NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Sequoyah Nuclear Plant (SQN), Unit 2	05000328	1 of 12

TITLE (4) After a Reactor Trip Breaker was removed it was found to have inoperable auxiliary contacts.

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 NAME	DOCKET NUMBER
									SQN, Unit 1	50-327
09	19	96	96	004	01	03	28	97	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

20.402(b)	20.405(c)	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	
20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A	(Specify in Abstract below and in Text, NRC Form 366A)	
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 (Include Area Code)
S. D. Gilley, Licensing Engineer	(423)843-7427

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
D	AA	BKR	W120	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 15 single-spaced typewritten lines) (16)

On September 19, 1996, at approximately 0929 hours EDT, with Unit 1 and 2 in power operation at approximately 100 percent, Reactor Trip Breaker "B" was installed, following removal of the original breaker for preventive maintenance. Investigation of a control room annunciation eventually called into question a set of auxiliary contacts on the reactor trip breaker. After management was notified of the situation, the decision was made to replace the breaker with the one that had been removed earlier.

Following removal of the breaker, additional investigation revealed that the linkage necessary to operate two of the three sets of relays was not connected. As a result, the contacts associated with these stacks were inoperable for approximately nine hours and five minutes while this breaker was installed. This exceeded the LCO 3.3.1 action time of six hours for the reactor trip system interlock P-4. The root cause of this event was an inadequate procedure and incorrectly working the procedure out of sequence. Also, an inadequate post maintenance test (PMT) allowed this condition to go undetected and the breaker to be declared operable (Refer to LER 50-328/97001). Corrective actions include revising the breaker procedure, reemphasizing the requirements for working steps out of sequence with involved personnel, training key individuals with vendor assistance and sensitizing the department to the vital nature of these breakers.

I. PLANT CONDITIONS

Unit 1 and Unit 2 were in power operation at approximately 100 percent.

II. DESCRIPTION OF EVENT

A. Event

On September 19, 1996, at approximately 0929 hours EDT, with Unit 2 in power operation at approximately 100 percent, Reactor Trip Breaker "B" (EIIS Code JD) was installed, following removal of the original breaker for preventive maintenance. When the replacement breaker was placed into service, an annunciation was received in the control room for a "computer alarm rod deviation and sequence NIS power range tilts." In response to the annunciator, operators determined that no rod deviation or quadrant power tilt ratio condition existed. Rod deviation readings were taken every four hours to verify that no rod deviation condition existed. These readings were continued until the alarm condition was cleared. The annunciation occurred because the software that determines rod deviation was not operating. A computer point was indicating the reactor trip breaker was open. Initial troubleshooting identified that the false indication of breaker position was being caused at the breaker or interface wiring. Reactor trip breaker position is used to flag certain calculations in the software; it has no effect on the calculation other than to flag the subroutine to run. A value was inserted into the computer so that the calculation software would run. Since no actual rod deviation condition existed, the alarm cleared.

Visual inspections were performed of the accessible reactor trip breaker components and no discrepancies were noted. A low voltage reading existed across the contacts that feed the computer input and dirty contacts were suspected. Management was notified of the situation, and made the decision to replace the breaker.

There are three relays in the breaker assembly that are mechanically connected to the breaker by linkages. The relays are arranged in a vertical stack. The bottom relay is connected to the breaker by a linkage, with a separate linkage connecting the bottom relay to the two upper relays. Inspections performed following removal of the breaker identified that the linkage necessary to operate the two upper sets of relays was not connected, causing the annunciation in the control room. The contacts associated with these two relays (including the P-4 interlock) were considered inoperable.

The contacts contained in the two upper relays are as follows:

*13-14 Turbine trip
15-16 Spare
17-18 Turbine first out annunciator
19-20 Computer point
*21-22 Feedwater isolation on reactor trip and Lo Lo Tavg;
Manual block of automatic reactuation of safety injection with reactor tripped;
Maintains feedwater isolation, turbine trip, and main feedpump trip signals initiated on high steam generator level trip even if steam generator level drops
23-24 Auto shunt trip test point
* Designated as P-4.

The problem with the linkage was only discovered after the breaker had been removed from service and the linkages became more accessible. The contacts associated with these stacks were inoperable for approximately nine hours and five minutes while this breaker was installed. The LCO 3.3.1 action time of six hours for the reactor trip system interlock P-4 was exceeded.

Investigation identified an event on Unit 1 that occurred on October 27, 1992, during a forced outage. During the performance of a surveillance instruction, reactor trip breaker "A" failed to close and the control fuse was found blown. A work request was initiated to perform troubleshooting. Although the documentation is inconclusive it appears that the inertia latch was binding and causing the fuse to blow and the inertia latch was removed, inspected and reinstalled. Performance of the surveillance instruction was resumed but was subsequently stopped again because an annunciator (Reactor Trip SSPS Train A Turbine Trip) failed to actuate. Further troubleshooting found one of the auxiliary switch linkage arms disconnected. From the available documentation it can not be determined whether that was the same linkage location that was disconnected during the September 19, 1996, event on Unit 2. The linkage was reconnected and the surveillance instruction was successfully completed on October 30, 1992. No evidence of additional corrective action, other than the reconnection of the linkage, has been found for the 1992 event.

The investigation also revealed that the maintenance procedure had been revised in July of 1994 to incorporate corrective actions from an event involving a reactor trip breaker which

had failed to close in March 1994. The cause of the 1994 breaker problem was deterioration of the cadmium plating on the inertia latch. The loss of the plating subjected the parts to corrosion which resulted in sticking. The corrective action for this event was to add steps to the procedure to disassemble the latch, inspect for burrs or residue, then reassemble the latch. The vendor was also contacted for permission to use a different type of lubricant on the inertia latch. After permission to use a different lubricant was obtained from the vendor, the procedure was revised a second time to specify the new type of lubricant.

In 1994 when the maintenance procedure was revised to remove and inspect the inertia latch it introduced the possibility of allowing the linkage to become disengaged each time the maintenance instruction was performed. This was due to the fact that the maintenance procedure did not recognize that one of the auxiliary linkages could become disengaged when the adjacent linkage was removed to allow removal of the inertia latch.

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

None.

C. Dates and Approximate Times of Major Occurrences

October 27, 1992	During a Unit 1 forced outage Reactor Trip Breaker 1A failed to close during performance of a surveillance instruction. The control fuse was found blown and troubleshooting began.
October 29, 1992	The inertia latch was removed and reinstalled. Performance of the surveillance instruction was resumed and subsequently stopped because of an annunciator which did not illuminate as expected. Further troubleshooting found one of the auxiliary contact linkages disconnected and the linkage was reconnected.
October 30, 1992	The surveillance was successfully completed.
March 30, 1994	Unit 1 Reactor Trip Breaker 1B failed to close.

April 3, 1994	An incident investigation team began an investigation of three events regarding the reactor trip breaker including the failure of the breaker to close. The root cause was determined to be sticking of the inertia latch. After an undetermined number of cycles the cadmium plating of the latch begins to come off, which subjects the surfaces to moisture and the formation of rust which can cause the latch to stick.
April 21, 1994	Corrective actions from the incident investigation were issued which include adding steps to the procedure for removal of the inertia latch to inspect for burrs or residue.
July 29, 1994	The procedure was revised so that the inertia latch could be disassembled and reassembled to inspect for burrs or residue that could affect operation of the latch. These steps were added in the lubrication section of the procedure immediately prior to lubrication of these surfaces. (The revised procedure did not acknowledge that by removing and reinstalling the inertia latch an adjacent linkage could become disengaged.)
October 2, 1995	The maintenance procedure was performed on Unit 1 reactor trip breaker 1B without incident.
October 4, 1995	The maintenance procedure was performed on Unit 1 reactor trip breaker 1A without incident.
September 19, 1996 0929 EDT	LCO 3.3.1 was entered to perform surveillance testing on Unit 2. At the same time Reactor Trip Breaker 2B was due for preventive maintenance. The maintenance procedure had already been performed on the breaker that would be used as the replacement.

September 19, 1996 0930 EDT	LCO 3.3.2 was entered for Reactor Trip Breaker 2B.
September 19, 1996 1046 EDT	Following activities to replace the original Reactor Trip Breaker 2B with a replacement breaker, the bypass breaker was opened, returning Reactor Trip Breaker 2B to service. LCO 3.3.2 was exited.
1048 EDT	LCO 3.3.1 was exited.
At approximately 1048 EDT	Received annunciation for "computer alarm rod deviation and sequence NIS power range tilts."
At approximately 1200 EDT	It was determined that the alarm indication was caused by the rod deviation software program not running because a trip condition was indicated for the reactor trip breaker.
1328 EDT	A value was inserted into the Integrated Computer System to allow the program to run and perform its intended function after troubleshooting determined the problem was external to the computer.
1328-1630 EDT	Technical Support personnel evaluated the breaker and the possible causes of the contact problem. They also developed troubleshooting activities which could be performed on the breaker without excessive risk to the plant. Visual inspections of accessible components identified no discrepancies. Voltage readings across the contacts associated with the computer input were low. Dirty contacts were suspected.
At approximately 1630 EDT	A management meeting was held to decide on a course of action. A plan was presented for limited troubleshooting on the breaker while it was installed. Management directed that the breaker be removed and the original breaker be reinstalled.

1745 EDT	LCO 3.3.1 was entered.
1746 EDT	LCO 3.3.2 was entered and the original breaker was put into position and troubleshooting began on the breaker that was removed. During troubleshooting activities, it was discovered that the linkage connecting the two upper stacks to the lower stack was disconnected. This discovery was the first evidence to indicate that contacts in addition to the one associated with the control room annunciation were affected.
1834 EDT	Exit LCO 3.3.2
1835 EDT	Exit LCO 3.3.1

D. Other Systems or Secondary Functions Affected

Two sets of contacts designated as P-4 which are the contacts required by TSs, were not considered functional. Three other contacts were also affected. They perform the following functions: turbine first-out annunciator; computer point Y0007D, which tells the computer whether the reactor trip breaker is tripped or not tripped; and automatic shunt trip-test point.

E. Method of Discovery

Annunciation was received in the MCR for "computer alarm rod deviation and sequence NIS power range tilts." The occurrence of this alarm coincided with the return to service of the breaker and was subsequently traced to the auxiliary contacts for the breaker. At this point, it was evident that there was a problem with this set of contacts. There was no indication of problems with any of the other contacts associated with the reactor trip breaker. The problem with the linkage affecting the two upper stacks of auxiliary contacts was not identified until the breaker was removed from service and additional troubleshooting was performed.

F. Operator Actions

In response to the annunciator, operators determined that no rod deviation or quadrant power tilt ratio condition existed. Rod deviation readings were taken every four hours to verify that no rod deviation condition existed. These readings were continued until the alarm condition was cleared. The annunciation occurred because the software that determines rod deviation was not operating. The linkage problem caused an indication to the software that the reactor trip breaker was open. When the reactor trip breaker is open the software does not need to operate and is inhibited. Since the reactor trip breaker has no effect on the calculations in the software, a value was inserted as part of the troubleshooting activities to indicate that the reactor trip breaker was not tripped, this allowed the calculation software to operate. Since no actual rod deviation condition existed, the alarm cleared.

Management decided to replace the breaker after troubleshooting of accessible components was inconclusive.

G. Safety System Responses

No safety system response was required.

III. CAUSE OF EVENT

A. Immediate Cause

The immediate cause of this condition was that the linkage which connects the bottom auxiliary switch to the two remaining auxiliary switches became disconnected during maintenance activities for the breaker and was not discovered until after the breaker was installed and subsequently removed from service. The breaker was installed for approximately three hours longer than the LCO action time of six hours.

B. Root Cause

The root cause of this event was an inadequate procedure. As the result of a failure of a reactor trip breaker to close in 1994, corrective actions were instituted to ensure that binding of the inertia latch did not occur. These corrective actions included adding instructions to the procedure to disassemble the inertia latch and inspect it for burrs or residue prior to

lubricating the latch. The procedure did contain the steps necessary to verify proper operation of the auxiliary contacts; however, these steps were located before the section on lubrication of the inertia latch. Thus, the checks necessary to ensure proper operation of the auxiliary contacts were performed prematurely. In addition, adequate instructions for the disassembly and reassembly of the inertia latch were not provided. The revised procedure did not acknowledge that by removing and reinstalling the inertia latch an adjacent linkage could become disengaged. This led to the decision by craft personnel and foreman that removal of one key-lock on the mechanical linkage could not affect the function of the other auxiliary contacts if the key-lock was properly reinstalled. The actual configuration is such that removal of the outer linkage and its key-lock can affect the adjacent linkage because the adjacent linkage is held into position by the outer linkage.

Also, sections of the procedure were incorrectly worked out of sequence which caused steps in Section 7.0, which would have identified the disengaged linkage, to be worked prior to disassembly of the inertia latch in Section 6.0.

The post maintenance test which was used to demonstrate operability following the maintenance was inadequate in that the auxiliary contacts (P4) were not properly checked. Specifically, the PMT did not check the turbine trip contact and the Engineered Safety Feature Actuation System contact was only checked in one state. For additional details regarding the PMT please refer to LER 50-328/97001.

IV. ANALYSIS OF EVENT

The replacement breaker that was installed would have performed its function of tripping the reactor had it been called upon to do so. However, two of the three relays for the auxiliary contacts on Reactor Trip Breaker "B" would not have changed state if Reactor Trip Breaker "B" had opened. The auxiliary contacts on the "B" breaker includes two P-4 contacts required by TSs to be operable. The P-4 contacts perform the following functions: 1) Feedwater isolation on a reactor trip and lo-lo Tavg.; 2) allows manual block of the automatic reactuation of safety injection; 3) maintains the feedwater isolation, turbine trip, and main feedpump trip signals initiated on a high steam generator (S/G) level trip even if S/G level drops; 4) a direct turbine trip.

Therefore, because of the problem with the linkage, feedwater isolation would not have

occurred from this contact, the SI signal could not be reset, and the feedwater isolation, turbine trip and main feedpump trip signals would not be maintained on a high S/G signal and the direct turbine trip would not have been initiated. These functions would not have occurred from the "B" breaker but Reactor Trip Breaker "A" was fully functional during this period of time (although the P-4 functions were not technically operable in accordance with TS, reference LER 50-328/97001) and would have performed its safety function including operation of its auxiliary contacts had it been called upon to do so. This would have allowed the auxiliary contact functions to perform as designed except for the SI block signal. The B train SI block signal would not have functioned and as a result, following an SI signal, operators would have had to manually isolate the B train components during the recovery. Based on the above considerations, it can be concluded that there were no adverse consequences to plant personnel or to the public as a result of this event.

V. CORRECTIVE ACTIONS

A. Immediate Corrective Action

The replacement breaker was removed and the original breaker was reinstalled. Upon discovery of the linkage problem, the other Reactor Trip Breakers on Units 1 and 2 were inspected to verify that this linkage was connected. This verification was completed and no linkage problems were found.

B. Corrective Action to Prevent Recurrence

The Maintenance procedures for the DB 50 Reactor Trip Breakers and the DB 50 Reactor Trip Bypass Breakers were revised to move the testing and checking of the auxiliary contact to the end of the procedures after all steps involving partial disassembly are completed. Caution notes were added to warn of the possible disengagement of the auxiliary contact linkage when the inertia latch is removed. Additionally, the procedures were clarified as to which sections could be worked out of sequence.

A training course was conducted by the vendor, specifically for DB 50 breakers. The course was given to those individuals responsible for the maintenance of reactor trip breakers. Maintenance on reactor trip breakers is performed only by designated crews and those crews received this training. In addition, two general foremen responsible for the crews that perform breaker maintenance as well as other individuals in electrical maintenance that are not directly involved with reactor trip breaker maintenance attended the training. Beyond the direct benefit that the component specific training provided to the individuals responsible for breaker maintenance it was also used to increase the overall sensitivity to reactor trip breaker maintenance. Maintenance management also used the training as a forum to convey recent events involving reactor trip breakers and to reemphasize management expectations.

Several different forms of communication were used to convey this event and the lessons learned to the appropriate personnel. Management held a meeting with the involved personnel to stress that in addition to performing tasks in accordance with procedures, it is also every employee's responsibility to evaluate whether those procedural steps are successful in accomplishing their objectives. It was also reemphasized that every employee will exercise diligence in the use of their skills and training to make sure that the actions prescribed in a procedure are the correct actions. Additional meetings were held with maintenance personnel not directly involved with this breaker replacement to discuss lessons learned from this event. A discussion of the event was added to the training course material for circuit breakers to increase performer awareness of potential problems. A training letter was issued to the appropriate personnel to reemphasize the following: ensure that procedures are revised with a sound technical basis, procedures need to be reviewed for functionality as a whole, not just the revised section, reviews should include the effect of revisions on post maintenance tests and sequence of performance, and procedure revisions should be reviewed for the need to have the procedure validated.

Corrective actions for the inadequate PMT will be addressed in LER 50-328/97001.

VI. ADDITIONAL INFORMATION

A. Failed Components

None

B. Previous Similar Events

A review of previous reportable events identified no LERs associated with the auxiliary contact linkage of the reactor trip breakers.

II. COMMITMENTS

None