

# ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8810120334 DOC.DATE: 88/10/04 NOTARIZED: NO DOCKET #  
 FACIL:50-261 H.B. Robinson Plant, Unit 2, Carolina Power & Light C 05000261  
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SUBJECT: LER 88-019-00:on 880905,inoperable containment fan coolers  
 due to biological fouling.

W/8 ltr.

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 TITLE: 50.73 Licensee Event Report (LER), Incident Rpt, etc.

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8/10/88

## LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2										DOCKET NUMBER (2) 0 5 0 0 0 2 6 1				PAGE (3) 1 OF 5	
TITLE (4) INOPERABLE CONTAINMENT FAN COOLERS DUE TO BIOLOGICAL FOULING															
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)		
09	05	88	88	019	001	01	00	48					0 5 0 0 0		
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)													
N		20.402(b)				20.405(c)				50.73(a)(2)(iv)				73.71(b)	
POWER LEVEL (10)		20.405(a)(1)(i)				50.38(c)(1)				50.73(a)(2)(v)				73.71(c)	
0 0 0		20.405(a)(1)(ii)				50.38(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)															
NAME Don Sayre, Senior Specialist - Regulatory Compliance										TELEPHONE NUMBER AREA CODE 8 0 3 3 8 3 - 1 2 4 2					
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					
X	B K	C L R	W 1 2 0	Y											
SUPPLEMENTAL REPORT EXPECTED (14)										EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR	
X YES (If yes, complete EXPECTED SUBMISSION DATE)										NO		01	31	89	

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

On September 5, 1988, with Unit 2 in Cold Shutdown, the licensee notified the NRC of a four-hour nonemergency event at 1502 hours, in accordance with 10CFR50.72. Inspection of the Containment Fan Coolers revealed significant biological fouling which reduced the overall cooling coil tube inner diameter by more than 20 percent, thereby reducing the coolers' Design Basis Accident heat removal capability. Inspection of the fan motor coolers found similar biofouling. Unit 2 had been removed from operation on August 31, 1988 to allow investigation into an apparent vacuum on the service water outlet of one of the fan coolers. The fan and motor coolers were cleaned, inspected, and hydrostatically tested. Other safety-related heat exchangers were evaluated for fouling and were found operable. Pressure indicators were installed on one fan cooler to alert Plant operators of fouling and thermocouples were installed to measure air side temperature differential as an indication of cooler performance. Unit 2 was returned to power operation on September 19, 1988. This LER is submitted pursuant to 10CFR50.73 (a)(2)(ii).

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PDR ADOCK 05000261  
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NRC Form 368A  
(9-83)

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY

APPROVED OMB NO. 315

EXPIRES: 8/31/88

FACILITY NAME (1)  H. B. ROBINSON S. E. PLANT, UNIT 2	DOCKET NUMBER (2)  0 5 0 0 0 2 6 1 8 8	LER NUMBER (3)			PAGE
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TEXT (If more space is required, use additional NRC Form 368A's) (17)

I. DESCRIPTION OF EVENT

On Monday, September 5, 1988 at 1502 hours, the licensee notified the NRC Operations Center of a four-hour nonemergency event in accordance with 10CFR50.72(b)(2)(i). Unit 2 had been in Cold Shutdown since 0916 hours, September 1, 1988.<sup>1</sup>

At the time of the notification, inspection of the Containment fan coolers had found significant biological fouling of the cooling coil tubes.<sup>2</sup> The biofouling had reduced the overall tube inner diameter by greater than 20 percent. According to the fan cooler designer, this reduction in tube inner diameter would create a "channeling" effect, with the majority of the inlet flow being channeled through a minority of tubes.<sup>3</sup> This effect, in addition to heat transfer loss across the tube surface, would reduce the heat removal capability of the coolers under Design Basis Accident (DBA) conditions.

Subsequent inspection of the four fan motor coolers also found similar biofouling.

The following chronological description provides pertinent information on the event including the associated investigation and resolution.

A 1983 Plant Modification, M-769, had installed new fan cooler coils of AL6X material to replace the original copper-alloy coils.<sup>4,5</sup>

In 1984, Plant Modification M-858, was developed to provide for replacement of Service Water System piping inside of the Reactor Containment Vessel.<sup>6,7</sup> The piping was replaced to resolve a problem with Microbiologically Induced Corrosion (MIC) of the Service Water piping. The intent was to replace piping where Service Water operating pressures were below 42 psig, the Containment Design Basis Accident (DBA) pressure scheduled for implementation during Refueling Outage No. 12, to begin in November 1988.<sup>8</sup> Flow data from a 1981 Plant Special Procedure, SP-291, was intended to provide the basis for determining which piping locations were affected.<sup>9</sup>

1/H. B. Robinson Steam Electric Plant, Unit No. 2 is a Westinghouse 700 megawatt Pressurized Water Reactor nuclear power plant, in commercial operation since March 1971.

2/Reactor Containment fan coolers EIIIS Codes: System - BK; Component - CLR; Manufacturer - W120.

3/Westinghouse designed the fan and motor coolers.

4/Plant Modification M-769, HVH Fan and Motor Cooler Replacement.

5/AL6X is a trade name for Alleghany Ludlum stainless steel material.

6/Plant Modification M-858, Unit 2: HVH-3 Service Water Piping Replacement and HVH-1, 2, 3, 4 Motor Cooler Piping Replacement.

7/Service Water System piping EIIIS Codes: System - BI; Component - Not available; Manufacturer - W120.

8/Containment Elevation 254 had been identified as the point above which the piping operating pressures could be below 42 psig. The fan and motor coolers are located on the third level of Containment, at Elevation 275.

9/Special Procedure SP-291, Service Water Discharge Pressure Verification for HVH-1, 2, 3, 4.

NRC Form 368A  
(9-83)

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/88

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)		
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H. B. ROBINSON S. E. PLANT, UNIT 2	0 5 0 0 0 2 6 1	8 8	0 1 9	0 0	0 3	OF	0 5

TEXT (If more space is required, use additional NRC Form 368A's) (17)

In mid-August of 1988, licensee Engineering personnel requested that the existing Service Water piping operating pressures inside Containment be calculated to confirm the piping locations affected. Discussions between the licensee Engineering groups considered replacing the Service Water supply and return piping inside Containment for the four fan coolers, HVH-1 through HVH-4, and their associated motor coolers. The discussions also considered an apparent discrepancy between Service Water System operating pressures as measured in late 1986/early 1987 versus the 1981 measurements. Operating pressures in the fan coolers service water return piping measured at locations in the Charging Pump Room of the Reactor Auxiliary Building, at Elevation 226, were 4 to 20 psig in 1986/1987 compared to 41 to 59 psig in 1981.

It was questioned whether an apparent siphon effect on the return piping header may be aggravating the pressure at the top of the HVH units, and whether the pressure drop was actually across the fan coolers or somewhere upstream on the supply side. Investigation continued until it was determined that resolution of potential operability questions would require additional testing that would have been extremely difficult to perform with the Plant operating due to the need for discretionary Limiting Conditions for Operation (LCOs) on the HVH units and Service Water Booster pumps.

At 0633, Wednesday, August 31, 1988, the reactor was taken to Hot Shutdown, initiated by Plant Management, to allow investigation into the Service Water concerns.

On September 3, HVH-4 was internally inspected and biofouling was found. The other three fan coolers were then inspected for fouling or flow blockage and similar conditions were found.

On September 5, review of information from the fan coolers designer determined that the reduction of the overall tube inner diameter by greater than 20 percent would create a channeling of the majority of the supply flow and reduce the heat removal capability of the coolers under DBA conditions. The NRC was notified in accordance with regulatory reporting requirements. Efforts continued to clean the cooler tubes and return the HVH units to service.

On September 15, Plant Management held a conference call with the NRC Region II Atlanta office, to provide information on the results of the investigation and the near term corrective actions as well as the intent for Plant startup. During the conversation, commitment was made to provide a long term corrective action plans to be performed during the 1988 Refueling Outage regarding the Service Water System by November 1, 1988.

On September 17, Plant heatup began. The Plant was taken critical on September 18 and on September 19, the reactor was returned to power operation.

This LER is submitted pursuant to 10CFR50.73 (a)(2)(ii).

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO.  
EXPIRES: 8/31/88

FACILITY NAME (1)  H. B. ROBINSON S. E. PLANT, UNIT 2	DOCKET NUMBER (2)  0 5 0 0 0 2 6 1 8 8	LER NUMBER (6)		
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TEXT (If more space is required, use additional NRC Form 388A's) (17)

II. CAUSE OF EVENT

The reduced pressure on the HVH units' Service Water return piping was caused by biofouling of the cooler tubes. The biofouling also caused the coolers to be inoperable with regard to heat removal capability under DBA conditions.

An assessment and determination of the root cause of the event is underway and will be published under a Plant Operating Experience Report, No. 88-19. This LER will be supplemented following Refueling Outage No. 12, to provide additional information on the root cause and corrective actions.

III. ANALYSIS OF EVENT

Plant Technical Specification 3.3.2.1.c requires four Containment fan coolers to be operable whenever the reactor is critical. Specification 3.3.2.1.d requires all essential features associated with the Fan Coolers to be operable whenever the reactor is critical.

The Containment cooling function is provided by two independent systems: fan cooler and containment spray pumps. During normal power operation, the fan coolers are used to remove heat lost from equipment and piping within Containment. In the event of a DBA, any one of the following combinations will provide sufficient cooling to reduce Containment pressure: (1) four fan cooler units, (2) two containment spray pumps, (3) two fan cooler units and one spray pump.

The Containment is designed for an accident pressure of 42 psig.

The four fan cooler units are assumed to have been inoperable prior to Plant shutdown on August 31, based on the subsequent discovery of significant biofouling in the cooling coils. It has not been determined when this fouled condition began. Since the coils were installed in 1983, it is possible that the long periods when the fan coolers were in standby during the 1984 steam generator replacement outage was the initiating factor in the fouling buildup. The inoperability of more than two fan coolers is outside of the design basis and constitutes an unreviewed safety question.

IV. CORRECTIVE ACTION

The four Containment fan coolers and their associated fan motor coolers were cleaned of biofouling and inspected. The units were hydrostatically tested to assure tube integrity and returned to service.

Plant Modification M-968 installed a differential pressure and a pressure indicator on the HVH-4 fan cooler to monitor performance and alert Plant operators of any change in differential pressure by 2 psi from normal as an indication of fouling. HVH-4 exhibited the lowest cooler discharge pressure prior to cleaning.

Other safety-related Service Water heat exchangers were evaluated or inspected for similar biofouling. None were found inoperable.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/88

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (8)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
H. B. ROBINSON S. E. PLANT, UNIT 2	0 5 0 0 0 2 6 1	8 8	— 0 1 9	— 0 0	0 5	OF 0 5

TEXT (If more space is required, use additional NRC Form 388A's) (17)

V. ADDITIONAL INFORMATION

## A. Failed Component Identification

The fan coolers are of Westinghouse Sturtevant design. The cooling coils are fabricated of copper plate fins vertically oriented on Alleghany Ludlum AL6X stainless steel tubes. The heat removal capability of the cooling coils is  $40 \times 10^6$  Btu/hour per air handling unit at saturation conditions. The design internal pressure of the coil is 150 psig at 300 degrees Fahrenheit and the coils can withstand an external pressure of 60 psig at a temperature of 298 without damage. Local flow and temperature indication of Service Water are provided for each air handling unit. Alarms indicating abnormal cooling water flow and radioactivity in the cooling water discharge are provided in the Plant Control Room. The coils are provided with drain pans and drain piping to prevent flooding during accident conditions. This condensate is drained to the Containment sump.

The fan cooler motors are totally enclosed water cooled, 350 horsepower, induction type, three phase, 60 cycle, 720 rpm, Thermalastic 440 volt with ample insulation margin. An air to water heat exchanger is connected to the motor to form an entirely enclosed cooling system. The motor coolers are fabricated of AL6X stainless steel.

Westinghouse Sturtevant cooling coils are Model No. WC-36112.23, stacked six high to a unit.

## B. Previous Similar Events

There have been a number of prior LERs issued on the Containment fan coolers as well as the Service Water System piping because of MIC; however, there have been no previous events involving fouling of the cooling coils as an impact to DBA heat removal capability.



Carolina Power & Light Company

ROBINSON NUCLEAR PROJECT DEPARTMENT  
POST OFFICE BOX 790  
HARTSVILLE, SOUTH CAROLINA 29550

OCT 4 1988

Robinson File No: 13510C

Serial: RNP/88-4637  
(10 CFR 50.73)

United States Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D. C. 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2  
DOCKET NO. 50-261  
LICENSE NO. DPR-23  
LICENSEE EVENT REPORT 88-019-00

Gentlemen:

The enclosed Licensee Event Report (LER) is submitted in accordance with  
10 CFR 50.73 and NUREG-1022 including Supplements No. 1 and 2.

Very truly yours,

R. E. Morgan  
General Manager  
H. B. Robinson S. E. Plant

Enclosure

cc: Dr. J. N. Grace  
Mr. L. W. Garner  
INPO

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