

# ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

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 AUTH. NAME: NORTH, P.J. AUTHOR AFFILIATION: Duke Power Co.  
 TUCKER, H.B. Duke Power Co.  
 RECIP. NAME: RECIPIENT AFFILIATION

DOCKET #  
05000269

SUBJECT: LER 89-003-00: on 890106, reactor bldg cooling units inoperable due to mgt deficiency.

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## LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Oconee Nuclear Station, Unit 1										DOCKET NUMBER (2) 0 5 0 0 0 2 6 1 9										PAGE (3) 1 OF 0 9													
TITLE (4) Reactor Building Cooling Units Inoperable Due to Management Deficiency																																	
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)				
																								Oconee Unit 2					0 5 0 0 0 2 6 1 9				
0 1			0 6			8 9			8 9		0 0 3		0 0 0		2 1 7			8 9			Oconee Unit 3					0 5 0 0 0 2 6 1 7							
OPERATING MODE (9) N						THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)																											
POWER LEVEL (10) 0						20.402(b)						20.405(c)						50.73(a)(2)(iv)						73.71(b)									
						20.405(a)(1)(i)						50.38(e)(1)						50.73(a)(2)(v)						73.71(c)									
						20.405(a)(1)(ii)						50.38(e)(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)(ix)																					
LICENSEE CONTACT FOR THIS LER (12)																																	
NAME Philip J. North, Regulatory Compliance																TELEPHONE NUMBER AREA CODE 7 1 0 4 3 1 7 3 1 - 1 7 1 4 5 1 6																	
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 fifteen single-space typewritten lines) (16)

The Unit 1 "B" Reactor Building Cooling Unit (RBCU) fusible dropout plate failed its initial drop test procedure on January 6, 1989 and failed a subsequent retest on January 7, 1989. The Unit 1 "C" RBCU fusible dropout plate also failed its initial drop test on January 7, 1989 (no retest was performed on the "C" RBCU plate). As a result of the failure of the two plates to drop as required, the immediate corrective actions were to declare the Units 2 and 3 RBCUs inoperable and to remove the plates from the RBCUs. Additionally, three of the six fusible links on the Unit 1 "C" dropout plate were not fusible links designed for this application, but were actually pieces of solid metal which appeared to be fusible links. The Unit 2 "C" and the Unit 3 "C" RBCU dropout plates also stuck to the RBCU ductwork and had to be pried away to allow removal of the plates. Unit 1 was in a refueling outage and Units 2 and 3 were operating at 100% power at the time of this incident. The root cause of this event was management deficiency, since a functional test was not required prior to initial operation of the RBCUs.

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## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES 8/71 85

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

## INTRODUCTION

The Unit 1 "B" Reactor Building Cooling Unit (RBCU) fusible dropout plate failed its initial drop test procedure on January 6, 1989 and failed a subsequent retest on January 7, 1989. The Unit 1 "C" RBCU fusible dropout plate also failed its initial drop test on January 7, 1989 (no retest was performed on the "C" RBCU plate). The Unit 1 "B" RBCU dropout plate failed to drop clear of the RBCU opening as required by procedure because of a lack of space separating the RBCU ductwork from adjacent structural steel. The Unit 1 "C" RBCU dropout plate failed its functional test because it stuck to the RBCU ductwork and therefore did not drop from the RBCU ductwork as required by procedure. As a result of the failure of the two plates to drop as required, the immediate corrective actions were to declare the Units 2 and 3 RBCUs inoperable and to remove the plates from the RBCUs. Additionally, three of the six fusible links on the Unit 1 "C" dropout plate were not fusible links designed for this application, but were actually pieces of solid metal which appeared to be fusible links. The Unit 2 "C" and the Unit 3 "C" RBCU dropout plates also stuck to the RBCU ductwork and had to be pried away to allow removal of the plates. Unit 1 was in a refueling outage and Units 2 and 3 were operating at 100% power at the time of this incident.

A functional test was not performed on the RBCU fusible dropout plates prior to initial operation of the RBCUs. If such a test had been performed, the interference caused by the adjacent structural steel, and the three incorrect links would have been discovered prior to Reactor operation. Also, periodic postoperational surveillance of the RBCU fusible dropout plates was not required or performed. If periodic surveillance of the RBCU dropout plates had been performed, problems associated with plate adherence to the ductwork would have been discovered or prevented. Therefore, the root cause of the above deficiencies is classified as a Management Deficiency due to inadequate surveillance.

## SEQUENCE OF EVENTS

1967 to 1971	• RBCU system designed and installed on Unit 1. Prior to operation of Unit 1, a functional verification was performed.
October 9, 1987	• Action plan developed to test and evaluate the RBCUs.
April 1, 1988	• Informal inspection of Unit 2 fusible dropout plates.
Unit 3 1988 refueling outage.	• Inspection of Unit 3 fusible dropout plates.

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U.S. NUCLEAR REGULATORY COMMISSION

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Oconee Nuclear Station, Unit 1	0500026989	89	003	00	03	OF 09

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

January 6, 1989  
1500 — Mechanical Maintenance (MM) began the Unit 1 "B" Reactor Building Cooling Unit (RBCU) fusible dropout plate test.  
1700 — Station Management was notified that the 1 "B" RBCU dropout plate had not functioned as required.  
1800 — Compliance duty representative and Design Engineering were contacted to determine the operability of the Unit 1 "B" RBCU.

January 7, 1989  
1600 — Unit 1 "B" RBCU fusible dropout plate failed a retest.  
1645 — Unit 1 "C" RBCU dropout plate failed its drop test.  
1800 — Unit 2 "A", "B", and "C" and Unit 3 "A" and "C" RBCU dropout plates were removed.

January 9, 1989  
1330 — Unit 3 "B" RBCU dropout plate was removed.

## BACKGROUND

There are three Reactor Building Cooling Units (RBCU) per Reactor Building. During normal operation, two RBCUs provide sensible cooling at 108,000 cfm each. During post accident operation, three RBCUs provide mostly latent cooling at 54,000 cfm each. Each RBCU contains a fan discharging air through a set of cooling coils, a fusible-linked dropout plate, motor-operated discharge damper, and associated ductwork.

The normal mode of RBCU operation involves discharging containment air across the cooling coils, through the dampers, and then distributing the air through the ductwork. In the event of an accident, severe stresses may be imposed on the lower portion of the ductwork, causing possible collapse or deformation. Such an accident would also result in Reactor Building temperatures above the melting temperature of the fusible links associated with the dropout plates and a pressure drop (due to RBCU fan static pressure) across the dropout plates. Under such accident conditions, a fusible-linked dropout plate in the upper section of ductwork is intended to assure that a positive path for recirculation of the Reactor Building atmosphere is available.

The dropout plate (one per RBCU) is held against the RBCU ductwork with a hinged bracket and fusible metal link arrangement. There are six rods per dropout plate, which connect the upper and lower hinged brackets. Each of the rods are joined together with one pair of fusible metal links. The

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fusible links are designed to melt at approximately 165 degrees F, releasing the hinged brackets and allowing the plates to drop away from the ductwork, thereby providing an exhaust path for the RBCU (regardless of lower ductwork condition). A dropout plate exposes a 30 square foot opening, which is capable of passing considerably more than the emergency air flow of 54,000 cfm each for design basis mitigation.

## DESCRIPTION OF INCIDENT

Between 1967 and 1971 the RBCU system was designed and installed on Unit 1. The original hinged design which attached the plate directly to the ductwork, was changed during this period due to interference with structural steel. Prior to operation of Unit 1, a functional verification of the RBCU fans and coolers was performed; however, the test did not challenge the fusible plates.

On October 9, 1987 a meeting was held to discuss RBCU concerns. This meeting resulted in an action plan to test and evaluate the RBCUs, including the fusible dropout plates. On November 23, 1987, the Unit 1 fusible dropout plates were scheduled for testing during the next outage during which an Integrated Leak Rate Test (ILRT) would be performed (1989 Unit 1 refueling outage). ILRT conditions provide denser air to more accurately simulate post accident conditions for testing RBCU fan performance.

On April 1, 1988 an informal inspection of the Unit 2 fusible dropout plates was performed to ensure the appropriate temperature rating for the fusible links was used, that the associated cables were long enough, hinges were lubricated, and that debris would not hinder proper operation of the hinges or obstruct the drop path of the plates. In response to an NRC Inspector Followup Item, this inspection process was later formalized and performed in accordance with procedure during the Unit 3 1988 refueling outage. The results of both inspections concluded that the Unit 2 and 3 fusible dropout plates were in proper working order.

On January 6, 1989, at approximately 1500 hours, Mechanical Maintenance (MM) personnel began the drop test of the Unit 1 "B" Reactor Building Cooling Unit (RBCU) fusible dropout plate. This was the first time a dropout plate had been formally tested. The Maintenance personnel utilized Work Request 52418H and procedure TM/O/A/3009/03 (RBCU-Fusible Patches-Blowout Test Using Electrothermal Links) to provide instructions and to document task performance. Personnel replaced the six pairs of thermal fusible links on the Unit 1 "B" dropout plate with electrothermal links according to procedure. In the functional test, the electrothermal links melted properly but, because of a lack of space between the RBCU and

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adjacent structural steel, the fusible dropout plate did not drop completely clear of the opening as required by the procedure.

At approximately 1700 hours, Station Management was notified that the Unit 1 "B" RBCU fusible dropout plate had failed its functional test procedure. The Compliance duty representative and Design Engineering support were contacted to assist in determining the operability of the Unit 1 "B" RBCU. Operability of the Unit 1 "B" RBCU was considered indeterminate at this time, because the test procedure did not adequately simulate post accident conditions. It was decided that the 1 "B" RBCU dropout plate would be retested and that the Unit 1 "C" RBCU dropout plate would be initially tested the next day. However, at approximately 1800 hours, the Unit 2 and Unit 3 "B" RBCUs were declared inoperable and a Limiting Condition for Operation (LCO) was entered pursuant to Technical Specifications. Unit 1 was in a refueling outage and was not required to enter a LCO.

As a contingency measure, at about noon on January 7, 1988 Design Engineering initiated a 10 CFR 50.59 safety evaluation to determine the acceptability of operating with dropout plates removed. At approximately 1600 hours on January 7, 1989, MM personnel retested the 1 "B" RBCU fusible dropout plate according to procedure. During the retest, an attempt was made to simulate a crushed duct by closing the fan's isolation dampers. The dampers could not be closed, thus the delta P across the plates did not accurately simulate the postulated post-LOCA conditions. The 1 "B" dropout plate again did not fall clear of the RBCU ductwork opening, but became lodged between the ductwork and adjacent structural steel. The 1 "C" RBCU fusible dropout plate was functionally tested at approximately 1645 hours and failed the test because it adhered to the RBCU ductwork and did not drop as required by procedure. Prior to the test on the Unit 1 "C" RBCU fusible dropout plate, it was recognized that there was only one fusible link per dropout rod and that three of the links were not the required fusible links but were pieces of solid metal. At approximately 1800 hours Units 2 and 3 RBCUs were declared inoperable and the action statement of Specification 3.0 was entered. Design Engineering then completed the 10 CFR 50.59 safety evaluation which determined that there were no unreviewed safety questions involved due to operation with fusible dropout plates removed. The plates on the Unit 2 "A", "B", and "C" RBCUs and the Unit 3 "A" and "C" RBCUs were removed. Prior to plate removal, after cutting the dropout rods associated with the Unit 2 "C" RBCU dropout plate, it was discovered that the Unit 2 "C" plate adhered to the RBCU ductwork. The Unit 2 "C" dropout plate had to be pried away from the ductwork to allow removal. The Unit 2 "A" and "B" and Unit 3 "A" and "B" RBCU dropout plates lodged between the RBCU ductwork and adjacent structural steel, similar to the Unit 1 "B" RBCU dropout plate, after the rods which hold the plates in place were cut, prior to plate removal. The Unit 3 "B" RBCU dropout plate wedged between the RBCU and adjacent structural steel, and could not be

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removed at this time. The Unit 3 "C" dropout plate had to be pried away from the RBCU ductwork because it adhered to the gasket between the plate and the ductwork. After being pried away from the ductwork, the Unit 3 "C" plate was removed from the ductwork opening. The LCO was therefore lifted from Unit 2. However, because one of the Unit 3 RBCU dropout plates still obstructed the ductwork opening, Unit 3 was still under a 7 day LCO at this time. On January 9, at approximately 1330 hours, MM technicians removed the Unit 3 "B" RBCU dropout plate from between the RBCU ductwork and adjacent structural steel, thereby establishing a flowpath and lifting the LCO from Unit 3.

## CAUSE OF OCCURRENCE

Functional testing revealed that the RBCU fusible dropout plate was not properly designed to drop clear of the ductwork without hanging up in the adjacent structural steel. This lack of clearance prevented the Unit 1 "B" RBCU fusible dropout plate from falling and clearing the RBCU ductwork opening as required. Also during testing, three "links" which were actually pieces of solid metal that appeared to be fusible links, were discovered on the Unit 1 "C" RBCU dropout plate. The above deficiencies are attributed to the lack of preoperational functional verification testing of the RBCU dropout plates. Neither Performance Management, nor Mechanical Maintenance Management had required periodic surveillance testing of the RBCU dropout plates. If periodic surveillance of the dropout plates had been performed, problems associated with the Units 1 "C", 2 "C" and 3 "C" RBCU dropout plate adherence to the ductwork would have been discovered or prevented. The deficiency associated with the RBCU dropout plates adhering to the RBCU ductwork is attributed to the lack of periodic postoperational surveillance of the RBCU dropout plates by Performance and Mechanical Maintenance.

All of the above deficiencies could have been prevented if Management had developed a preoperational functional verification test and a postoperational surveillance program for the RBCU dropout plates. Therefore, these deficiencies are classified as a Management Deficiency due to inadequate surveillance. It is noted that the Unit 1 RBCUs were functionally tested prior to operation using procedure, TP/1/A/160/2 (Reactor Building Coolers Functional Test), however this test did not include the RBCU fusible dropout plates.

An action plan to test and evaluate the RBCUs was agreed upon by Oconee Performance, Maintenance, Projects, General Office Performance, and Design Engineering on October 9, 1987. The action plan was the first document found which identified the need to test the RBCU fusible dropout plates, but it did not specify when the tests would be performed. A memo dated November 23, 1987 from Oconee Performance to Design Engineering specified

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U.S. NUCLEAR REGULATORY COMMISSION

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that the Unit 1 dropout plates would be tested during the 1989 Unit 1 refueling outage during the ILRT. It is also noted that, due to the identified need to perform an inspection of the RBCU dropout plates, an informal inspection of the Unit 2 RBCU fusible dropout plates was conducted by Mechanical Maintenance on April 1, 1988.

The inspection process was formalized in accordance with NRC Inspector Followup Items 269, 270, 287/88-08-03, and the Unit 3 RBCU fusible dropout plates were inspected according to procedure MP/O/A/3009/14 (RBCU-Fusible Patches- Preventive Maintenance Inspection) during the Unit 3 1988 refueling outage. This inspection was conducted to ensure the appropriate temperature rating for the fusible links was used, that the associated safety cables were long enough, and that debris would not hinder proper operation of the hinges or obstruct the plate "drop path". The failure of the Units 1, 2, and 3 RBCU dropout plates to properly function indicates that a testing program was needed in conjunction with the inspection program. The Unit 1 test described in this report was the first documented functional test of the RBCU dropout plates. The Unit 1 test was also the first time that the Unit 1 plates had been formally inspected. Units 2 and 3 RBCU dropout plates were to have been inspected and tested at the next respective unit refueling outage.

Units 2 and 3 are currently operating with their RBCU fusible dropout plates removed. The RBCU ductwork is therefore in its "accident alignment", which has been determined to be acceptable by Design Engineering in accordance with 10CFR50.59 Safety Evaluation criteria.

There has been one incident in the past year involving RBCUs. LER 287/88-03 addressed degraded capabilities of the Unit 3 RBCUs due to fouling. None of the corrective actions contained in LER 287/88-03 could have prevented the incident described in this report. Therefore, this is a nonrecurring event.

Because the RBCU fusible dropout plates are considered as part of the RBCU ductwork and because they failed to function as required, this event is NPRDS reportable. The RBCU ductwork system was designed by Bechtel and was installed by a local contractor. No part numbers are associated with the dropout plates.

No releases of radioactive materials, radiation exposures, or personnel injuries were involved with this event.



## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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## CORRECTIVE ACTIONS

The immediate corrective action was to declare Units 1, 2, and 3 Reactor Building Cooling Units (RBCU) inoperable.

Subsequent corrective actions were:

Completion of a 10CFR50.59 Safety Evaluation, for operation with the fusible dropout plates removed from the RBCUs.

Removal of dropout plates from all RBCUs after the Unit 1 "B" RBCU plate failed the retest procedure and the Unit 1 "C" RBCU dropout plate failed its first test procedure.

Approval of a Station Problem Report requesting redesign of the RBCU dropout plates or justification for leaving the plates off of the RBCUs.

Redesign and successful test of all three Unit 1 RBCU fusible dropout plates.

Planned corrective actions are:

A RBCU task force has been formed to address problems associated with the RBCUs.

Redesign and test Unit 2 and Unit 3 RBCU fusible dropout plates.

Upon reinstallation of the plates, Mechanical Maintenance shall perform functional tests on the RBCU dropout plates at a frequency suitable to ensure plate operability.

A pilot study to reconstruct the design basis of the Emergency Feedwater System is expected to be completed by June 30, 1989. The extent of verification of other systems will be based on the results of the pilot study. Duke Power Company plans on discussing the results of the study with the NRC in 1989.

## SAFETY ANALYSIS

The results of the January 6, 1989 and January 7, 1989 tests of the Unit 1 Reactor Building Cooling Unit (RBCU) "B" and "C" fusible dropout plates indicate that the ability of the dropout plates to guarantee an adequate path for the post-accident steam/air mixture off of the RBCU coil discharges, in the event of post-LOCA duct blockage, may have been

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hindered. A test condition representative of the post-LOCA situation (RBCUs circulating high density air in the Reactor Building, with lower ductwork blockage) was not attained during the tests, and would likely have improved the performance of Unit 1 "B" RBCU dropout plate; however, the Unit 1 "C" RBCU dropout plate had become adhered to the duct over time, and the existence of non-fusible links on this plate rendered it inoperable. In addition, the structural steel in front of the Unit 1 "B" RBCU dropout plate prevented it from falling completely away, which, in the absence of a test condition representative of a post-LOCA situation, implicated all of the remaining fusible plates.

In light of the above, it was assumed on January 7 that all of the fusible dropout plates on the RBCUs were inoperable.

Upon removal of the RBCU fusible dropout plates in both Units 2 and 3 to ensure operability, it was further noted that the structural steel in front of the plates interfered to some extent with all "A" and "B" RBCU dropout plates, and that the "C" dropout plates on Units 2 and 3 RBCUs had adhered to the ductwork in similar fashion to Unit 1 "C" RBCU dropout plate. By design, the plates are required to function only in the event that, after a high-energy-release accident, the lower portions of the RBCU ductwork have crimped, flooded, or otherwise deformed sufficiently so as to block airflow completely. It should be noted that there are two distinct branches of ductwork in the system, and the likelihood of both branches being blocked simultaneously is remote. A mechanism of destruction that leaves an airflow path (e.g., ductwork torn open or detached below the RBCU coils) is redundant to the fusible dropout plates' function. Obviously, destruction location and mechanism cannot be predicted.

Given the assumed inoperability of all RBCU fusible dropout plates, the post-LOCA Reactor Building heatup and pressurization would be mitigated by the Reactor Building Spray System, Low Pressure Injection (LPI) coolers, and the passive structural heat sinks. The Reactor Building spray system takes suction from the borated water storage tank during the injection phase, and from the sump during the recirculation phase. Reactor Building spray suction can be manually aligned to the LPI cooler discharge in order to obtain cooler spray at the discretion of station management. The potential exists that the long term Reactor Building response may exceed the Environmental Qualification (EQ) envelope with a complete failure of the RBCUs. The probability of actually exceeding the EQ envelope is considered to be low considering the substantial period of time that exists for damage control measures and for optimizing the mitigation capability of the above mentioned systems.

An accident which required the RBCU dropout plates to fall did not occur and corrective actions are being implemented to assure future operability; therefore, the health and safety of the public were not affected as a result of this incident.

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**DUKE POWER**

February 17, 1989

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

Subject: **Oconee Nuclear Station**  
**Docket Nos. 50-269, -270, -287**  
**LER 269/89-03**

Gentlemen:

Pursuant to 10CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report (LER) 269/89-03 concerning the inoperability of reactor building cooling units. My letter of February 6, 1989 informed the NRC of the delay in submitting this report.

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,

Hal B. Tucker

PJN/ler8

Attachment

xc: Mr. M.L. Ernst  
Regional Administrator, Region II  
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