



Duke Energy
Oconee Nuclear Station
7800 Rochester Highway
Seneca, SC 29672
(864) 885-3107 OFFICE
(864) 885-3564 FAX

W. R. McCollum, Jr.
Vice President

June 12, 2002

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

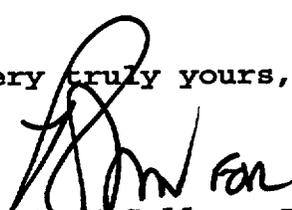
Subject: Oconee Nuclear Station
Docket Nos. 50-269,-270, -287
Licensee Event Report 269/2002-02, Revision 1
Problem Investigation Process No.: O-02-1357

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 269/2002-02, Revision 1, concerning discovery of a scenario for fire damage that could potentially result in inoperability of a component credited for Appendix R fire mitigation. As a result, the component was retroactively declared inoperable for a period longer than allowed by Technical Specifications. Revision 1 clarifies the role of periodic roving fire watches instituted as an interim corrective action.

This report is being submitted in accordance with 10CFR 50.73(a)(2)(i)(B), Conditions Prohibited By Technical Specification. This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,


W. R. McCollum, Jr.

Attachment

IE 22

Document Control Desk

Date: June 12, 2002

Page 2

cc: Mr. Luis A. Reyes
Administrator, Region II
U.S. Nuclear Regulatory Commission
61 Forsyth Street, S. W., Suite 23T85
Atlanta, GA 30303

Mr. L. N. Olshan
Project Manager
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Mr. M. C. Shannon
NRC Senior Resident Inspector
Oconee Nuclear Station

INPO (via E-mail)

LICENSEE EVENT REPORT (LER)

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

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, NEOF-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.

1. FACILITY NAME Oconee Nuclear Station, Unit 1	2. DOCKET NUMBER 050- 0269	3. PAGE 1 OF 8
---	--------------------------------------	--------------------------

4. TITLE
Potential for Fire to Indirectly Damage Mitigation Component

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
03	22	2002	2002	- 02	- 01	06	12	02	Unit 2	50 270
									FACILITY NAME	DOCKET NUMBER
									Unit 3	50 287

9. OPERATING MODE	1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)									
10. POWER LEVEL	100	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)			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)			X 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 L.E. Nicholson, Regulatory Compliance Manager	TELEPHONE NUMBER (Include Area Code) (864) 885-3292
--	---

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		
YES (If yes, complete EXPECTED SUBMISSION DATE).	x	NO		MONTH	DAY	YEAR

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On March 22, 2002, with all three Oconee units operating in Mode 1 at 100% Rated Power, an engineering evaluation identified the potential for an adverse valve actuation during a design basis fire. This valve actuation involves the inadvertent opening of either of two valves in the low pressure injection (LPI) system due to an assumed failure in the valve control circuitry. The opening of either valve would cause the Borated Water Storage Tank (BWST) to empty its contents to the Reactor Building Emergency Sump. The water from the BWST would flood the Reactor Coolant Make-Up (RCMU) Pump resulting in its failure. The RCMU pump supplies reactor coolant pump seal and make-up flow during some design basis fire scenarios.

Roving fire watches have been implemented as compensatory measures in the area of the affected cables. These fire watches are required while the unit is in Modes 1, 2, or 3 and will remain in place until modifications are implemented to mitigate this condition.

The apparent cause of this condition is a historic design deficiency. An engineering risk assessment concludes that the likelihood of the actual spurious actuation of these valves is extremely low. This event is considered to have minimal safety significance with respect to the health and safety of the public.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	0500269	2002	- 02	- 00	2 OF 8

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

EVALUATION

BACKGROUND

This event is reportable per 10CFR50.73(a)(2)(i)(B), Conditions Prohibited By Technical Specification.

Each Unit's Low Pressure Injection (LPI) System [EIIS:BP] is used to remove decay heat during cold shutdown and refueling operations. The LPI System also acts as a portion of the Emergency Core Cooling System (ECCS). Following the depletion of the Borated Water Storage Tank (BWST) after a Loss of Coolant Accident (LOCA), the LPI System takes suction from the Reactor Building Emergency Sump (RBES), located in the lower level of each Unit's Reactor Building [EIIS:NH].

On each unit, valves LP-19 and LP-20 (train A and train B respectively) are normally closed motor operated valves (MOVs) capable of being opened and closed from the respective Control Room to align the associated RBES to the suction of that Unit's LPI Pumps.

The Standby Shutdown Facility (SSF) [EIIS:NB] serves as a backup for existing Oconee safety systems to provide an alternate and independent means to achieve and maintain a Hot Standby condition for 72 hours for all three of the Oconee Units following sabotage, flooding, or a design basis (10CFR50, Appendix R) fire. The lower level of each Unit's Reactor Building contains an SSF Reactor Coolant Make-Up (RCMU) Pump designed to supply Reactor Coolant Pump seal injection flow in the event that the normal make up system (High Pressure Injection [EIIS:BG]) becomes inoperable during an SSF event.

Oconee Technical Specifications (TS) 3.10.1 Condition C requires that the SSF RCMU Pump be operable when any Unit is in a Mode 3 Condition or above. Should the RCMU Pump be determined to be inoperable, TS 3.10.1 Required Action C.1 requires that the RCMU Pump be restored to an operable status within 7 days. TS 3.10.1 further requires that the affected Unit be placed in a Mode 4 Condition (Hot Shutdown) within 84 hours if the RCMU Pump cannot be restored to an operable status following this 7 day period.

10CFR50 Appendix R Section L applies to plants that used Alternate Shutdown as a means to provide safe shutdown train separation. 10CFR50 Section L.7 contains the following requirement: "The safe shutdown equipment and systems for each fire area shall be known to

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	0500269	2002	02	00	3 OF 8

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

be isolated from associated non-safety circuits in the fire area so that hot shorts, open circuits, or shorts to ground in the associated circuits will not prevent operation of the safe shutdown equipment. The separation and barriers between trays and conduits containing associated circuits of one safe shutdown division and trays and conduits containing associated circuits or safe shutdown cables from the redundant division, or the isolation of these associated circuits from the safe shutdown equipment, shall be such that a postulated fire involving associated circuits will not prevent safe shutdown."

The SSF RCMU Pump is presently considered operable (following the implementation of compensatory measures) but non-conforming with respect to licensing bases for adverse valve movement. Without those compensatory measures in place, the RCMU Pumps on all 3 Oconee Units were technically inoperable for an extended period of time. Therefore, the TS 3.10.1 Condition C allowed action time of 7 days has not been met.

At the time this condition was identified, Oconee Units 1, 2, and 3 were operating in a Mode 1 condition at approximately 100 percent power. On March 23, 2002, Unit 1 was shutdown for its normal refueling outage.

EVENT DESCRIPTION

The original analyses for Oconee Appendix R fires included the consideration of the effects of one worst case spurious actuation. Engineering analyses concluded that cable and conductor failures were not credible for Oconee due to armor sheathed cable construction. Subsequent to the initial Appendix R analyses, NRC Generic Letter 86-10, "Implementation of Fire Protection Requirements," addressing "hot shorts," was issued. Duke's evaluation of Generic Letter 86-10 reaffirmed that the construction of the metallic armor jacketed control cables, used for Motor Operated Valves, precluded cable to cable shorts. This evaluation concluded that the most likely failure mode was a conductor short to the grounded armor during a fire, thus causing the failure of the associated control power fuse, failing the valve "as is."

In 1997, a potential vulnerability was identified by engineering review of industry information obtained through the Operating Experience Program. The review recognized that LP-19 and 20, RBES suction valves, each had a single cable to provide open/close

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
Oconee Nuclear Station, Unit 1	0500269	2002	02	00	4	OF 8

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

control and position indication for the associated valve. The review then postulated that a "smart fire" (one starting in the most vulnerable area) which damaged one of these control cables could potentially result in a conductor to conductor short within this single cable. Therefore a spurious actuation might cause the associated valve to open. If either valve on the affected unit opened, borated water from the BWST would flow to the RBES under the force of gravity head. Corrective actions to address this vulnerability focused on potential actions to recognize flow of this water to the RBES and to mitigate the occurrence by recovering the BWST inventory.

On March 22, 2002, subsequent changes to the operating procedures used to mitigate spurious actuation of LP-19 or LP-20 during an Appendix R fire event were receiving an engineering review. As a result of questions raised by the review, it was recognized that the volume of water lost from the BWST to the RBES as a result of the spurious actuation of valves LP-19 and/or 20 might challenge the operability of the RCMU Pump located in the lower level of the affected Unit's Reactor Building. The concern was that a loss of inventory from the BWST to the RBES would result in a water level 6 inches above the RCMU Pump motor center line. Since the SSF RCMU Pump motor is not designed for operation under water, Engineering concluded that, in this specific scenario, water would enter the stator housing and result in the failure of the RCMU pump motor.

A Problem Investigation Process (PIP) was written and an Operability Evaluation initiated. Operations implemented compensatory measures establishing periodic roving fire watches in the normally unoccupied areas along the cable routes where the control cables for LP-19 and 20 are subject to fire damage. These roving fire watches will remain in effect while any unit is in Mode 3 or above until modifications to re-cable the subject valve control circuits are completed. There are also operable fire detection and manual fire suppression systems in the areas where control circuit cables for these valves are susceptible to fire damage.

The Operability Evaluation concluded that the compensatory fire watch would allow sufficient response time to provide adequate assurance that LP-19 and 20 could be protected from fire damage. Therefore the SSF RCMU pump is considered Operable. However, in retrospect, the SSF RCMU pump had been susceptible to failure due

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	0500269	2002	- 02	- 00	5 OF 8

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

to this postulated spurious opening of LP-19 or 20 since October 1986 when the SSF was placed in service.

Modifications to control circuits for LP-19 and LP-20 are being prepared and implemented on a schedule commensurate with the safety significance of this issue. The modifications will address the separation of control circuit wiring in independent cables to inhibit the energized conductors from having the potential to "hot short" when exposed to fire damage and causing a spurious opening of these valves.

Because Unit 1 entered a refueling outage shortly after identification of this issue, the control circuit cables for Unit 1 valves 1LP-19 and 20 were modified prior to Unit start-up on April 28, 2002. This modification separated the control circuit wiring into independent cables to inhibit the energized conductors from having the potential to "hot short," thus eliminating the possibility for spurious actuation of these valves. Therefore the Unit 1 roving fire watches were subsequently discontinued. Roving fire watches continue to patrol the Unit 2 and 3 equipment and cable spread rooms.

An Engineering review will be performed to identify any other potentially safety significant spurious actuation scenarios. Appropriate actions will be taken to resolve any individual vulnerability identified.

CAUSAL FACTORS

The apparent cause of this condition is a historic design deficiency existing since the Standby Shutdown Facility was declared operational in October 1986. Contributing to the period of time in which this condition remained undisclosed was the failure to immediately recognize the possibility that the RCMU Pump could be rendered inoperable when the likelihood of a hot short resulting in the spurious actuation of valves LP-19 and 20 was first identified in 1997.

Although previous historic Oconee design deficiencies have been identified, no similar reportable events with the same apparent cause have occurred at Oconee within the previous 36 months.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	0500269	2002	- 02	- 00	6 OF 8

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

CORRECTIVE ACTIONS

Immediate:

1. Interim roving fire watches were established in the areas where the control cables for LP-19 and 20 are subject to fire damage. These fire watches will be in effect while any unit is at Mode 3 or above, until modifications to eliminate the vulnerability are complete.

Subsequent:

1. The control circuit cables for Unit 1 valves 1LP-19 and 1LP-20 were modified to provide independent cables to eliminate the possibility for spurious actuation of these valves.

Planned:

1. Control circuit modifications will be implemented to provide separation of Unit 2 and 3 LP-19 and LP-20 control circuit wiring to prevent a "hot short" from causing a spurious valve opening.
2. An Engineering review will be performed to identify any other potentially safety significant spurious actuation scenarios. Appropriate actions will be taken to resolve any individual vulnerability identified.

There are no NRC commitment items contained in this LER.

SAFETY ANALYSIS

The cable of the control circuitry wiring for each of the LP-19 and LP-20 valve circuits has 8 conductors. One conductor is in the center of the cable, surrounded by the 7 other conductors, which are then surrounded by metallic armor sheathing. Only two of these conductors are energized while the valve is in its normally closed position. In order for a spurious actuation to occur, the cable must be damaged such that one of these two energized conductors contacts one specific "target" conductor connected to the "open" coil in the valve operator motor control center. Contact with the armor sheathing or one of the other 5 conductors should result in a short to ground, which would cause the control circuit fuse to blow and prevent any spurious actuation.

The cable is manufactured such that the conductors are not paired to be along side each other over the length of the cable. Instead

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	0500269	2002	02	00	7 OF 8

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

they are randomly "braided" so that they change physical orientation to each other as they travel along the cable. Any two conductors which happen to be adjacent at one point in the length of the cable may not be adjacent at some point further along the length of the cable. Thus there are some orientations where the target conductor is not adjacent to either energized conductor, which would significantly reduce the potential for a "smart short" at those locations.

These physical attributes of the cable construction would indicate that a fire exposure at any random location along the length of the cable would cause the most outer conductor, closest to the armor sheathing, to have its insulation heated first such that it would make contact. Once the conductor voltage can overcome the decreased resistance of the decomposing insulating material, an electrical short to ground can occur and cause the control power circuitry fuse to fail. A fuse failure prior to a short to the target conductor would prevent any spurious actuation of the valve's motor breaker.

The predominant cable type for motor operated valve controls at Oconee is PVC insulated, galvanized metallic armor surrounding individual conductors. PVC insulation has an ignition temperature of 735 degrees Fahrenheit¹. EPR Hyperlon insulated control circuit cables are used for valves LP-19 and 20 on Unit 1. Insulating material made of EPR Hyperlon has a higher ignition temperature than PVC.

A series of experimental fire tests² were conducted involving energized electrical circuits using Oconee motor operated valve control circuit cable and circuit design. These circuits include control power transformers that limit available fault current and voltage. Based upon the test results, demonstrating the robust fire resistance characteristics of the cable, fire induced spurious valve actuations are not expected to occur. One of these experimental tests demonstrated that under conditions of extreme physical abuse (e.g., a right angle bend of the cable in the tray, without limiting current circuit design, conducted under severe exposure to fire) fire induced spurious valve actuation could occur. Thus, while the probability of fire induced spurious

¹ R. J. Budnitz, "Spurious Actuation of Electrical Circuits Due to Cable Fires: Technical Investigator's Report," Future Resources Associates, study managed by EPRI in coordination with NEI

² Budnitz

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	0500269	2002	- 02	- 00	8 OF 8

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

actuation cannot be ruled out, it is not expected to occur under plant conditions.

Based upon the conservatisms in test methodologies, it has been estimated that the cable must be exposed to a developed fire for a period in excess of 30 minutes in order to cause a fault in the LP-19 and 20 control circuit cables.

Fire brigade drills have been practiced in the areas in which LP-19 and 20 valve control circuit cables are subject to fire damage. These drills have shown fire brigade response times of less than 30 minutes. The brief response time allows the fire brigade to get positioned and initiate mitigating actions prior to fires becoming fully developed; therefore it is not expected that these cables will be exposed to the temperature at which cable degradation occurs (threshold temperatures greater than 700 degrees Fahrenheit) for any significant duration.

In summary, the likelihood of an actual spurious actuation occurring due to a "smart fire" causing the right two conductors to short together rather than shorting to ground has a very low probability. The additional contribution to core damage frequency resulting from the issue of spurious actuation of LP-19 or LP-20 has been calculated to be less than $3E-8$ per year³.

Therefore, there was no impact on the health and safety of the public due to this event.

ADDITIONAL INFORMATION

There were no releases of radioactive materials, radiation exposures, or personnel injuries associated with this condition.

No actual equipment failure occurred, therefore this condition is not considered reportable under the Equipment Performance and Information Exchange (EPIX) Program.

³ PRA Analysis of Spurious Operation of Oconee Valves LP-19 or 20