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AUTH.NAME AUTHOR AFFILIATION
FIES,C.L. Washington Public Power Supply System
BAKER,J.W. Washington Public Power Supply System
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 92-007-00:on 920225,both divs of primary containment atmosphere control hydrogen recombiner sys inoperable & plant shutdown initiated.Caused by less than adequate design.Design changes implemented.W/920325 ltr.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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

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Docket No. 50-397

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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

SUBJECT: NUCLEAR PLANT WNP-2, OPERATING LICENSE NPF-21 LICENSEE EVENT REPORT NO. 92-007

Transmitted herewith is Licensee Event Report No. 92-007 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.

Sincerely,

LT Hansel for
J. W. Baker
WNP-2 Plant Manager (Mail Drop 927M)

Enclosure

cc: Mr. John B. Martin, NRC - Region V
Mr. C. Sorensen, NRC Resident Inspector (Mail Drop 901A, 2 Copies)
INPO Records Center - Atlanta, GA
Ms. Dottie Sherman, ANI
Mr. D. L. Williams, BPA (Mail Drop 399)

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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)

PRIMARY CONTAINMENT HYDROGEN RECOMBINER INOPERABLE DUE TO FLOODING/DRAINAGE PROBLEMS

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)
0 2	2 5	9 2	9 2	-- 0 0 7	-- 0 0	0 2	2 6	9 2		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)			
POWER LEVEL (10) 1 0 0	X	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)	X 50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X 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
C. L. Fies, Compliance Engineer	AREA CODE 5 0 9 3 7 7 - 4 1 4 7

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 1315 hours on February 25, 1992 WNP-2 concluded that both divisions of the Primary Containment Atmosphere Control (CAC) Hydrogen Recombiner system were inoperable and a plant shutdown was initiated. The Licensing Basis Documents have a requirement for simultaneous operation of CAC and Residual Heat Removal (RHR) Suppression Pool Cooling during Emergency Operations. This requirement could not be met because operation of RHR in this mode would result in internal flooding of the CAC equipment. Concurrently with the investigation of this RHR interface issue, actual internal flooding problems were realized during testing of the CAC system. This flooding occurred when the CAC drain subsystem did not function properly.

The root cause of these events was a less than adequate design and design change implementation. A contributing cause was inadequate testing to verify change implementation.

Immediate corrective action was taken to place the plant in cold shutdown per the Technical Specification requirements.

Further corrective action was taken to implement two design changes to correct the flooding/drainage problems with CAC. Testing was performed to verify system operability.

There was safety significance since the operability of both divisions of one of the WNP-2 Engineered Safety Features was impacted. However, this safety significance is mitigated by the low probability of needing the CAC system with an inerted primary containment.

The event posed no threat to the health and safety of either the public or plant personnel.

Plant Conditions

Power Level - 100%
Plant Mode - 1

Event Description

At 1315 hours on February 25, 1992 WNP-2 concluded that both divisions of the Primary Containment Atmosphere Control (CAC) system were inoperable. In accordance with LCOs 3.6.6.1 and 3.0.3 of the Technical Specifications along with the Emergency Plan Implementing Procedures (PPM 13.1.1) a plant shutdown was initiated and an Unusual Event was declared.

At WNP-2 the CAC System includes redundant catalytic hydrogen recombiners (CAC-HR-1A/B) provided to combine the hydrogen and oxygen in the Primary Containment during post LOCA conditions. The redundant recombiner subsystems (A and B) are located outside the Primary Containment in the Reactor Building (Secondary Containment). Each redundant subsystem consists of a blower, wet scrubber, electric heater, catalyst vessel, after cooler, moisture separator, and associated instrumentation, valves and piping. A constant speed blower is used to draw the atmosphere from the Primary Containment, process it through the equipment and return it back to the Containment.

The Licensing Basis Documents have a requirement for simultaneous operation of CAC and the Suppression Pool Cooling mode of RHR during Plant Emergencies. This requirement could not have been met due to the back pressure in the CAC drain piping which would have filled the CAC System if both CAC and RHR had been operated simultaneously. This condition was discovered during a periodic review of plant procedures by a System Engineer.

Flooding would occur because the drain line for the CAC equipment was connected through a loop seal to the RHR line that returns flow to the Suppression Pool. The backpressure in this line with RHR running would be approximately 90 psig which would flood the CAC equipment unless the interface isolation valves (RHR-V-134A/B) were closed. During CAC System operation the RHR-V-134A/B valves must be open to allow the Scrubber (CAC-AW-1A/B) and the recombination water to drain to prevent flooding the CAC units.

Concurrently with the investigation of RHR drain interface issue, actual flooding problems were realized. A special test, PPM 8.3.230, CAC-HR-1B Recycle Flow Verification, was being performed on the morning of February 25, 1991. The test was being run to obtain recycle flow data, prove scrubber operation and verify

the high temperature shutdown function. This test required operation of the "B" Recombiner (CAC-HR-1B) with the CAC Scrubber (CAC-AW-1B) in operation. The Scrubber drains through the loop seal to the RHR system and is the main source of water from CAC as a result of system operation. During the performance of this test, erratic cyclic operation of the CAC system air flow was noted and the "B" unit Blower (CAC-FN-1B) and motor were partially flooded approximately 45 minutes after initiation of scrubber water flow. The partial flooding resulted when the Scrubber drain water backed up into the CAC units. Further investigation and testing of the "A" recombiner unit on February 27, 1992 showed the drain problem to be present on the redundant unit.

Immediate Corrective Action

With both recombiners inoperable due to RHR interface problems, Technical Specification 3.0.3 was entered and an unusual event was declared in accordance with WNP-2 Emergency Procedures at 1315 hours on February 25, 1992. The plant proceeded to cold shutdown conditions per the Technical Specification requirements. This event was called in to the NRC as required by 10CFR50.72. A second phone call was made at 1910 hours on February 27, 1992 to report the inadequate drainage for both divisions of CAC.

Further Evaluation and Corrective Action

A. Further Evaluation

1. These events is being reported per the requirements of 10CFR50.73. First, it is reportable under 50.73(a)(2)(i)(B) as a "condition prohibited by the Plant's Technical Specifications" since the system did not meet the OPERABLE definition contained therein. Second, 50.73(a)(2)(ii)(B) is applicable as the system was in a "...condition that was outside the design basis...". Third 50.73(a)(2)(v) is applicable as, "Any event or condition that alone could have prevented the fulfillment of the safety function..." in controlling the release of radioactive material and mitigating the consequences of an accident. Finally, 50.73(a)(2)(vii) is impacted since these events caused, "...two independent trains...to become inoperable...." in a single system designed to mitigate the consequences of an accident.

2. Further evaluation showed restricting orifices (RHR-RO-8A/B and RHR-RO-9A/B) were installed in the RHR returns to the Suppression Pool during the later phases of construction by the Architect Engineer/Construction Contractor. Design change 215-M-N002 was written in April 1983 to move the restricting orifices because of excessive cavitation and vibration. The change moved the orifices from a point upstream of the CAC drain line to a point downstream of the CAC drain. Calculation 5.17.26 requires a RHR pump head of 267 ft at a flow rate of 7450 gpm through the RHR heat exchanger. When the orifice, sized to this requirement, was moved downstream of the CAC drain line the two systems could not be operated at the same time as this would result in CAC internal flooding. No evaluation of this system interaction was found in the design package.

3. The Emergency Operating Procedures do not preclude the simultaneous operation of CAC and RHR in the Suppression Pool Cooling Mode. The FSAR (page 15.6-30) also states the plant has the capability to operate CAC and RHR in the Suppression Pool Cooling mode at the same time.

4. A review of the Preoperational Test (PT 22.0-A) Summary showed that drainage problems were experienced on CAC during testing in November 1983. On November 28, 1983 the test summary remarks note that after scrubber flow was established the temperatures dropped rapidly due to the blower pumping water. It was noted that no water was draining and the blower, CAC-FN-1B, tripped on overload. The remarks note that prior to tripping cyclic filling and draining was occurring in the moisture separator. As a result of this testing a design change was initiated.

5. A review of the design documents associated with CAC showed two design changes (S215-M-7001 and S215-M-7097) were issued in January 1984 to eliminate water carryover to the blowers of the CAC units. These design changes were implemented by Plant Modification Record 84-304 in March 1984. Changes were made in the piping associated with the CAC drains but operability tests (MWR AY5618) conducted to verify adequate control of scrubber water flow did not detect the flooding problem. Surveillance tests performed since startup were done without scrubber water in operation.

6. A review of past CAC problems showed the "A" CAC skid was flooded on May 24, 1990. This occurred while conducting stroke time testing on CAC drain valve RHR-V-134A simultaneously with operation of RHR A in the Suppression Pool Cooling mode of operation. A formal root cause analysis was performed for the event (Material Deficiency Report 290-0391) and five corrective action plans were generated. However, no corrective action was identified to prevent flooding of CAC in the event that both CAC and RHR were operated simultaneously during emergency conditions.

7. The root cause of this event was a less than adequate design and design change implementation. The interaction between CAC and RHR should have been identified when the design change for the restriction orifices was evaluated for plant impact. A contributing cause was inadequate testing to verify change implementation.

8. There were no structures, components or systems that were inoperable prior to the start of this event which contributed to the event.

B. Further Corrective Action

1. An Urgent Plant Modification (92-0056) was initiated to correct the interface problem between CAC and RHR. The drain line was rerouted from the RHR return line to the Suppression Pool to an unused line that was part of the deactivated RHR Steam Condensing mode of operation. This change prevents water from backing up from RHR into the CAC equipment.

2. An Urgent Plant Modification (92-0057) was initiated to correct the CAC drainage problem. The inlet side of the loop seal was vented to the incoming line from primary containment. This change provided a path for the air trapped in the loop seal to escape when scrubber flow begins to flow into the loop seal. It also precludes the formation of a vacuum that could hinder drainage from the scrubber.

3. Two Test Procedures, PPM 8.3.248TP and 8.3.230TP, CAC-HR-1A/B Recycle Flow Verification from Drywell, were written and performed to verify operation of the CAC system. These tests verified operation of the system confirming the functioning of manual recycle flow from the control room and proper draining of the system with the CAC scrubber in operation.

Safety Significance

We believe this event has safety significance since the operability of both divisions of one of the WNP-2 Engineered Safety Features was impacted. However, the actual safety significance is mitigated by the very low probability of the need for the system.

In the design basis analysis, the probability of hydrogen production following a large LOCA event has been assessed by the Supply System PRA effort. A large LOCA can be due to pipe break or due to failure of sufficient SRV's to open when needed. On the basis of generic failure rate for pipes and plant-specific failure rate for SRV's, the probability of a large LOCA has been determined. A large LOCA event can be mitigated as long as any one of the ECCS systems operate. Plant-specific system unavailabilities have also been determined. The hydrogen production (or a LOCA without coolant injection) probability can be assessed by multiplying the LOCA probability by the product of the individual ECCS System unavailabilities. This number is approximately 1E-7/year. NRC's safety goal is 1E-4/year for core damage and 1E-6/year for containment failure. Although hydrogen production does not mean there is a subsequent burn or containment failure, hydrogen production probability already meets the safety goal for containment failure.

Severe accident studies done in support of Individual Plant Evaluation (IPE) work has shown that the amount of oxygen generated and surviving as a gas in a degraded core scenario is very small. With an inerted containment the oxygen is not likely to exceed the flammability limits precluding the need for the hydrogen recombiners. In addition, the initial work being done on the WNP-2 IPE concludes that CAC is a negligible contributor toward accident mitigation. For core melt accidents, the exothermic metal water reaction, once started, generates large quantities of hydrogen. Since there is a limited amount of oxygen that can be reacted it is of marginal value. Hydrogen combustion is not a possible containment failure mechanism for an inerted containment (Reference: FAI/91-110, Deflagration and Detonation of Hydrogen, July 1991).

Similar Events

LER 91-029 reported the condition where a contract engineer performing a setpoint calculation review had discovered that incorrect Containment Atmosphere Control (CAC) Recycle Flow Control (CAC-FC-67A/B) Instruments were installed for both divisions in the control room. The root cause of that event and the one described in this event were similar. Corrective actions in the form of a Supply System SSFI were in progress when the events described in this LER occurred.

EIIS Information

Text Reference	EIIS Reference System	EIIS Reference Component
Primary Containment Atmosphere Control (CAC)	BB	--
Residual Heat Removal (RHR)	SO	--
Catalytic Hydrogen Recombiners (CAC-HR-1A1B)	BB	RCB
Primary Containment	NH	--
Isolation Valves (RHR-V-134 A/B)	SO	V
CAC Scrubber (CAC-AW-1 A/B)	BB	AHV
CAC Blown (CAC-FN-1 A/B)	BB	FN
RHR Restricting Orifices (RHR-RO-8 A/B, RHR-RO-9 A/B)	SO	RO
Recycle Flow Controller (CAC-FC-67 A/B)	BB	FC