

Duke Power Company  
McGuire Nuclear Station  
12700 Hagers Ferry Road  
Huntersville, NC 28078-8985

(704)875-4000



DUKE POWER

March 17, 1994

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

Subject: McGuire Nuclear Station Unit 1  
Docket No. 50-369  
Licensee Event Report 369/93-12, Revision 1  
Problem Investigation Process No.: 1-M93-1244

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 369/93-12, Revision 1 concerning a Unit 1 Turbine Driven Auxiliary Feedwater Pump automatically starting. This report is being submitted in accordance with 10 CFR 50.73 (a) (2) (iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

A handwritten signature in cursive script, appearing to read 'T.C. McMeekin'.

T.C. McMeekin

TLP/jca

Attachment

xc: Mr. S.D. Ebnetter  
Administrator, Region II  
U.S. Nuclear Regulatory Commission  
101 Marietta St., NW, Suite 2900  
Atlanta, GA 30323

INPO Records Center  
Suite 1500  
1100 Circle 75 Parkway  
Atlanta, GA 30339

Mr. Victor Nerses  
U.S. Nuclear Regulatory Commission  
Office of Nuclear Reactor Regulation  
Washington, D.C. 20555

Mr. George Maxwell  
NRC Resident Inspector  
McGuire Nuclear Station

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PDR ADOCK 05000369  
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bxc: E.L. Walsh  
P.R. Herran  
R.C. Norcutt  
K.L. Crane  
B.F. Caldwell  
S.G. Benesole (CNS)  
G.H. Savage  
G.B. Swindlehurst  
M.S. Tuckman  
R.F. Cole  
D.B. Cook  
G.A. Copp  
C.A. Paton  
J.I. Glenn  
P.M. Abraham  
Zach Taylor (CNS)  
NSPB Support Staff (EC 12-A)

LICENSEE EVENT REPORT (LER)

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 (IMRB), 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.

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TITLE(4) Unit 1 Turbine Driven Auxiliary Feedwater Pump Automatically Started Because Of Inappropriate Actions.

EVENT DATE(5)			LER NUMBER(6)		REPORT DATE(7)			OTHER FACILITIES INVOLVED(8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	DOCKET NUMBER(S)
12	06	93	93	12	01	01	05	94	05000

OPERATING MODE(9) 1	THIS REPORT IS SUBMITTED PURSUANT TO REQUIREMENTS OF 10CFR (Check one or more of the following)(11)								
POWER LEVEL(10) 100%	20.402(b)	20.405(c)	X	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)		TELEPHONE NUMBER	
NAME R. J. Deese, Manager SRG	AREA CODE 704	785-4065	

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT(13)									
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS

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 December 6, 1993, while operating in Mode 1 (Power Operation) at 100 percent power, Unit 1 experienced an inadvertent Engineered Safety Features (ESF) actuation when the Turbine Driven Auxiliary Feedwater (TDCA) Pump automatically started. Operations personnel were performing a valve stroke timing test for valve 1CA-48B, CA Pump Number 1 To Steam Generator 1C Control, as required by procedure PT/1/A/4252/03B, CA Train B Valve Stroke Timing - Quarterly (TD Pump Flowpath). During performance of the procedure, Operations Technician A was placing a jumper on terminal B-21R in the CA Pump 1B Control Panel. Technician A inadvertently placed the jumper on terminal B-22R directly below terminal B-21R. When the jumper was placed on terminal B-22R, a path to ground was created and the control power fuses for the associated valves were blown. Loss of control power to these valves caused them to move and subsequently started the TDCA Pump. The ground path is speculated to have been initiated by an exposed wire end on the test lead used. Causes of Inappropriate Action have been assigned to this event. Planned corrective actions include the rework of test points to allow use of a safer type test lead, check of test leads and jumpers to assure good electrical integrity, and review of the circumstances of the event with appropriate personnel.

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**EVALUATION:****Background**

The Auxiliary Feedwater (CA) system [EIIS:BA] is provided as a backup for the Main Feedwater (CF) system [EIIS:SJ]. It is designed as a means to dissipate heat from the Reactor Coolant (NC) system [EIIS:AB] when normal systems are not available. The CA system can also be used in normal plant startup and shutdown as main feedwater, when the flow is less than 3 percent maximum designed feedwater flow. The CA system is not required to function during normal plant operation, and it is aligned for standby readiness.

The CA system contains 2 motor [EIIS:MO] driven pumps [EIIS:P], 1 turbine [EIIS:TRB] driven (TD) pump and associated piping, valves [EIIS:V] and controls. The TD pump is capable of supplying feedwater to all four steam generators (SGs) [EIIS:SG] at  $\geq 180$  gpm/SG.

**Description of Event**

On December 6, 1993, at approximately 1030, Operations (OPS) Test personnel were performing a Train B valve stroke timing test on valve 1CA-48B, CA Train B Number 1 To Steam Generator 1C Control. The test was required by procedure PT/1/A/4252/03B, CA Train B Valve Stroke Timing - Quarterly (Turbine Driven Pump Flowpath). At approximately 1045, in accordance with step 12.3.10 of the procedure, OPS Test Technicians A and B were attempting to place a switched jumper in the open position across sliding link B-21 in the CA Pump 1B Control Panel.

OPS Test Technician A verified the location of terminal B-21L and OPS Test Technician B independently verified the location. OPS Test Technician A then installed a threaded banana clip connector on terminal B-21L. OPS Test Technician B then independently reverified the banana clip connector to be on terminal B-21L. OPS Test Technician A then plugged the switched jumper into the banana clip on terminal B-21L. Because of the presence of two wires and associated nuts on terminal B-21R, OPS Test Technician A was unable to install a banana clip connector on the terminal. An adaptor with an alligator clip connector was being used for that connection. Due to past problems with alligator clip jumpers coming off of terminals, OPS Test Technician A decided to plug the switched

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jumper into the alligator clip adaptor before making the connection to terminal B-21R. Both OPS Test Technicians verified that the switch was in the open position.

OPS Test Technician A then verified the position of terminal B-21R. OPS Test Technician B independently verified the position of terminal B-21R. OPS Test Technician A then started to make the connection. OPS Test Technician B commented that the rubber boot on the alligator clip connector may need to be pulled back to gain greater opening capacity of the clip to fit over the terminal nut and safely make the connection. OPS Test Technician A stopped, pulled the rubber boot back, and proceeded to attempt to make the connection. An inadvertent contact was made to terminal B-22R directly below the intended connection point.

Upon the inadvertent contact the OPS Test Technicians reported hearing the sound of relays and valves cycling and the Turbine Driven CA Pump starting. OPS Test Technician A immediately realized that contact had been made with terminal B-22R instead of B-21R. OPS Test Technician A removed the jumper from B-21L and B-22R and moved away from the control panel. OPS Test Technicians A and B remained at the panel and maintained phone communication with control room personnel until the incident was under control. The OPS Test Supervisor was then called and informed of the event.

OPS Control Room personnel noted the automatic start of the Turbine Driven CA Pump and the movement of the control valves to their open position. Attempts to regain control of the pump or valves were unsuccessful. The Turbine/Generator load was reduced by 8 MWe to compensate for the cooldown caused by the pump injection. The Turbine Driven CA Pump was then tripped manually and the Turbine/Generator load was returned to normal. Once the Turbine Driven CA Pump was secured, OPS Test Technician A and B left the area and consulted with their Supervisor. Work Order 93087884 was initiated to investigate the reason for the automatic start. Subsequently, Instrumentation And Electrical (IAE) personnel discovered the fuses [EIIS:FU] between terminals BA-1 & 2 and BA-3 & 4 in Terminal Box 601 were blown. The blown fuses had removed control power from the associated control valves and caused them to fail open and caused the automatic start of the Turbine Driven CA Pump. Also, since the control power had failed, the Steam Generator Blowdown (BB) [EIIS:WI] Containment Isolation valves had not closed because the signal to close from CA could not get to the valves. The fuses were replaced, the signal path was restored, and the BB Containment Isolation Valves closed as required. The BB valves and Turbine Driven CA pump were then realigned. The cause for the blown fuses was determined to have been a short to ground during the performance of the valve stroke timing test.

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Problem Investigation Process (PIP) 1-M93-1244 was initiated to further investigate the circumstances surrounding the event.

The required notification was made to the NRC at 1340, in accordance with procedure RP/O/A/5700/10, NRC Immediate Notification Requirements.

### Conclusion

This event is assigned causes of Inappropriate Action due to Inattention To Detail, Failure To Follow Procedure, and The Action Taken Was Not The Best Alternative. In performance of the procedure, OPS Test Technician A was to place a switched jumper across sliding link B-21 in the CA Pump 1B Control Panel. Due to the lack of adequate threads on terminal B-21R, it was necessary to utilize an adaptor with an alligator clip connector to connect the jumper to that terminal. The adaptor used contained an exposed wire end due to the way it had been constructed. Even though this presented very little exposed surface area, a potential existed for the exposed wire end to create an electrical short circuit. An Inappropriate Action due to Inattention To Detail existed because the OPS Test Technicians involved in this event did not recognize the potential risk when selecting this adaptor for use in performance of the procedure.

Also, a second Inappropriate Action due to Inattention To Detail existed when OPS Test Technician A connected the jumper to the wrong terminal. After stopping to pull the rubber boot back on the alligator clip connector, no reverification was performed to ensure the correct terminal had been selected prior to making the electrical connection. Due to the location of B-22R and the position of OPS Test Technician A, terminal B-22R fell directly in the line of sight with the previously installed connector on terminal B-21L and appeared to be the correct terminal. Since self checking and independent verification was interrupted and not re-initiated, OPS Test Technician A touched the alligator clip to terminal B-22R instead of B-21R. Because of the location and configuration of the control panel the line of sight of OPS Test Technician B was blocked at the moment the connection was made.

When the connection was made with terminal B-22R, an electrical short to ground was created. The electrical short caused fuses between terminals BA-1 & 2 and BA-3 & 4 in Terminal Box 601 to open. The fuses opening removed control power from the associated valves causing them to fail open and caused the automatic start of the Turbine Driven CA

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Pump. The exact point of contact causing the short to ground can not be determined; however, it appears to have been from the exposed wire end on the alligator clip adaptor to an exposed terminal on relay [EIIS:FLY] BA-2 directly below terminal B-22R.

LER 369/89-25 documented the automatic actuation of the Unit 1 TD CA pump because of an Inappropriate Action. The event centered around errors caused by use of jumpers with alligator clips similar to the jumper used in the current event. One of the corrective actions for LER 369/89-25 was to evaluate the permanent installation of banana plug adapters on the terminal posts of the CA Pump Auxiliary Panels. This would have eliminated the use of alligator clip jumpers in these panels. Instead of a permanent installation of the banana plug adapters, it was recommended that terminals be reconfigured to allow the use of them during testing. Procedural controls were put in place on December 12, 1989, to ensure that approved screw on safety insulated connectors are used on all applicable jumper work. The terminals involved in LER 369/89-25 were reworked on January 15, 1990. On January 21, 1991, procedure PT/1/4252/03B was revised to add 'B' Train valves. On August 9, 1991, the wiring for the 'B' Train valves was reworked to allow the use of sliding links to facilitate the required testing. After this wiring change, test points associated with 1CA-48B and 1CA-52B would not accommodate the installation of the banana plug adapters due to double nuts on the terminal studs. Alligator clip jumpers were necessary to perform the test for these valves. No actions were taken to have these terminals reworked removing the double nuts to accommodate the banana plug adapters. A note was added to procedure PT/1/A/4252/03B, CA Train B Valve Stroke Timing - Quarterly - Turbine Driven Pump Flowpath on February 25, 1993 stating a switched jumper with alligator clip connectors will be needed to safely time valve 1CA-48 and 1CA-52. The decision to use the alligator clips in lieu of reworking the terminals was not the best alternative and is therefore considered an Inappropriate Action.

Step 12.3.8 of the procedure states to ensure that approved screw on safety insulated connectors are used on all applicable jumper work. Do NOT use alligator clip jumpers unless accompanied by appropriate supervision. When performing the procedure during this event, step 12.3.8 had been initialed by OPS Test Technician C in the Control Room [EIIS:NA] for OPS Test Technician A via telephone. No supervisory personnel were present at the CA Pump 1B Control Panel during performance of the jumper installation.

When questioned, the OPS Test Technician A stated that appropriate supervisory personnel were aware they were performing the procedure and, because of past communication concerning this activity, believed they were enabled to initial this step and go on even though the supervisor was not present. After replacement of the open fuses and

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restoration of the valves and pump to standby readiness, the OPS Test Technicians and OPS Test Supervisor discussed the situation but no need was seen for the OPS Test Supervisor to be present during performance of the jumper installation. Because the same personnel performed the procedure the second time and little time had elapsed, the same enclosure was used to document the test. The steps which had been covered prior to the event were gone over during the second performance but were not re-initialed. Completion of these steps without the presence of a supervisor is considered an Inappropriate Action due to Failure to Follow Procedures.

Station Management personnel have evaluated circumstances surrounding procedure adherence during this event and determined that adherence did not meet management expectations and was contrary to recent training. Management personnel have counseled the individuals involved and will initiate a site communication plan to assure each station employee understands procedure adherence expectations and the consequences of failure to comply.

The OPS Test Technicians involved in the performance of this procedure were qualified pursuant to the McGuire Employee Training and Qualification System. They had performed the test before and were familiar with the equipment involved.

Jumpers in use by OPS Test Group personnel have been checked to ensure they are properly insulated to prevent possible inadvertent electrical shorting. Also, appropriate personnel will receive Operating Experience Program (OEP) training on the circumstances surrounding this event, corrective actions associated with the event, and review of proper use of electrical jumpers. An evaluation will be performed of the use, maintenance, and administrative controls on electrical jumpers used by all groups at McGuire. Terminal connections in the CA Pump 1B Control Panel will be reworked to allow use of banana plug adapters. WO 93042797 has been written to replace relay BA-2 in the CA Pump 1B Control Panel.

A review of the Operating Experience Program (OEP) database and Problem Investigation Process database for twenty-four months prior to this event revealed six events where an ESF actuation was caused by an Inappropriate Action. LER's 369/92-07, 369/92-09, 370/92-01, 370/92-02, 370/93-05, and 370/93-06 documented an ESF Actuation involving an Inappropriate Action. This number of events has alerted management to human performance problems and actions are being taken to address the concern. However, none of these events involved the same system, group, or procedure associated with this event. Therefore, the particulars of this event are not considered recurring.



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This event is not Nuclear Plant Reliability Data System Reportable.

There were no personnel injuries, radiation overexposures, or uncontrolled releases of radioactive materials as a result of this event.

**Corrective Actions:**

- Immediate:**
- 1) Turbine/Generator load was reduced to compensate for the cooldown caused by the TDCA Pump injection.
  - 2) OPS personnel manually tripped the TDCA Pump, then restored the Turbine/Generator to normal.
  - 3) Work Order 93087884 was generated to investigate the reason for the automatic pump start.
  - 4) IAE personnel replaced fuses between terminals BA-1 & 2 and BA-3 & 4 in Terminal Box 601.
  - 5) OPS personnel realigned the TDCA Pump and BB Valves for standby readiness.
- Subsequent:**
- 1) OPS Test personnel successfully completed the valve stroke timing test on valve 1CA-48B.
  - 2) Work Request 93042797 was initiated to replace relay BA-2 in the CA Pump 1B Control Panel.
  - 3) PIP O-M93-1287 was initiated to investigate the steps necessary to eliminate the need to use alligator clip jumpers during testing in the Solid State Protection System (SSPS) cabinets on both units.
  - 4) PIP O-M93-1288 was initiated to investigate the steps necessary to eliminate the need to use alligator clip jumpers during testing in the CA Pump Control Panels.

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- 5) All jumpers in use by OPS Test personnel for testing were examined to ensure they were properly insulated and all suspect jumpers were removed from service.
- 6) OPS Test personnel have initiated changes to the procedures used for valve stroke timing to require a pre-job briefing concerning the hazards involved in the use of jumpers during this type testing.
- 7) Station Management personnel evaluated the circumstances surrounding procedure adherence during this event and have counseled individuals involved.

**Planned:**

- 1) Appropriate OPS Test personnel will receive OEP training on circumstances surrounding the event, corrective actions associated with the event, and the proper use of electrical jumpers.
- 2) Safety Assurance personnel will evaluate site wide use, maintenance, and administrative controls on jumpers used at McGuire.
- 3) Site Communications personnel will initiate a site communication plan to assure each employee understands procedure adherence expectations and the consequences of failure to comply.
- 4) Safety Assurance personnel will evaluate past work history and current work practices of the OPS test group to assure other procedure use and adherence problems do not exist.

**Safety Analysis**

The CA system is designed to supply minimum flow to the intact SGs for any condition which requires decay heat or reactor coolant heat dissipation. Additionally, the Turbine Driven CA Pump, which is sized to handle all SG's simultaneously, can perform the required design function independently of the Motor Driven Pumps and without electrical power. The ability of the Turbine Driven CA Pump to supply water to the intact SGs was unaffected by this vent. The pump received an automatic start signal and supplied water into all four SGs. The only unusual occurrence during this event was the failure of the BB Containment Isolation Valves to isolate when the Turbine Driven CA Pump received the automatic start

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signal. This failure to isolate was due to the loss of control power to the CA valves which occurred when the short circuit existed. The Control Room personnel were fully aware that BB valves had not isolated, and were capable of manually closing the valves if needed. The BB valves were not considered inoperable since their ability to close upon initiation of a safety signal was not affected. Since the pump started and supplied the SGs, as designed, this event is not considered significant.

The health and safety of the public were not effected by this event.

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## Addendum 1

This LER was originally assigned a cause of Management Deficiency due to actions associated with a similar event and documented on LER 369/89-25. In LER 369/89-25, one corrective action was to evaluate the permanent installation of banana plug adapters on the terminal posts of the CA Pump Auxiliary Panels. Valve testing during that time was limited to the controls associated with 'A' Train only. The evaluation recommended that the affected terminals in the CA Pump Auxiliary Panels be reconfigured to allow the use of the banana plug adapters during testing. Initially, no evidence could be found to show that the terminals were ever reconfigured. After further investigation, it was discovered that in fact the terminals had been reworked as recommended by the evaluation on January 15, 1990.

Later in 1990 it was decided that the valve's controls for both Trains should be tested. Initial tests revealed that the sliding links could not be used and a Station Problem Report was written. On August 9, 1991, a modification was implemented to rework the terminals on the affected valve controls. This modification was written to move wires from the left side to the right side of the terminals to facilitate the use of sliding link terminals. The Engineer involved in this modification was unaware of the previous problem with double nuts. When the work was performed a problem identical to the one which was originally identified on LER 369/89-25 was created. At this point the test personnel chose the use of alligator clip jumpers to perform the test.

There were procedures and processes in place to eliminate the wiring problems, as was done on the other Train's circuits in December of 1989. However, a cause of Inappropriate Action due to the action taken by the OPS Test Technicians not being the best alternative is assigned to this event. The OPS Test Technicians should have originated the necessary work orders to have the terminals reworked.

The planned corrective actions associated with LER 369/93-12 are still valid. No additional corrective actions are required.