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SUBJECT: LER 93-021-00:on 930514,CAC sys water accumalation & failure in standby SW sys due to inadequate original analysis of the sys design.No corrective actions required because CAC sys & primary containment not operational in Mode 5.W/930614 ltr.

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NCR 293-584

June 14, 1993
G02-93-157

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. 93-021

Transmitted herewith is Licensee Event Report No. 93-021 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,

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

JVP/KBL/cgeh
Enclosure

cc: Mr. B. H. Faulkenberry, 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)

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LICENSEE EVENT REPORT (LER)

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TITLE (4)

CONTAINMENT ATMOSPHERE CONTROL (CAC) SYSTEM WATER ACCUMULATION AND POTENTIAL CONTAINMENT BYPASS

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 5	1 4	9 3	9 3	-- 0 2 1	-- 0 0	0 6	1 4	9 3		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 5

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

POWER LEVEL (10): 0 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, Licensing Engineer	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)

On May 14 and June 2, 1993, followup actions resulting from a recently completed Supply System Safety System Functional Inspection (SSFI) discovered two problems with the Containment Atmosphere Control (CAC) system. The first problem that was discovered was a potential for water accumulation in the CAC system's low-point piping containing flow orifices and flow control valves. The water could affect the ability to measure and control flow in the system. The second problem discovered was a bypass of Secondary Containment in the event of a single failure in the Standby Service Water (SW) system that supplies scrubber water to the CAC system operating during post Loss Of Coolant Accident (LOCA) conditions. Post-LOCA, Primary Containment gas could escape to the environment via the failed SW system and thus bypass the Secondary Containment.

No immediate corrective actions were required because the CAC system and Primary Containment are not required to be operational in Mode 5.

The root cause for both events was inadequate original analysis of the system design.

Further corrective actions to alleviate possible water accumulation during prolonged CAC system operation, post-LOCA, following accident conditions included installation of drains in the lowest elevations of CAC system piping. To alleviate the Containment bypass issue, further corrective actions included providing procedural instructions to trip the appropriate CAC subsystem if its corresponding service water supply becomes unavailable.

Abstract (Cont'd)

These events have safety significance because the operability of both divisions of one of the WNP-2 Engineered Safety Features (CAC) and the plant Containment could have been impacted. However, for both events this safety significance is mitigated by the low probability of the events occurring.

Plant Conditions

Power Level - 0%
Plant Mode - 5 (Refueling)

Event Description

On May 14, 1993, at 1030 hours, with the reactor in Mode 5 (Refueling), an evaluation concluded a water accumulation problem could occur in the CAC system following prolonged operation during accident conditions. This condition was identified by a plant support engineer while he was performing a followup action for a previously performed Supply System Safety System Functional Inspection (SSFI). At WNP-2, the CAC system includes redundant catalytic hydrogen recombiners. The recombiners are designed to combine hydrogen and oxygen in the Primary Containment during postulated post-LOCA conditions. The recombiner subsystems (A & B) are skid mounted and are located on the 572 foot elevation of the Reactor Building (Secondary Containment). During postulated LOCA conditions, the CAC system is designed to function as an extension of the Primary Containment for leakage control. Each redundant subsystem consists of a blower, scrubber, catalytic recombiner with an electric preheater, aftercooler, moisture separator, and associated instrumentation, valves, and piping. Each subsystem includes two flow measuring systems, one to measure total flow and the other to measure recycle flow. The recombination rate varies inversely with the amount of flow recycled through each CAC subsystem.

The plant support engineer determined that CAC piping containing total and recycle flow orifices [CAC-FE-6A(B) and 7A(B) respectively] and associated flow control valves [total flow control valve CAC-V-2A(B) and recycle flow control valve CAC-FCV-6A(B)] effectively form multiple loop seals in each CAC skid. Gas flowing out of the moisture separator (and then through CAC piping containing the flow orifices and flow control valves) during postulated post-LOCA conditions will be saturated at 100°F. The pressure of the gas will drop as it flows through the orifices and flow control valves. These pressure drops will cause vapor in the process gas stream to condense and possibly collect in the low-point piping. The condensate could cause the orifices to measure and control flow erroneously. Additionally, the condensate could restrict the amount of recycle flow to the blowers' suctions, which will enrich gas moving from Containment, through the blowers, and then to the CAC hydrogen recombiner beds. As the higher

enrichment of gas recombines exothermically, recombiner bed outlet temperatures could increase to the recombiner outlet high-temperature trip setpoint. Conversely, if condensate accumulation obstructed flow back to Containment, recycle flow would increase but system throughput would decrease and hydrogen-oxygen control would be degraded.

Similarly, on June 2, 1993, at 1215 hours, with the reactor in Mode 5, an additional evaluation concluded that a post-LOCA Primary Containment gas-bypass of Secondary Containment (the Reactor Building) could occur through the CAC system. This problem was discovered by a Supply System engineer who was involved with the original SSFI and who was performing followup work on open Quality Finding Reports (QFRs). As previously mentioned, each CAC subsystem includes a scrubber [CAC-AW-1A(B)] that cools and removes impurities from the gas stream from Primary Containment before the gas enters the CAC blowers (see figure 1).

The safety-related Standby Service Water (SW) system supplies water to each scrubber from separate spray ponds located outside Secondary Containment. Each scrubber includes a flow control valve [CAC-FCV-5A(B)] which is remote-manually positioned from the main control room to control flow to the desired value. As designed, service water drains from the scrubbers to the Suppression Pool during CAC operation. However, in the event of a single failure of a Service Water pump (shaft shear, power loss, or equivalent), the SW system would drain and create a Secondary Containment bypass flowpath. The bypass flowpath would be from CAC piping conveying gas from Primary Containment to the scrubber, out of the SW-to-scrubber inlet piping, and through drained SW piping to the outside environment via the spray pond.

Immediate Corrective Actions

No immediate corrective actions were required because the CAC system and Primary Containment are not required to be operational in Mode 5.

Further Evaluation, Root Cause, And Corrective Action

Further Evaluation

1. The water accumulation problem and the bypass problem were reported to the NRC on May 14, 1993, (1114 hours) and on June 2, 1993, (1330 hours) respectively as four-hour nonemergency events as specified by 10CFR 50.72(b)(2)(i), which reads, "Any event, found while the reactor is shut down, that, had it been found while the reactor was in operation would have resulted in the nuclear power plant, including its principal safety barriers, being seriously degraded or being in an unanalyzed condition that significantly compromises plant safety."

2. The bypass problem was additionally reported to the NRC on June 2, 1993, at 1330 hours, as a four-hour nonemergency event as specified by 10CFR 50.72(b)(2)(iii)(C), which reads, "Any event

or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to control the release of radioactive material."

3. Both problems discussed by this LER are being reported under 10CFR 50.73(a)(2)(v), which reads, "Any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident."

4. There were no structures, components, or systems inoperable prior to identification of these two problems that contributed to the problems.

5. LER 91-029, issued to the NRC on December 2, 1991, discussed the inadequacy of the CAC system recycle flow control loops. In part, this LER committed to performing a technical assessment of the CAC system. The assessment was performed in accordance with Safety System Functional Inspection (SSFI) guidelines.

6. The SSFI team issued CAC Functional Inspection Technical Assessment 91-019 on June 11, 1992. In part, the SSFI report postulated the fact that the CAC skid vendor, Air Products Company, Inc. (APCI), presented an incorrect correlation for CAC flowrates to the Supply System and erred in calculating a flow factor prior to initial plant startup.

7. To resolve the issue associated with the CAC system flow orifices and other related flow-issues, the Supply System contracted Colorado Engineering Experiment Station, Inc. (CEESI) for technical assistance. CEESI was contracted to perform testing on a CAC skid mockup to determine the flow characteristics of flow orifices CAC-FE-6A(B) and 7A(B). Final results of the CEESI tests were received by the Supply System in April of 1993.

8. CEESI subsequently communicated to the Supply System that water was observed during their testing activities. This prompted further evaluation of the CAC system by Supply System engineering. It was during further review of the CAC system that Supply System engineering determined that the CAC low-point piping could accumulate condensation. Upon discovery of the problem, engineering wrote PER 293-584 (May 12, 1993) to initiate further investigation and problem resolution.

9. Similar to the first event described in this LER, it was during the Supply System SSFI team's continuing review of the CAC Functional Inspection Technical Assessment 91-019 that the Secondary Containment bypass problem was discovered. The SSFI engineer was reviewing CAC flow test data when he surmised that a loss of service water during CAC operation could create a bypass flowpath of Secondary Containment.

10. Engineering analysis indicated that the drained service water piping would not be pressurized to the point of overcoming existing SW loop-seal backpressure for over 20 minutes with no operator action to secure CAC. Procedures have been revised to have operators secure CAC within 20 minutes upon a loss of service water.

Root Cause

The root cause for the water accumulation problem and the Secondary Containment bypass problem in both CAC subsystems was inadequate original analysis of the system design to ensure the CAC system would serve its intended function. The design was less than adequate in that it failed to recognize and prevent a potential for accumulation of condensate in the piping containing the flow orifices and flow control valves. And although the CAC system was designed as an extension of Primary Containment to ensure no leakage from the CAC system boundary could occur during a LOCA, the original design analysis failed to identify the bypass of Secondary Containment in the event of a single failure in the SW system.

Further Corrective Action

1. The Supply System has installed three drain lines per CAC skid to alleviate the potential for water accumulation in the CAC piping containing system flow orifices and flow control valves. These drains tie into the existing Scrubber loop seal which drains to the Suppression Pool via Residual Heat Removal (RHR) system drain piping. Each set of drains is installed in the low-point piping in each CAC subsystem.

2. Prior to the actual drain piping installation, the modification was tested by simulating the installation with tygon tubing. Testing of each skid consisted of isolating each subsystem from Containment, installing tygon test tubing, turning on and operating each subsystem for several hours, and verifying that each loop seal maintained a water level below the drain connections. The tests were then repeated with the CAC system connected to the Containment. The test criteria was satisfied by visually observing water levels in the tygon tubing and by ultrasonically determining the water levels in the existing hard-piped scrubber loop seals. The Supply System is confident that this design change will preclude similar problems with condensation from challenging CAC operability.

3. Plant operating procedures have been revised to provide instructions for tripping a CAC subsystem if its corresponding supply of service water becomes unavailable. Tripping the CAC system automatically causes the CAC system's containment isolation valves and scrubber-inlet flow control valves to close. This provides multiple barriers between Containment and the environment.

Safety Significance

These events have safety significance because the operability of both divisions of CAC (one of the WNP-2 Engineered Safety Features) and the plant Containment could have been impacted. However, for both events this safety significance is mitigated by the low probability of the events occurring. Severe accident studies done in support of Individual Plant Evaluation (IPE) work have 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 recombiners. The potential for bypassing containment is further mitigated by the fact that if the CAC system had actually been operating during an accident condition, the system would eventually have tripped on high temperature following a loss of Standby Service Water and automatically isolated itself from Containment. In addition, over 600 feet of buried 18" pipe that will remain full of water in the Standby Service Water piping would tend to decrease the amount of halogens released to the atmosphere thereby mitigating, to some extent, the thyroid dose potential from the event.

Similar Events

There have been several events reported in LERs on the CAC system. A report summarizing the CAC events that occurred in 1991 and 1992 was transmitted to Mr. J. B. Martin, NRC Region V on November 2, 1992. The report reviewed CAC activities involving design, system modifications, maintenance and operations improvements, and provides a summary root cause. The report also provided a chronology of CAC events during that time period.

EIIS Information

Text Reference	EIIS Reference System	EIIS Reference Component
Containment Atmosphere Control System	BB	---
Primary Containment	---	---
Secondary Containment	---	---
Standby Service Water System	BS	---
CAC-FE-6A(B) & 7A(B)		OR
CAC-V-2A(B) & CAC-FCV-6A(B)		FCV
CAC Blowers		BLO
CAC Moisture Separators		MC
CAC Scrubbers		SCB
CAC Hydrogen Recombiner Beds		RCB
Residual Heat Removal System	SO	

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TITLE (4)
CONTAINMENT ATMOSPHERE CONTROL (CAC) SYSTEM WATER ACCUMULATION AND POTENTIAL CONTAINMENT BYPASS

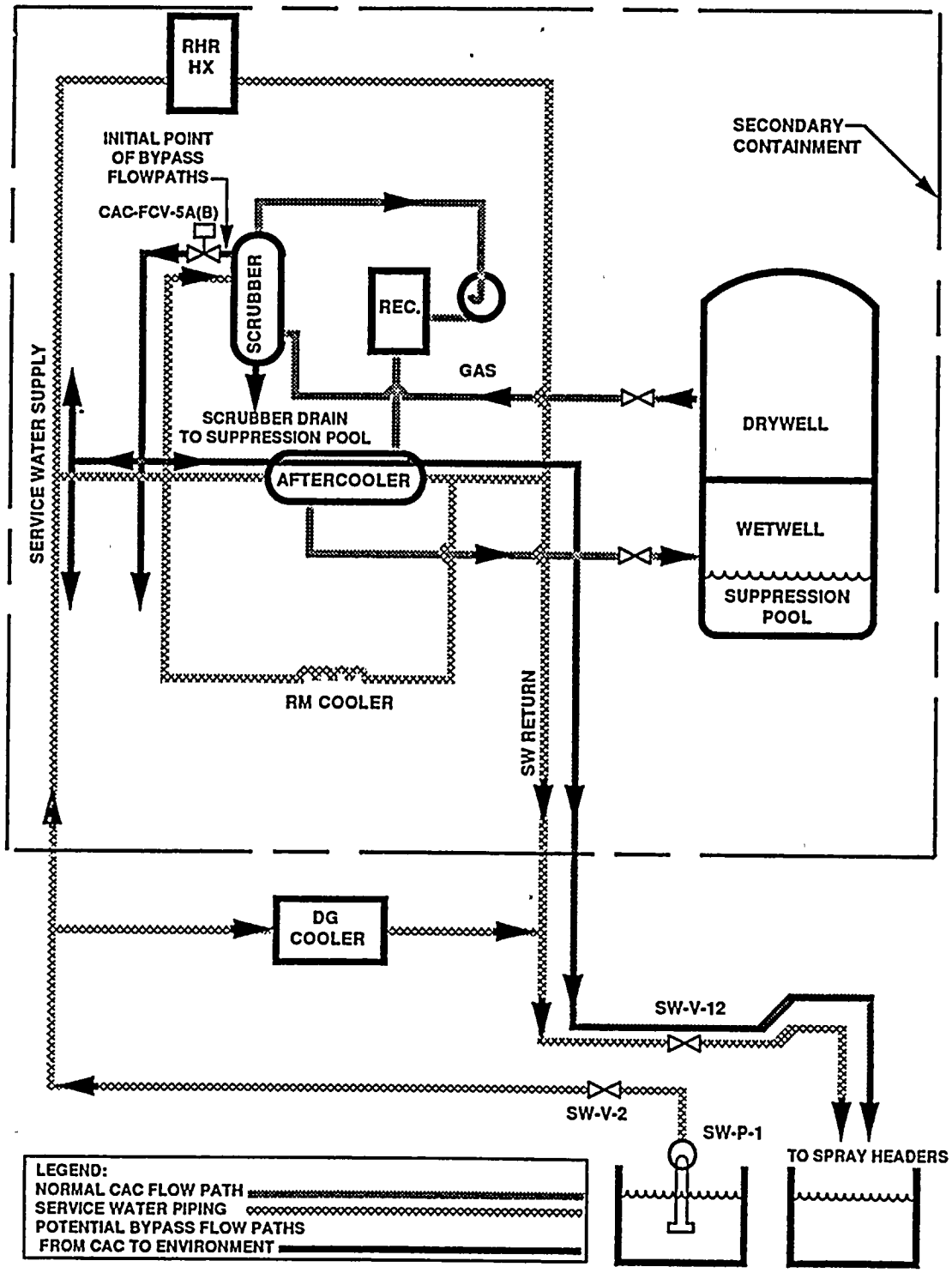

FIGURE 1: CONTAINMENT BYPASS: CAC TO SW SPRAY PONDS