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SUBJECT: LER 93-031-01:on 931109,engineering evaluation determined that MCR HVAC sys will not maintain CR temp.Caused by inadequate design margin in original design.PER written to document potential analysis concerns.W/940107 ltr.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • 3000 George Washington Way • Richland, Washington 99352

January 7, 1994
G02-94-009

NCR 293-1302

Docket No. 50-397

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

Subject: **NUCLEAR PLANT WNP-2, OPERATING LICENSE NPF-21**
LICENSEE EVENT REPORT NO. 93-031-01

Transmitted herewith is Licensee Event Report No. 93-031-01 for the WNP-2 Plant. This report is submitted in response to the report requirements of 10CFR50.73 and discusses the items of reportability, corrective action taken, and action taken to preclude recurrence.

The event reported by this LER is a supplement to 93-031 originally submitted on 12-09-93. Supplemental information principally consists of amplification of the following topics: 1) Further Corrective Action, 2) Safety Significance, and 3) EIIS Information. This amplification, as well as other editorial changes, are appropriately flagged with revision bars.

Sincerely,

J. V. Parrish (Mail Drop 1023)
Assistant Managing Director, Operations

JVP/KRL/la
Enclosure

cc: Mr. K. E. Perkins, NRC - Region V
Mr. R. Barr, NRC Resident Inspector (Mail Drop 901A, 2 Copies)
INPO Records Center - Atlanta, GA
Mr. D. L. Williams, BPA (Mail Drop 399)

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Washington Nuclear Plant - Unit 2	0 5 0 0 0 3 9 7	1 OF 6

TITLE (4)
MAIN CONTROL ROOM HVAC HIGH TEMPERATURE CONDITION DURING A DBA

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 NUMBERS(S)
1 0	0 9	9 3	9 3	0 3 1	0 1	0 1	0 7	9 4		0 5 0 0 0
										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)			
1				
POWER LEVEL (10) 1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	77.71(b)
	20.405(a)(1)(i)	50.36(c)(1)	x 50.73(a)(2)(v)	73.73(c)
	20.405(a)(1)(ii)	50.36(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	TELEPHONE NUMBER
K.B. Lewis, Technical Specialist	AREA CODE 5 0 9 3 7 7 - 4 1 4 5

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 (16)

At 1200 hours on November 9, 1993, with the reactor at 100% power, an engineering evaluation determined that the Main Control Room HVAC system will not maintain control room temperature below the design basis limit of 104 degrees Fahrenheit following a Design Basis Accident (DBA). This postulated event involves extreme warm-weather conditions with only the Standby Service Water system available for heat removal. The potential to exceed this design temperature limit is based on current knowledge of Standby Service Water system fouled cooling coil UA values.

Upon discovery, a PER was written to document the potential design analysis concerns. Further corrective actions include revising the applicable procedure to maintain control room temperature below its design limit and reviewing other components utilizing service water to ensure appropriate fouling and cooling water temperatures have been considered.

The root cause of this event was inadequate design margin in the original design including a failure to account for cooling-coil fouling. A contributing cause was a less than adequate process for factoring fouling considerations into the original and subsequent design calculations.

Although this condition does not presently affect plant operability, the design basis temperature could have been exceeded during past summers coincident with design basis accident conditions.

Plant Conditions

Power Level - 100%
Plant Mode - 1 (Power)

Event Description

At 1200 hours on November 9, 1993, with the reactor at 100% power, an engineering evaluation determined that the Main Control Room HVAC system will not maintain control room temperature below the design basis limit of 104 degrees Fahrenheit following a Design Basis Accident (DBA). This postulated event involves extreme warm-weather conditions with only the Standby Service Water system available for heat removal. The potential to exceed this design temperature limit is based on current knowledge of Standby Service Water system fouled cooling coil UA values. New calculations indicate that Main Control Room temperature could exceed 104 degrees Fahrenheit approximately 12 hours into the postulated accident and that its temperature could peak at approximately 107.9 degrees Fahrenheit.

Calculations show that a standby service water temperature of 83.4 degrees Fahrenheit can maintain the Main Control Room at or below the 104 degrees Fahrenheit design limit. As shown by calculation ME-02-93-12, for a postulated DBA during the months of October through April, the maximum service water temperature does not exceed 80.8 degrees Fahrenheit; therefore, with significant margin, control room operability is not compromised by this event during those months. Only during warm-weather months would reduced heat load be needed to preclude the potential to exceed the 104 degrees Fahrenheit design limit.

Immediate Corrective Action

Upon discovery, a PER was written to document the potential design analysis concerns. Because this postulated event does not currently affect plant operability, no additional immediate corrective action was necessary.

Further Evaluation, Root Cause, and Corrective Action

Further Evaluation

1. On November 9, 1993, at approximately 1408 hours, this event was reported to the NRC by telephone in accordance with 10CFR50.72(b)(2)(iii)(D) which requires the Licensee to notify the NRC within four hours of "any event ... that alone could have prevented the fulfillment of the safety function of structures of systems that are needed to mitigate the consequences of an accident". This event is also being reported to the NRC in accordance with 10CFR50.73.(a)(2)(v)(D) "... mitigate the consequences of an accident".

2. There were no structures, systems, or components inoperable at the time of this report submittal that contributed to this hypothetical problem.

3. The Main Control Room HVAC system includes two divisional air handlers, WMA-AH-51A and 51B. Each air handler is provided with normal and emergency cooling coils. Emergency coils WMA-CC-51A-1 and 51B-1 include connections with the Standby Service Water system and an Emergency Chiller system provided for control room habitability. As stated, the potential to exceed the Main Control Room design temperature limit is based on current knowledge of Standby Service Water system fouled cooling coil UA values:

   a. The original 1971 Burns and Roe calculation (BRI 9.32.0 and its two subsequent revisions) which calculated Main Control Room, Cable Spreading Room, and Critical Switchgear Room HVAC system temperatures demonstrated that the Main Control Room would remain below 104 degrees Fahrenheit with a service water temperature of 85 degrees Fahrenheit, fixed load values and appropriate safety factors, and a UA value corresponding to 100% efficiency.

   b. Following the original 1971 Burns and Roe calculation, utilities began to receive industry documents describing biofouling problems associated with service water cooling coils and heat exchanger tubes. Specifically, NRC Generic Letter GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment (July 1989)", included recommended actions to mitigate the effects of biofouling. In compliance with NRC GL 89-13, the Supply System implemented by R5 (1990) differential pressure and thermal performance testing on water-to-water heat exchangers in the plant, and differential pressure testing on air-to-water cooling coils served by service water.

      As performance concerns developed from the water-to-water testing, it was decided to expand the thermal performance testing to cooling coils. In the spring of 1992, cooling coil performance was measured and found to be below acceptable levels; cooling coils were then cleaned during the 1992 R7 outage. Monitoring of the coils has continued through two summers, and it has been found that a performance level above 65% UA (manufacturer's predicted value is 100%) can be assured with current water treatment methods.

   c. During the months of January and February 1992, the NRC conducted Electrical Distribution System Functional Inspection EDSFI 92-02. This inspection identified the need to update maximum temperatures associated with Engineered Safety Feature (ESF) equipment rooms and maximum service water temperatures during warm-weather conditions. Results of calculations driven by this inspection and results of ESF room cooler performance monitoring indicating degraded UA values due to fouling prompted recognition of the need to revise room temperature calculations including those for the Main Control Room.

d. Due to the substantial amount of electrical engineering work required to determine the value of each individual control room heat load, mechanical engineering alternatively performed a test to conservatively determine the Main Control Room HVAC heat load in March 1993. This test was performed with normal control room heat loads active to provide a conservative bounding load for use in analyses of the control room HVAC system during DBA conditions.

1) Support of the R8 Outage initially delayed analysis of this test data.

2) In June 1993, initial review of test data showed a control room heat load similar to that used in previous calculations which resulted in an acceptable control room temperature. This initial review was based on earlier calculation results which used a 100% UA value. That review did not recognize the need to reduce UA.

3) On November 9, 1993, further evaluation with a reduced UA value of 65% showed that the 104 degrees Fahrenheit design limit could be exceeded during periods of peak service water temperatures during warm-weather conditions with existing measured heat loads. Specifically, the maximum control room temperature could reach approximately 107.9 degrees Fahrenheit during this postulated event.

Root Cause

The root cause of this event was inadequate design margin in the original design. Specifically, service water cooling coils installed with the Main Control Room HVAC air handlers were not designed with sufficient margin to account for fouling, as well as increases in Main Control Room heat load and service water temperature over the design life of the plant. Additionally, initial calculations involving control room temperatures used a UA value of 100%, which reflects an early failure to consider fouling of cooling coils transporting spray pond water. A contributing cause was a less than adequate process for factoring fouling considerations into the original and subsequent design calculations.

Further Corrective Action

1. Abnormal Condition Procedure PPM 4.4.5.2 (Service Water System Operation without Tower Makeup), was deviated on November 12, 1993, to provide instructions for ensuring service water spray pond temperature does not preclude service water from maintaining control room temperature below its design limit.

2. Plant Chemistry is currently treating the service water spray ponds with a broad-spectrum microbicide and an algicide. Current treatment has arrested UA value degradation; however, the arrested value is currently insufficient to maintain control room temperature below its design limit during the postulated event reported by this LER. The Chemistry Department is continuing their research into alternate or backup microbicides that could improve performance.

3. As in the past, the Supply System cleaned selected room coolers during the R8 outage. Monitoring of specific coolers after R8 indicated that UA performance dropped to a value insufficient to maintain control room temperature below its design limit during the postulated event reported by this LER. Performing on-line cleaning has not been implemented due to forced entry into restrictive operating conditions during the cleaning process.

4. Based on the low probabilities associated with the limiting sequences evaluated (approximately 5.5E-5/year) and available industry guidance, it is considered appropriate to rely on manual operator action to remove certain room heat loads from service if required to maintain control room temperature below its design temperature limit of 104 degrees Fahrenheit. These actions will not hamper operator actions early in the postulated event, as the control room temperature is not expected to peak for approximately 12 hours into the event.

   a. Applicable procedures will be revised by January 28, 1994 to direct shedding certain control room heat loads to maintain the control room temperature below its design temperature limit.

   b. Revised procedures directing shedding certain control room heat loads to maintain the control room temperature below its design temperature limit will be presented on a one-time basis during the conduct of the License Operator Training Program. Additionally, this LER will be included in the one-time presentation. Training will be completed by March 31, 1994.

5. Review heat exchange equipment using service water as a cooling fluid to assure that appropriate fouling and cooling water temperature are considered in design. Include the review of thermal performance data pertinent to the equipment. This will be completed by June 30, 1994.

6. Review the heat transfer component design and specification processes/procedures and identify areas where WNP-2 specific fouling and margin philosophies can be documented for those doing design in the future. This will be completed by June 30, 1994.

Safety Significance

This event has minimal safety significance. The Main Control Room temperature is calculated to reach approximately 107.9 degrees Fahrenheit during this postulated event; however, safety-related equipment in the Main Control Room should function adequately at increased temperature since the control room was designed for a minimum of 104 degrees Fahrenheit with margin. Manufacturers design their equipment to function adequately beyond the specified room temperature (104 degrees in this case). This practice was confirmed by a review by Equipment Qualification of several hundred manufacturer/models as part of the Diesel and Radwaste Building equipment temperature assessments. The review found that inherent design margins were typically in excess of the postulated excess temperature value in the Main Control Room of 3.9 degrees Fahrenheit. Further, a Probabalistic Risk Assessment was performed to determine the probability for the Main Control Room to exceed its design limit during Design Basis conditions. The

assessment considered a limiting sequence involving a Large Loss Of Coolant Accident (LLOCA) and a Loss of Offsite Power (LOOP) resulting ultimately in a delayed event, "control room temperature greater than its design basis limit". The results of this assessment show that the postulated sequence of events has a probability of approximately 5.5E-5/year. The assessment also considered the occurrence of the Safe Shutdown Earthquake causing a LOOP as a separate sequence. This sequence also has a probability of approximately 5.5E-5/year.

There is a high likelihood that the Tower Makeup (TMU) system would be able to replenish the service water spray ponds with relatively cool water from the Columbia River and thus enable control personnel to maintain control room temperature below 104 degrees Fahrenheit. The TMU system pumphouse is a structure impervious to tornado damage. Additionally, electric cabling to the TMU pumphouse, as well as TMU pumphouse transformers, are protected against missiles, and emergency power can be made available from on-site sources to run the TMU pumps.

Plant procedure PPM 4.4.5.2, entitled "Operation of Standby Service Water System Without TMU Available", cites additional sources of spray pond makeup water from WNP-2, as well as WNP-1. Additional makeup from Unit 2 is available from any of three wells with transfer via fire system piping or water truck; Unit 1 makeup is available from a well or the River Makeup Water system via temporary piping or water truck.

Similar Events

There are no LER events similar to this event.

EIIS Information

Text Reference	EIIS Reference System	EIIS Reference Component
Main Control Room HVAC System	--	--
Standby Service Water System	BI	--
Emergency Chiller System	KM	--
Air Handlers WMA-AH-51A1 (51B1)	--	AHU
Emergency Coils WMA-CC-51A-1 (51B-1)		CL
Tower Makeup System	KI	--
Tower Makeup System Pumphouse	--	--
Tower Makeup System Transformer	--	XFMR