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ACCESSION NBR:8909220133 DOC.DATE: 89/09/15 NOTARIZED: NO DOCKET #
 FACIL:50-261 H.B. Robinson Plant, Unit 2, Carolina Power & Light C 05000261
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SUBJECT: LER 89-010-00:on 890816,inadequate auxiliary feedwater pump
 net positive suction head.

W/8 ltr.

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Carolina Power & Light Company

Company Correspondence

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SEP. 15 1989

Robinson File No: 13510C

Serial: RNP/89-3128
(10 CFR 50.73)

United States Nuclear Regulatory Commission
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
LICENSEE EVENT REPORT 89-010

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

CTB:lko

Enclosure

cc: Mr. S. D. Ebnetter
Mr. L. W. Garner
INPO

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APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

Based on calculations performed as part of the on-going Design Basis Reconstitution, it was determined that adequate net positive suction head (NPSH) for the Auxiliary Feedwater (AFW) pumps could not be assured for all possible combinations of running AFW pumps and Condensate Storage Tank (CST) levels. To assure adequate NPSH to the MD AFW pumps, the SD AFW pump was administratively removed from service at 1255 hours on August 16, 1989. The NRC was notified of this design deficiency by the Emergency Notification System (ENS) at 1346 hours in accordance with 10CFR50.72(b)(1)(ii)(B). Refined calculations showed that sufficient NPSH could be assured for only one MD AFW pump operating at rated flow, which resulted in MD AFW pump "B" being administratively removed from service at 2230 hours on August 21, 1989. Practical resolution of the problem could not be achieved within the 24 hour Technical Specification time requirement; a plant shutdown was initiated at 0000 hours on August 22, 1989. Pursuant to the requirements of 10CFR50.72(b)(1)(i)(A), the NRC was notified of the unit shutdown via the ENS at 0011 hours on August 22, 1989. Prior to returning the unit to service, the AFW suction piping will be replaced and the pumps inspected and refurbished. This Licensee Event Report is submitted to fulfill the requirements of 10CFR50.73(a)(2)(ii)(B), 10CFR50.73(a)(2)(i)(A), and Technical Specification 3.4.4.a.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 365A's) (17)

I. Description of Event

Based on calculations performed as part of the on-going Design Basis Reconstitution, it was determined that adequate net positive suction head (NPSH) for the Auxiliary Feedwater (AFW) pumps could not be assured for all possible combinations of running AFW pumps and Condensate Storage Tank (CST) levels. The H. B. Robinson Unit 2 (HBR2) AFW system consists of a CST which supplies two motor driven (MD) and one steam driven (SD) AFW pump by a common suction header.^{1,2} With all AFW pumps running at design flow rates and a CST level of 100%, available NPSH would be insufficient following a main steamline break. Although sufficient flow would be available for decay heat removal, continued operation of all AFW pumps at design flow rates could not be assured under all postulated accident scenarios.

Based on notification to the site of the results of this calculation, the SD AFW pump, which was determined to be the most limiting with regard to required NPSH, was declared administratively out of service at 1255 hours on August 16, 1989. This was accomplished by opening the power supply breakers to the SD AFW pump steam supply valves. Since MD AFW pump "B" had been declared out of service for unrelated reasons at 0015 hours on August 16, the requirements of Technical Specification 3.4.5 were applicable which required at least one of the two AFW pumps to be returned to an operable status within 24 hours. At 1715 hours on August 16, MD AFW pump "B" was returned to service following maintenance and testing. However, since at least one AFW pump had been inoperable since 0015 hours, the requirements of Technical Specification 3.4.4 were applicable. This specification states that, "with one (AFW) pump and/or essential features inoperable, restore that (AFW) pump and/or essential features to operable status within the 72 hours, or submit a Special Report to the Commission within 30 days . . . and; restore all three (AFW) pumps and their essential features to operable status within 7 days or be in at least hot shutdown within 6 hours." Based on the conditions at that time, a plant shutdown was required to be initiated not later than 0015 hours on August 23, 1989.

¹ H. B. Robinson Steam Electric Plant, Unit No. 2 is a Westinghouse 700 MW Pressurized Water Reactor in commercial operation since March 1971.
² EIIS Codes: System - BA; Components - P, TK; Manufacturer - W120, P025, C310.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/88

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

With the plant on-line at full load, an effort was undertaken to validate the results of the calculation by taking measurements of suction pipe pressure drop with both MD AFW pumps running and providing flow to the steam generators. Based on the empirical data obtained, it was determined that the existing calculation produced results which were nonconservative. When adjusted for the empirical data obtained, the revised calculation resulted in a further increase in the required CST level to assure adequate NPSH to the two operable MD AFW pumps. As such, it was concluded that sufficient NPSH could be assured for only one MD AFW pump operating at rated flow, even with a maximum level available in the CST. Therefore, at 2230 hours on August 21, MD AFW pump "B" was declared administratively out of service to assure adequate NPSH to the remaining MD AFW pump. As such, Technical Specification 3.4.5 was again applicable. Since it was apparent that practical resolution of the root cause of this problem could not be achieved within the 24 hour Technical Specification time requirement, a plant shutdown was initiated at 0000 hours on August 22.

Based on the above discussion, this Licensee Event Report serves to meet the following reporting requirements:

1. 10CFR50.73(a)(2)(ii)(B) - an event or condition that resulted in the plant being in a condition that was outside the design basis.
2. 10CFR50.73(a)(2)(i)(A) - the completion of any nuclear plant shutdown required by the plant's Technical Specifications.
3. Technical Specification 3.4.4.a requires that if one AFW pump and/or essential features is inoperable for more than 72 hours, submit a 30 day Special Report to the NRC outlining the cause of the inoperability and the action taken to return the pump and/or essential features to operable status.

II. Cause of Event

The cause of this event is a design deficiency in that the AFW pumps' suction piping was inadequate to provide the required NPSH during simultaneous operation of all AFW pumps at rated flow, even when assuming a maximum level in the CST.³ This design deficiency has existed since initial plant startup. The three AFW pumps are supplied by a common six inch ID header from the CST. As stated above, with all AFW pumps in operation at rated flow, the pressure drop through this suction piping caused the NPSH available to the AFW pumps to be less than the NPSH required.

³Cause Code: B.

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TEXT (If more space is required, use additional NRC Form 305A's) (17)

Further, it has been determined during removal and inspection of the suction piping that the inner wall of this piping has experienced a significant buildup of deposits and corrosion products. This buildup was not sufficient to be considered as an element of flow blockage, but had increased the roughness of the inner pipe wall to such a degree that an approximated "friction factor" for the roughened pipe wall fell into the range normally expected for concrete piping. This general corrosion of the inner pipe wall caused an increased pressure drop through the AFW pump suction piping, thereby aggravating the NPSH problem. The exact cause of this general corrosion has not yet been established, but it is reasonable to believe that a significant portion of this corrosion developed during the 1970s and early 1980s, prior to the implementation of the more strict EPRI Water Chemistry Guidelines.

III. Analysis of Event

As stated above, the calculational results showed that available NPSH to the AFW pumps was insufficient to assure continued operation under the full range of postulated accident scenarios. It was further stated that this design deficiency has apparently existed since initial plant startup. To assess the safety significance of this situation, a review was performed of available historical operating records and computer data. This review revealed instances, the first documented case occurring in December of 1986, where all AFW pumps automatically started, but, as the SD AFW pump came on-line, volume flow from all three pumps was reduced. For example, during a reactor trip with automatic start of all AFW pumps which occurred on July 10, 1987, the following actual flows were experienced:

	<u>Actual Flow</u>	<u>Expected Flow</u>
MD AFW Pump A	250 GPM	325 GPM
MD AFW Pump B	248 GPM	325 GPM
SD AFW Pump	385 GPM	600 GPM

During this review, there were no instances identified where insufficient flow was available to the steam generators. Also, no instances were discovered where all AFW pumps were in simultaneous operation for a significant length of time (greater than approximately 8 to 10 minutes). No instances were identified where an AFW pump tripped or was otherwise made unavailable due to insufficient NPSH.

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

Assuming a situation occurred in which AFW flow was insufficient or unavailable, plant procedures provide compensatory or mitigating actions to help restore heat removal capability from the steam generators. These procedures include Abnormal and Emergency Operating Procedures. Various options would be available to either restore AFW flow, or to provide flow to steam generators using an alternate water source such as main feedwater pumps or condensate pumps. Restoration of one MD AFW pump would be sufficient to ensure secondary heat removal for the accident scenarios analyzed in Chapter 15 of the HBR2 Final Safety Analysis Report.

This event is reported pursuant to the requirements of 10CFR50.73(a)(2)(ii)(B), 10CFR50.73(a)(2)(i)(A), and Technical Specification 3.4.4.a.

IV. Corrective Action

To correct the design deficiency associated with the AFW pump suction piping, the existing piping will be completely removed and replaced with a larger diameter suction pipe. The new common suction header will have a twelve inch ID versus the existing six inch ID piping. Also, various sections of piping from the common suction header to the individual AFW pumps will be replaced with larger diameter pipe. Analyses are in progress to ensure that this larger suction piping arrangement will reduce the pressure drop sufficiently to ensure adequate NPSH under all operating configurations.

Also, to the extent possible, the newly installed suction piping will be stainless steel. The piping to be removed, which was susceptible to the general corrosion observed, was carbon steel. The stainless steel piping will be less susceptible to corrosion.

In addition, while the unit is shutdown for replacement of the AFW suction piping, all of the AFW pumps will be disassembled, inspected, and refurbished as needed. This includes an inspection of the pump casing and internals, and an examination to determine whether there is visible evidence that any of the pumps have sustained cavitation damage due to inadequate NPSH. At the time of this report, an examination of these pumps had been completed. This examination revealed no indication of significant degradation caused by inadequate NPSH.

To firmly establish that the modified and refurbished AFW system fully meets all design requirements and conditions for operability, a series of post-modification tests will be performed. These tests are intended to ensure that the AFW system is fully operable and ready to support safe operation of the unit.

Should any of the on-going analyses or investigations result in conclusions or corrective actions which are different than those stated, a supplement to this LER will be provided describing these results and activities.

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

Certain aspects of this event have been reviewed by an NRC Augmented Inspection Team, the site Resident Inspectors and Region II, and the Office of Nuclear Reactor Regulation. This event will also be discussed within a Startup Conference and an Enforcement Conference. Based on these activities, additional causes and corrective actions may be identified. These developments will be documented within the correspondence associated with these inspection and enforcement activities.

V. Additional Information

A. Failed Component Identification

None

B. Previous Similar Events

1. Licensee Event Report 89-008, submitted May 4, 1989, described a potential for loss of both trains of Residual Heat Removal (RHR) by flooding of the RHR pump pit. This potential was discovered during a field-walkdown of the Design Basis Document.
2. Licensee Event Report 88-023, submitted November 9, 1988, described a potential overcurrent condition on safety-related Motor Control Centers. This was discovered during performance of calculations prepared as part of the Design Basis Reconstitution.