ACCELERATED DOCUMENT DISTRIBUTION SYSTEM

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9311040259 DOC.DATE: 93/10/28 NOTARIZED: NO DOCKET #
FACIL:50-269 Oconee Nuclear Station, Unit 1, Duke Power Co. 05000269
AUTH.NAME AUTHOR AFFILIATION
BENESOLE,S.G. Duke Power Co.
HAMPTON,J.W. Duke Power Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 93-004-01:on 930405,discovered that control logic associated w/CCW pump discharge valves may not be single failure proof.Caused by design deficiency.Opened CCW cross connect valves.W/931028 ltr.

DISTRIBUTION CODE: IE22T COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 9
TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD1-3 LA	1	1	PD1-3 PD	1	1
	WIENS,L	1	1			
INTERNAL:	ACRS	2	2	AEOD/DOA	1	1
	AEOD/DSP/TPAB	1	1	AEOD/ROAB/DSP	2	2
	NRR/DE/EELB	1	1	NRR/DE/EMEB	1	1
	NRR/DORS/OEAB	1	1	NRR/DRCH/HHFB	1	1
	NRR/DRCH/HICB	1	1	NRR/DRCH/HOLB	1	1
	NRR/DRIL/RPEB	1	1	NRR/DRSS/PRPB	2	2
	NRR/DSSA/SPLB	1	1	NRR/DSSA/SRXB	1	1
	REG FILE 02	1	1	RES/DSIR/EIB	1	1
	RGN2 FILE 01	1	1			
EXTERNAL:	EG&G BRYCE,J.H	2	2	L ST LOBBY WARD	1	1
	NRC PDR	1	1	NSIC MURPHY,G.A	1	1
	NSIC POORE,W.	1	1	NUDOCS FULL TXT	1	1

NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK, ROOM P1-37 (EXT. 504-2065) TO ELIMINATE YOUR NAME FROM DISTRIBUTION LISTS FOR DOCUMENTS YOU DON'T NEED!

FULL TEXT CONVERSION REQUIRED
TOTAL NUMBER OF COPIES REQUIRED: LTTR 30 ENCL 30

RIDS/ADDS/ADDS

Duke Power Company
Oconee Nuclear Site
P.O. Box
Seneca SC 29679

DUKE POWER

October 28, 1993

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 269/93-04, Revision 1

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/93-04, Revision 1, concerning a postulated single failure during a LOCA/LOOP may result in the loss of post accident cooling. This supplement includes the results of the single failure analyses on Emergency Condenser Cooling Water supply to the Low Pressure Service Water system.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(v)(D). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

J. W. Hampton
Vice President

/ftr

Attachment

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

Mr. L. A. Wiens
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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

Mr. P. E. Harmon
NRC Resident Inspector
Oconee Nuclear Site

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)
Oconee Nuclear Station, Unit One	05000 269	1 OF 8

TITLE (4) A Postulated Single Failure During A LOCA/LOOP May Result In The Loss Of Post Accident Cooling Due To A Design Deficiency

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									Oconee, Unit Two	05000 270
04	08	93	93	-- 04 --	01	10	28	93	FACILITY NAME: Oconee, Unit Three	DOCKET NUMBER: 05000 287

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
POWER LEVEL (10)	100	20.402(b)		20.405(c)		50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)		50.36(c)(1)	X	50.73(a)(2)(v)(D)	73.71(c)
		20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)	OTHER
		20.405(a)(1)(iii)		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. G. Benesole, Safety Review Manager	(803) 885-3518

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

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 April 5, 1993 during an inspection of the Emergency Condenser Cooling Water System, a NRC resident discovered that the control logic associated with the Condenser Cooling Water (CCW) Pump discharge valves may not be single failure proof. An evaluation by Oconee Engineering revealed that a single failure could close all CCW Pump Discharge Valves on a single unit following a LOCA/LOOP. This would isolate the primary suction flow path for the Low Pressure Service Water (LPSW) Pumps. At 1730 hours, on April 8, 1993, with all three Oconee Units at 100% Full Power, a 24 hour action statement for Technical Specification 3.3.7 was entered due to the inability of the LPSW System to withstand a design basis accident and a single failure in the CCW System. The root cause of this event is Design Deficiency: Unanticipated Interaction of Systems, (Design Oversight). Corrective action was to cross connect the CCW System of all three Oconee Units to overcome the single failure vulnerability of the LPSW suction. In addition, a modification is planned to ensure that at least one CCW Pump discharge valve will remain open when all CCW Pumps trip, even with a single failure in the control circuitry.

BACKGROUND

The Condenser Cooling Water (CCW) System [EIIS:BS] supplies the Low Pressure Service Water System (LPSW) [EIIS:BI] through the CCW crossover header. The CCW System also supplies other systems and components. The Emergency Condenser Cooling Water System (ECCW) is a part of the CCW System and performs two separate functions. One of these functions is to recirculate CCW to the intake canal following the loss of Lake Keowee. The second function is an unassisted siphon. This siphon has two distinct purposes; one supplies suction for the LPSW System and the other provides cooling water flow through the condenser. The CCW System includes four CCW Pumps per unit and an associated discharge valve. Each CCW Pump has a pump/valve interlock such that when the last CCW Pump is turned off or upon loss of power, its discharge valve will remain open to ensure siphon flow. All open valves stay open if all pumps stop at the same time.

The Continuous Vacuum Priming System (V) maintains the ECCW System operable to initiate ECCW siphon flow from the intake canal, through the main condenser to the Keowee Hydro discharge. The V System includes two Emergency Steam Air Ejectors (ESAE), one for Unit 1 and Units 2 and 3 share the other.

The LPSW System provides cooling for components in the Turbine Building [EIIS:NM], the Auxiliary Building (AB) [EIIS:JE] and the Reactor Building (RB) [EIIS:NH]. Engineering Safeguards [EIIS:JE] equipment located in the AB and RB (such as the Low Pressure Injection System [EIIS:BP] and Reactor Building Coolers) is cooled by the LPSW System. The LPSW System is required to be operable per Technical Specification 3.3.7.

The Final Safety Analysis Report states that the cooling water systems are designed so no single component failure will curtail normal station operation or impair emergency safeguards operation.

EVENT DESCRIPTION

A Probabilistic Risk Assessment (PRA) for Internal and External Events was published in June 1984 for Oconee Nuclear Station (ONS) Unit 3. In 1982, preliminary results of the study indicated that flooding of the Turbine Building (TB) was a dominant accident sequence with respect to degraded core accidents. To reduce the impact of a major TB flood, interim actions were taken. Actions included closing the Condenser Cooling Water (CCW) crossover valves (1-CCW-40 Unit 1 Crossover Tie and 3-CCW-42 Unit 3 Crossover Tie) to improve the effectiveness of flood isolation. On November 12, 1982, Operations closed 1-CCW-40 and 3-CCW-42.

On April 5, 1993, at approximately 1500 hours, a NRC resident inspector was performing a review of the Emergency Condenser Cooling Water (ECCW) System's electrical drawings. During this review, it was discovered that a failure of relay 2POX3 in conjunction with a LOOP, may have the potential to prevent the operation of the ECCW siphon flow, therefore isolating the primary suction flow path for the Low Pressure Service Water (LPSW) Pumps. The NRC resident immediately notified Oconee Engineering (OE) of his finding. OE began evaluating the finding.

On April 6 and 7, 1993, OE continued evaluating the finding. As part of this evaluation, an alternate suction flow path was identified. However, a review of a calculation performed on this flow path revealed that it would result in insufficient Net Positive Suction Head (NPSH) for the LPSW Pumps during a Loss of Coolant Accident (LOCA) / Loss of Offsite Power (LOOP). It was also noted as part of the evaluation that other relays in the control circuitry associated with the CCW Pump Discharge Valves also represented potential single failures.

It was noted during the evaluation that the CCW Design Basis Document for the CCW System did not require the system to be single failure proof.

On April 8, 1993, at approximately 1730 hours, all three units entered the 24 hour action statement for Technical Specification 3.3.7 due to the inability of the LPSW system to withstand a design basis accident and a single failure in the CCW System.

On April 9, 1993, OE performed an operability evaluation to address the concern with water supply from the CCW System to the LPSW System if a single failure of the relay associated with CCW Pump discharge valves occurs. This evaluation determined that the LPSW System is conditionally operable. The condition of operability is that the position of the CCW crossover valves (1-CCW-40 and 3-CCW-42) be changed from closed to open, and this change would be acceptable for thirty days. OE calculated that sufficient NPSH to LPSW Pumps would be provided when taking suction through the cross-connect from any unit's CCW intake. These valves were opened and the 24 hour action statement was exited.

On May 4, 1993, OE determined that it would be acceptable to operate with the crossover valves (1-CCW-40 and 3-CCW-42) open. Calculations revealed that operating with these valves in the open position results in an insignificant increase in the probability of Turbine Building flooding, leading to core melt.

On May 6, 1993, during the review of the ECCW System a NRC resident inspector questioned the ability of the CCW supply to the LPSW System to withstand a single failure with one Emergency Steam Air Ejector (ESAE) out

of service. The NRC resident immediately notified OE of his concerns. OE began evaluating the operability of the ECCW System.

On June 3, 1993, OE completed an operability evaluation which addressed the concern raised on May 11, 1993. The evaluation determined that the ECCW System was past inoperable during previous similar plant configurations because the CCW crossover valves were closed. The evaluation also revealed that lake levels have been periodically lower than the calculated level needed to provide suction via gravity flow to the LPSW pumps. This would also cause the ECCW System to be past inoperable during similar plant configurations due to low lake levels. OE continued to perform the single failure analyses on the ECCW supply to the LPSW System.

On September 30, 1993, OE completed the single failure analyses of the ECCW supply to the LPSW System. The analyses revealed that the components listed below may have introduced single failure vulnerabilities to the ECCW System for each unit prior to the opening of the crossover valves.

UNIT 1	UNIT 2	UNIT 3
1MS-46 (Emergency Air Ejector Steam Control)	2MS-46	2MS-46
1V-82 (Continuous Priming Tank Outlet Control)	2V-82	2V-82
1V-63 (Continuous Priming to Discharge Piping Control)	2V-63	3V-63
ESAE (Unit 1)	ESAE (Unit 2)	ESAE (Unit 2)
Control Relay 1CVPX	Control Relay 2CVPX	Control Relay 2CVPX
Relay POX3	Relay POX3	Relay POX3
Time Delay Relay POX4	Time Delay Relay POX4	Time Delay Relay POX4
Relay 1POX	Relay 2POX	Relay 3POX
Relay 1POX1	Relay 2POX1	Relay 3POX1
Relay 1POX1T	Relay 2POX1T	Relay 3POX1T
Relay 1POX2	Relay 2POX2	Relay 3POX2

The analyses concluded that there are no single failures in the ECCW flow path which would cause suction to be lost to the LPSW pumps when all three units are operating. Failures do exist that would defeat unit specific ECCW flow, but credit is taken for the CCW cross-connect line to supply the station flow demands during accident conditions from the available unit's ECCW System. However, if Unit 1 or both Units 2 and 3 are shutdown, then the ECCW System cannot withstand a single failure within the Vacuum System on any component of the above list.

CONCLUSIONS

The root cause of this event is a Design Deficiency, Unanticipated Interaction of Systems, Design Oversight. Prior to 1982 the Emergency Condenser Cooling Water (ECCW) System was not subject to single failure vulnerability due to the ability to cross connect any of the three Oconee Units through the Condenser Cooling Water (CCW) cross connect lines to feed the Low Pressure Service Water (LPSW) System. In 1982 as a result of the Probabilistic Risk Assessment (PRA), the CCW crossover valves were closed. The closing of these valves inadvertently compromised the ability of the ECCW system to provide adequate NPSH to the LPSW Pumps, during a Design Basis Accident with a single failure of the control circuitry.

The Design Basis Document (DBD) for the CCW System was completed December 1990 and revised in 1992. The DBD process includes extensive research and comment on all the design criteria for a system, including requirements related to single failure. This represented an opportunity to detect the current issue. Review of internal correspondence on the development of the CCW DBD indicates the author and reviewers concluded that because the CCW System was a support system and not strictly part of the LPSW, the Oconee Licensing Basis did not require it to be single failure proof and that this was consistent with the original design. However, it now appears this interpretation was too narrow. It also conflicts with Section 9.2.2 of the Final Safety Analysis Report which contains a broad statement that the system is single failure proof. Properly interpreting and reflecting this criterion in the DBD would not have prevented the current problem but would have detected it sooner. This specific case of a judgement error in preparation of the CCW DBD was not process related, therefore is not considered to be recurring.

A review of the past LERs, within the last two years, revealed two (LER 269/92-11 and LER 269/92-16) events which involved design deficiencies from a failure to anticipate interaction of systems, design oversight. LER 269/92-11 involved a single failure which could cause the overhead path Air Circuit Breaker 1 or 2, for the Keowee unit aligned to the underground, to close. LER 269/92-16 involved a potential single failure that could cause

the loss of both Keowee emergency power paths. This problem is therefore considered to be recurring. The corrective actions for the events identified above included modifications and the completion of the single failure analysis of Keowee Hydro Station's power system. These corrective actions could not have prevented this event.

This event did not involve equipment failure and therefore was not NPRDS reportable. There were no radiological overexposures, radioactive releases or personnel injuries associated with this event.

CORRECTIVE ACTIONS

Immediate

1. All three Oconee Units entered the 24 hour action statement for Technical Specification 3.3.7.

Subsequent

1. Opened Condenser Cooling Water (CCW) cross connect valves 1-CCW-40 and 3-CCW-42.

2. Performed an evaluation of operating continuously with the cross-over valves in the open position in the event of a Turbine Flood.

3. Performed a calculation to verify that the LPSW Pumps would have sufficient NPSH with the cross-over valves open and if the CCW Pump discharge valves were to go closed.

4. Change Operations procedures to document opening of 1-CCW-40 and 3-CCW-42.

5. Administrative controls were placed on removing Emergency Steam Air Ejectors from service.

6. Changed Operations procedures to close the CCW inlet side High and Mid Point vacuum priming isolation valves.

7. Changed Operations surveillance procedure to verify lake levels per Selected Licensee Commitment 16.9.

Planned

1. Design and implement a modification of the control circuitry for the CCW Pump discharge valves to ensure that one valve will remain open when all CCW Pumps are tripped.

2. Changed the CCW Design Basis Document to state that ECCW supply to the LPSW system is required to be single failure proof.

3. Perform single failure analyses on ECCW supply to LPSW.

SAFETY ANALYSIS

The emergency function of the Condenser Cooling Water (CCW) system is to provide a source of water to the Low Pressure Service Water (LPSW) system, which, in turn, provides water for the Low Pressure Injection (Decay Heat Removal) System, the Reactor Building Coolers (RB Ventilation), and various motor, oil, and auxiliary heat exchangers.

In the event of a LOCA, off-site power is available and any operating CCW pump would continue to operate, providing adequate flow rate and NPSH to the LPSW pump suction header.

In the event of a LOCA/LOOP, off-site power would be lost. Under certain scenarios, the CCW pumps would either trip directly due to undervoltage or would be tripped by the Emergency Power Switching Logic "Load Shed" feature. In either case, the intent of the system design is that at least one of the CCW pump discharge valves would remain open to provide a path for gravity/siphon flow, which would be adequate for all emergency functions.

However, the potential exists for a single failure to defeat the control logic of the CCW pump discharge valves. Such a single failure could allow all four CCW pump discharge valves to close and prevent gravity/siphon flow.

Therefore, if one of these restrictive scenarios had occurred, the CCW system could not have supported proper operation of the LPSW system. As a result, long term core cooling and RB cooling could have been adversely affected.

These consequences should be minimized by procedural guidance in Emergency Operating Procedures which instructs the operators to restore power to, and restart, at least one CCW pump as soon as practical for each unit affected by the LOOP.

LPSW does not provide any significant contribution to core cooling until the water inventory in the Borated Water Storage Tank is depleted and the Low Pressure Injection system is placed in recirculation mode to take suction from the Reactor Building emergency sump. This is typically several minutes into the LOCA scenario, and should occur after a CCW pump has been restored to service.

If, for some reason, a CCW pump cannot be restarted on the affected unit, isolation valves could have been opened to connect the affected unit to the CCW system of one of the other Oconee units. Even if the other two Oconee Units were affected by the LOOP, the gravity/siphon CCW flow for one unit would be adequate to provide required flow and NPSH for the LPSW system on the LOCA unit.

In conclusion, the probability of a LOCA/LOOP occurring is very low. Therefore, the inoperability of the Emergency CCW System did not adversely affect the health and safety of the public.