator backup relay, relay 121GB. Operation of this relay results in the opening of the main generator PCB and closure of the steam supply to the turbine. Meggar testing was performed to establish a possible cause for the operation of the protective relay. For the A phase main transformer high side potential device (PD) circuit, a low meggar reading was found. Additional troubleshooting found evidence that the phase A capacitance tap connector from the 500KV bushing to the PD had experienced arcing. Moisture was also found in the bushing well and the lubricant around the bushing well was blackened indicating a fault on the A phase capacitance tap connector. Once this problem was found, the capacitance tap bushing area was cleaned, and new lubricant was applied. In addition, the exposed surfaces of the connector were sealed with an RTV sealant. Resistance tests were subsequently performed with the readings found to be normal. Due to the problems found on the A phase, the B and C phase capacitance tap connectors were inspected even though the PD circuits meggar tested satisfactorily. No problems were found on the B phase. C phase was found to have lost a portion of its lubricant, and the remaining lubricant was blackened but no significant burn odor was noted. The same type of repairs performed on the A phase were made to both the B and the C phases. This event was documented as LER 390/97-010.

C. Additional Information:

None.

D. Safety System Functional Failure Consideration:

This event is not considered a safety system functional failure in accordance with NEI 99-02 in that the principal plant safety systems operated as designed. Therefore, the functional capability of the overall system was not jeopardized.

E. Loss Of Normal Heat Removal Consideration:

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

VIII. COMMITMENTS

None.