

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) <b>Sequoyah, Unit 2</b>	DOCKET NUMBER (2) <b>0 5 0 0 0 3 2 7 8</b>	PAGE (3) <b>1 OF 0 8</b>
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TITLE (4)  
**Performance Of An Inadequate Maintenance Instruction For The Inspection Of The Reactor Trip Breakers Resulted In A Main Feedwater Isolation**

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)		
0 3	2 4	8 8	8 8	0 1 5	0 0	0 4	1 9	8 8				0 5 0 0 0		
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OPERATING MODE (9) <b>3</b>	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)									
POWER LEVEL (10) <b>0 0 0</b>	20.402(b)	20.406(e)	<input checked="" type="checkbox"/>	50.73(a)(2)(iv)	73.71(b)					
	20.405(a)(1)(i)	50.38(c)(1)	<input type="checkbox"/>	50.73(a)(2)(v)	73.71(e)					
	20.405(a)(1)(ii)	50.38(c)(2)	<input type="checkbox"/>	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 360A)					
	20.405(a)(1)(iii)	50.73(a)(2)(ii)	<input type="checkbox"/>	50.73(a)(2)(viii)(A)						
	20.405(a)(1)(iv)	50.73(a)(2)(iv)	<input type="checkbox"/>	50.73(a)(2)(viii)(B)						
20.406(a)(1)(iv)	50.73(a)(2)(iii)	<input type="checkbox"/>	50.73(a)(2)(ix)							

LICENSEE CONTACT FOR THIS LER (12)		TELEPHONE NUMBER	
NAME <b>Don Siska J. L. Long, Plant Operations Review Staff</b>		AREA CODE <b>6 1 5</b>	<b>8 7 0 - 7 2 5 4</b>

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MO: <b> </b>	DAY: <b> </b>	YEAR: <b> </b>
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO				

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

On March 24, 1988, unit 2 was in mode 3 (hot standby) while Electrical Maintenance (EM) personnel were performing maintenance on the train "A" reactor trip bypass breaker in accordance with an approved maintenance instruction (MI). At approximately 0130 EST, during the performance of the train "A" bypass breaker cell switch inspection, an inadvertent train "A" main feedwater (MFW) isolation occurred. The MFW isolation was the result of a reactor trip breaker "open" signal concurrent with a low reactor coolant system (RCS) average temperature. A subsequent evaluation of this event revealed that the trip breaker "open" signal was the result of EM personnel operating the cell switch in the train "A" bypass breaker compartment as required by MI-10.9.2. Plant operators immediately halted all maintenance activities on the reactor trip bypass breakers and recovered from the MFW isolation.

A review of the subject MI revealed that the procedure did not have the necessary steps to preclude an MFW isolation when more than one reactor trip breaker was "racked out" or completely removed from its compartment. In addition, an evaluation that had been performed to assess the impact of MI-10.9.2 on plant operation was inadequate. To prevent recurrence of this event, Instruction Change Forms (ICFs) were issued to permanently change the MIs for the reactor trip breakers as well as the bypass breakers. TVA will also review the content of this LER with the personnel responsible for reviewing the plant impact evaluation associated with the performance of the MIs. In addition, TVA will review/critique this event with the individuals involved in the field validation of the subject MIs.

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

DESCRIPTION OF EVENT

On March 24, 1988, unit 2 was in mode 3 (0 percent power, 2235 psig, 547 degrees F) while Maintenance Instruction (MI)-10.9.2, "Bypass Trip Breaker Type DB50 and Switchgear Inspection Associated with System 99," was in progress. During the performance of this MI, at approximately 0130 EST, an inadvertent train "A" main feedwater (MFW) (EIIS Code SJ) isolation occurred. The MFW isolation was the result of a reactor trip breaker (EIIS Code JC) "open" signal concurrent with a low reactor coolant system (RCS) (EIIS Code AB) average temperature (i.e., Tavg was less than 554 degrees F).

In response to Nuclear Regulatory Commission (NRC) Generic Letter 83-28, "Required Action Based on Generic Implication of Salem ATWS Events," Sequoyah Nuclear Plant (SQN) committed to perform various maintenance activities on the SQN units 1 and 2 reactor trip and bypass trip breakers. These maintenance activities were developed by the Westinghouse Owners Group (WOG) and are designed to ensure the proper operation of the reactor trip and bypass trip breakers during anticipated plant transients. Included in these maintenance activities is an inspection and lubrication of the reactor trip and bypass trip breaker cell switches.

There are four reactor trip breakers for each unit; reactor trip breaker "A" (RTA), bypass breaker "A" (BYA), reactor trip breaker "B" (RTB), and bypass breaker "B" (BYB). During normal plant operation, reactor trip breakers RTA and RTB, which are in series, are closed thereby connecting the output of the motor-generator sets to the rod drive power supply cabinet. To facilitate maintenance activities, BYA, which is electrically parallel with RTA, can be placed in service and RTA can be open, "racked out," or completely removed. Similarly, BYB, which is electrically parallel with RTB, can be substituted for RTB. The logic of the breaker control circuits prohibits the concurrent use of BYA and BYB at any time.

There are two cell switches in each of the four reactor trip breaker compartments. The two cell switches have four contacts each and are actuated by a spring-loaded plunger whenever a reactor trip breaker or bypass breaker is either "racked out" or completely removed from the compartment. Actuation of the cell switches results in the contacts changing state. The cell switch contacts are contained within various control and alarm circuits of other plant components, and their changing state could result in the operation of engineered safety features (ESF) equipment or the initiation of main control room (MCR) annunciators (EIIS Code IB). Thus, because of the importance of proper operation of the cell switches, the intent of WOG recommended maintenance activities is to ensure that the cell switches are adequately maintained and capable of performing their design function.

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To implement the recommended maintenance activities for the reactor trip breakers, SQN personnel developed MI-10.9.1, "Reactor Trip Breaker Type DB50 and Switchgear Inspection Associated with System 99." A similar procedure, MI-10.9.2, was developed to implement the recommended maintenance activities for the bypass breakers. Each procedure is applicable to both units 1 and 2 and was reviewed in accordance with Administrative Instruction (AI)-43, "Independent Qualified Review." In addition, both procedures were field validated in mode 5 before they were scheduled to be performed to ensure that sufficient information was provided to adequately perform the required maintenance activities. Performance of the subject procedures had originally been scheduled for the fall of 1987. However, since SQN did not have the appropriate graphite grease necessary for lubrication of the breaker components at that time, a decision was made to delay the maintenance. On March 21, 1988, it was determined that the required maintenance on the breakers had not yet been performed, and since performance of these procedures was required before unit 2 could enter mode 2 (startup), it was decided to perform maintenance on all four breakers concurrently.

At approximately 0125 EST on March 24, 1988, during the performance of the train "A" bypass breaker cell switch inspection, the unit 2 lead reactor operator (RO) in the MCR observed a "Protection System Train 'A' Trouble" alarm. Although the RO was cognizant that MI-10.9.2 was in progress, the personnel performing the MI did not inform him that the maintenance activities on the breaker would cause an alarm. Upon observation of the alarm, the RO telephoned the Electrical Maintenance (EM) personnel performing the MI to determine if the maintenance activities on the breaker had caused the subject alarm. EM personnel informed the RO that they had operated the cell switch on the right side of the compartment for bypass breaker "A" in accordance with section 6.7.2 of the subject MI. After additional discussion between the RO and EM personnel, it was concluded that operation of the cell switch on the right side of the breaker compartment caused the alarm to annunciate in the MCR. To confirm their conclusion, the RO acknowledged and cleared the alarm, and the EM assistant repeated the operation of the cell switch. Upon repeating the operation, the "Protection System Train 'A' Trouble" alarm annunciated a second time in the MCR, thereby confirming their conclusion.

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Following further discussion between the RO and the EM technician regarding the operation of the cell switch and the resulting alarm, it was agreed that EM personnel could continue with the MI. The determination to continue with the MI was based on the assumption that operation of the cell switch on the left side of the compartment would also cause an alarm to annunciate in the MCR. At this point, the EM technician, who was still in telephone communication with the RO, instructed the EM assistant to operate the cell switch on the left side of the breaker compartment. After the EM assistant depressed and released the spring-loaded plunger on the cell switch, a MFW isolation occurred. The first indication of the MFW isolation to the RO was the annunciation of a "Low Tav<sub>g</sub> Reactor Trip Main Feedwater Valves Actuated" alarm followed by his observation that the train "A" MFW isolation valves (2-FCV-3-33 and 2-FCV-3-87) were closing and the train "A" MFW pump had tripped.

Immediately following indication that a MFW isolation had occurred, the RO instructed the EM personnel to stop work and bring the MI to the MCR. Subsequently, the MFW isolation signal was reset, the MFW isolation valves were reopened, and the train "A" MFW pump was reset.

CAUSE OF EVENT

Immediate Causes

1. The EM technician operated the cell switch on the left side of the compartment for bypass trip breaker "A." Operation of the cell switch completed the logic necessary to cause a MFW isolation. The MFW isolation logic is discussed below.

A MFW isolation signal is generated when the reactor trip breaker opens and a low RCS Tav<sub>g</sub> (i.e., less than 554 degrees F) signal is present. As shown in Figure 1, the logic requires the reactor trip breaker or bypass breaker to be open (or racked out) and Tav<sub>g</sub> to be less than 554 degrees F to initiate a MFW isolation signal. During operation in mode 3, the RCS Tav<sub>g</sub> is typically maintained at the no-load Tav<sub>g</sub> of approximately 547 degrees F. As a result, the low Tav<sub>g</sub> portion of the MFW isolation signal was present during the performance of the subject MI. Opening the trip breakers or removal of the trip breakers from their compartments would then complete the logic necessary for a MFW isolation signal. However, a MFW isolation did not occur when the breakers were initially opened and removed because a sustained reset signal was being applied by the operator in the MCR. The Solid State Protection System (SSPS) (EIS Code JC) logic is designed such that a sustained reset signal from MCR handswitch 2-HS-3-99A will prevent the generation of a MFW isolation signal during a change of state of the

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input signal. However, if either the low Tavg or trip breaker "open" signal is interrupted and then reestablished without a reset signal present, a MFW isolation signal will be generated. In this case, with the low RCS Tavg signal already present and no reset signal being applied, operation of the cell switch on the left side of the breaker compartment interrupted then reestablished the trip breaker "open" signal, thereby causing the train "A" MFW isolation.

- Maintenance on all four reactor trip breakers was being performed concurrently; hence, all four reactor trip breakers were open and racked out. As described previously, under normal conditions, only one trip breaker per train would be racked out at any one time while the opposite breaker would be in service. Since the required contacts associated with the cell switch for the reactor trip breaker that was in service would have been open, operation of the bypass breaker cell switch would not have resulted in a trip breaker "open" signal to the SSPS.
- The unit 2 RO and EM personnel did not understand the significance of the "Protection System Train 'A' Trouble" alarm. The subject alarm was not anticipated during the performance of MI-10.9.2; however a reevaluation of the MI was not performed before EM personnel were allowed to continue.

Root Causes

- MI-10.9.2 was inadequate. EM personnel correctly followed their procedure; however, the MI did not have the proper steps to preclude the ESF actuation.
- Although the MI received extensive field validation while both units were in mode 5, the validation process did not identify potential problems of performing the procedure in other operational modes or on more than one breaker at a time.
- Following the revision of MI-10.9.2 to incorporate the WOG recommendations, the review process was not in accordance with the requirements of AI-43. That is, AI-43 requires each qualified reviewer to consider the necessity for a cross-disciplinary review. It is the responsibility of each individual reviewer to obtain the appropriate cross-disciplinary review. Although instrumentation systems were involved in this procedure (i.e., the SSPS), Instrument Maintenance personnel were not requested to perform a cross-disciplinary review. As a result, the potential consequences of operating the cell switches were not adequately considered.

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- An evaluation of MI-10.9.2 that was performed to assess the impact on plant operation was inadequate. This evaluation did not identify the potential problems that could be associated with performing maintenance on all four trip breakers concurrently under the existing plant conditions. As described previously, if maintenance was being performed on only one breaker at a time (with the other breakers closed) this event could not have occurred.

ANALYSIS OF EVENT

This event resulted in the inadvertent actuation of ESF equipment which is reportable during all modes of operation in accordance with 10 CFR 50.73, paragraph a.2.iv.

During this event, all plant equipment operated as designed. The train "A" MFW isolation valves (loops 1 and 3) closed, and the train "A" MFW pump tripped. Since Technical Specification (TS) Table 3.3-3 requires actuation of auxiliary feedwater (AFW) when both MFW pumps trip only during plant operation in modes 1 and 2, the train "B" MFW pump trip circuitry had been deenergized to preclude a spurious AFW pump start. As a result, the trip signal to both MFW pumps did not result in an AFW pump start. Following this event, plant operators took appropriate action to reset the MFW isolation signal and the train "A" MFW pump, then reopened the train "A" MFW isolation valves. Thus, there were no safety consequences associated with this event.

As described previously, this event could not have occurred when the plant was critical since either the reactor trip breaker or its associated bypass breaker must be "racked in" and closed while the reactor is critical. With the required trip breaker racked in and closed, a trip breaker "open" signal could not be generated by operating the cell switch on a breaker that has been removed for maintenance.

CORRECTIVE ACTIONS

As immediate corrective action, the lead unit 2 RO halted all work associated with MI-10.9.2 and took the appropriate actions to recover from the MFW isolation. Following a subsequent review of the event, Instruction Change Form (ICF)-88-0655 and ICF-88-0656 were issued to revise MI-10.9.1 and MI-10.9.2, respectively. The ICFs require EM personnel to install electrical jumpers (and/or disconnect wires) to preclude the possibility of an ESF actuation during future performances of these procedures. These ICFs also require EM personnel to notify Operations before inspecting and lubricating the reactor trip breaker and bypass breaker cell switches. The subject ICFs were reviewed by both EM and Instrument Maintenance personnel and were approved on March 24, 1988. Following the implementation of the ICFs, the MIs were completed without further incident.

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To ensure that SQN procedures are adequately reviewed, TVA will issue a training letter to SQN qualified reviewers which will include a synopsis of this event and reiterate the requirement for obtaining appropriate cross-disciplinary reviews. This training letter will be issued by April 30, 1988.

To ensure an adequate plant impact assessment is performed before work on plant safety systems is initiated, TVA will review the content of this LER with the work control group responsible for reviewing plant impact statements. This review will be complete by June 30, 1988. In addition, TVA will review/critique this event with the individuals involved in the field validation of the subject MIs. This review will emphasize the importance of performing plant procedures in the manner in which they were field validated and will be complete by June 30, 1988.

ADDITIONAL INFORMATION

There have been no previously reported occurrences of MFW isolations resulting from inadequate maintenance instructions.

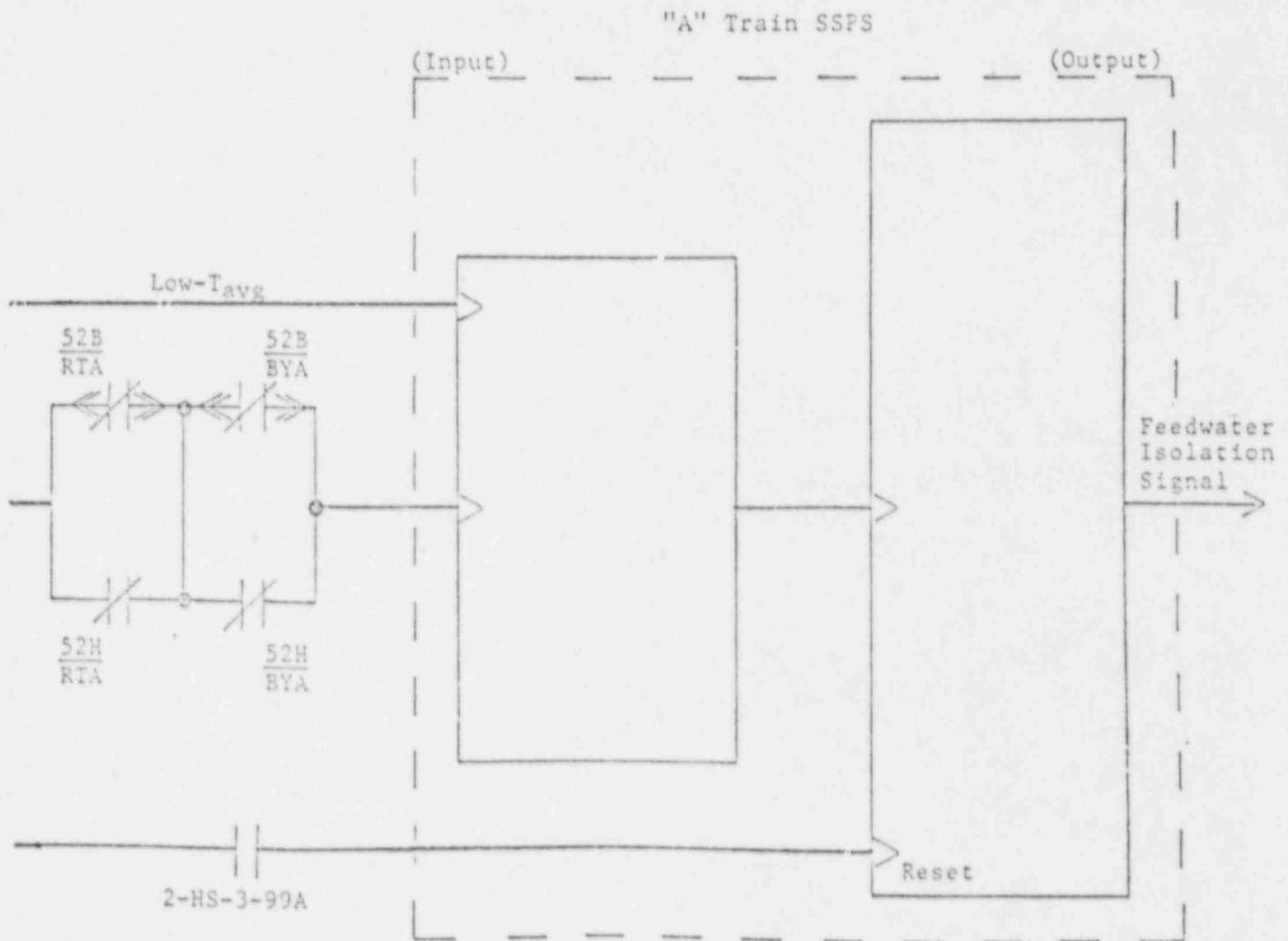
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FIGURE 1



52H (cell switch) - Shown with the breaker in the "racked out" position.

52B (breaker auxiliary contact) - Shown with the breaker in the "open" position.

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

April 19, 1988

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

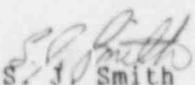
Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 2 - DOCKET NO.  
50-328 - FACILITY OPERATING LICENSE DPR-79 - REPORTABLE OCCURRENCE REPORT  
SQRO-50-328/88015

The enclosed licensee event report provides details concerning the performance of an inadequate maintenance instruction for the inspection of the reactor trip breakers that resulted in a main feedwater isolation. This event is reported in accordance with 10 CFR 50.73, paragraph a.2.iv.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

  
S. J. Smith  
Plant Manager

Enclosure  
cc (Enclosure):

J. Nelson Grace, Regional Administrator  
U. S. Nuclear Regulatory Commission  
Suite 2900  
101 Marietta Street, NW  
Atlanta, Georgia 30323

Records Center  
Institute of Nuclear Power Operations  
Suite 1500  
1100 Circle 75 Parkway  
Atlanta, Georgia 30339

NRC Inspector, Sequoyah Nuclear Plant