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September 11, 2000

United States Nuclear Regulatory Commission
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Operating Licenses DPR-58 and DPR-74
Docket Nos. 50-315 and 50-316

Document Control Manager:

In accordance with the criteria established by 10 CFR 50.73 entitled Licensee Event Report System, the following report is being submitted:

LER 315/1998-001-03, "Containment Air Recirculation System Flow Testing Results Indicate Condition Outside the Design Basis".

This revision of the LER replaces all previous revisions in their entirety. The LER was rewritten for clarity, and the Analysis and Corrective Actions sections were corrected and updated to include new information.

No commitments were identified in this submittal.

Should you have any questions regarding this correspondence, please contact Mr. Wayne J. Kropp, Director Regulatory Affairs, at 616/697-5056.

Sincerely,

A. Christopher Bakken, III
Site Vice President

/mbd
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NRC Form 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503

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TITLE (4)

Containment Air Recirculation System Flow Testing Results Indicate Condition Outside the Design Basis

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 NAME D. C. Cook Unit 2	DOCKET NUMBER 05000-316
01	04	98	1998	-- 001	--	03	09	11	2000	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
			20.2201 (b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
POWER LEVEL (10)	00		20.2203(a)(1)		20.2203(a)(3)(i)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
			20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or n NRC Form 366A
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
M. B. Depuydt, Regulatory Compliance	616/465-5901, x1589

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If Yes, complete EXPECTED SUBMISSION DATE).	X	NO				

Abstract (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

This revision replaces all prior revisions in their entirety. The LER was rewritten for clarity and the Analysis and Corrective Actions sections were corrected and updated to include new information.

During the month of January 1998, airflow testing of both units' containment air recirculation/hydrogen skimmer (CEQ) systems was performed. The tests demonstrated that the as-found flows in the steam generator and pressurizer enclosures, fan-accumulator rooms, and instrument rooms were less than the flow stated in Chapter 5 of the UFSAR. An ENS notification was made on January 5, 1998 in accordance with 10CFR50.72(b)(2)(i) for Unit 1. The notification was subsequently updated three times to provide additional information for Unit 1 and to report similar conditions on Unit 2.

The low flow results were attributed to the system not being balanced and to system design, as well as the conditions under which the system was tested. In addition, an incorrectly installed valve actuator affected the unit 1 CEQ system performance. A modification was installed on both units to increase airflow from the pressurizer enclosure. The procedure used to set the actuator and valve orientation for the Unit 1 valve was enhanced and the actuator installation corrected. The CEQ system for both units was rebalanced to meet the performance acceptance criteria in Chapter 5 of the UFSAR.

Analyses were performed using the degraded as-found flow values to determine hydrogen concentrations in containment post-accident for both large and small break Loss of Coolant Accidents. The analyses showed that hydrogen concentration in all areas would remain below 4 volume-percent for all break sizes. Therefore, the identified condition is of minimal safety significance.

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TEXT *(If more space is required, use additional copies of NRC Form (366A)* **(17)**

Conditions Prior to Event
Unit 1 was in Mode 5, Cold Shutdown
Unit 2 was in Mode 5, Cold Shutdown

Description of Event
On January 4, 1998 containment air recirculation/hydrogen skimmer (CEQ) system testing was initiated. The testing was being performed as corrective action related to LER 316/97-009-00, "Blockage of Containment Air Recirculation Inlet Line results in Condition Outside Design Basis." The testing was performed to confirm that required flows could be demonstrated for both containment air recirculation systems on both units.

The hydrogen skimmer system is designed to control the hydrogen concentration in the various areas, or compartments, of containment below 4 volume-percent. This is accomplished by purging the compartments using a portion of the atmosphere in the lower containment. This flow mixes the atmosphere from the lower containment with the atmosphere in the compartment, diluting any hydrogen that is generated in the compartment.

During testing of the Unit 1 CEQ system, flows in the steam generator and pressurizer enclosures, fan-accumulator rooms, and instrument room were found to be less than the flows stated in UFSAR Section 5.5.3. It was determined that the lower flows could reduce the effectiveness of this mixing effect and impact the ability of the CEQ system to perform its design function. Subsequently, an ENS notification was made on January 5, 1998 at 0040 hours in accordance with 10CFR50.72(b)(2)(i). This notification was updated at 2250 hours the same day upon discovery that 1-VMO-101, the 1-HV-CEQ-1 fan inlet shutoff butterfly valve was approximately 50 percent open when it should be either full open or full closed. This created the potential for ice condenser bypass and partially explained the low flow conditions observed during testing.

The ENS notification was again updated on January 19 and 20, 1998 to include Unit 2 after surveillance test results indicated similar low flow conditions existed on that unit as well. LERs 315/98-001-00, -01 and -02 were submitted in accordance with 10CFR50.73(a)(2)(ii) for a condition outside the design basis, as is this supplement. This supplement replaces all previous revisions in their entirety.

Cause of Event
The low flow conditions were attributed to the system not being correctly balanced during the previous surveilance test. In addition, the containment configuration during surveilance testing results in a pressure drop across the containment divider barrier that is lower than the design value. The design pressure drop is based on the containment configuration which would exist during the postulated accident. The test condition was set up with system recirculation flow through equipment hatches instead of the ice condenser, as the ice condenser was fully loaded with ice at that time. In this configuration, the hydrogen skimmer flow from the steam generator and pressurizer enclosures, and fan rooms, is reduced.

After balancing the system, it was determined analytically that the flow from the pressurizer enclosure would marginally meet its design criteria as defined in Chapter 5 of the FSAR. This was determined to be a design problem related to the size of pipe on the outlet of the pressurizer enclosure.

It was identified that 1-VMO-101 was not correctly positioned due to an incorrectly installed valve actuator, which allowed the valve to remain open 45 degrees from the centerline in the fully open and the fully closed positions. When the valve actuator was placed on a valve, it was aligned with a valve shaft keyway that is parallel to the valve disc. The shaft of 1-VMO-101 has an extension, and the extension has a keyway that is rotated 45 degrees from the valve shaft keyway's position. The actuator was installed in relation to this keyway rather than the valve shaft keyway. This occurred because the procedure for actuator installation did not contain specific instruction to use the valve shaft keyway as the reference.

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The valve testing program and the post maintenance testing (PMT) requirements did not detect this condition. The increased torque observed during valve operation was the result of contact with the stops, and not because of valve seating. The PMT test only checked that the actuator was functioning.

Analysis of Event

Two analyses were performed. The first, completed in 1998, specifically evaluated hydrogen concentration in the Pressurizer and Steam Generator (SG) enclosures. A second analysis was completed in late 1999, which evaluated overall containment concentrations, and confirmed the previous analysis results for the Pzr and SG enclosures.

Pressurizer Enclosure Analysis

This analysis was performed using the Unit 1 Cycle 16 and Unit 2 Cycle 12 specific core-wide metal-water reaction values, and a pressurizer skimmer flow value of 137cfm. This is the 1-HV-CEQ-1 as-found pressurizer flow minus 30 cfm for measurement uncertainty.

The maximum hydrogen concentration in the pressurizer enclosure was calculated by using a 2-inch Design Basis Accident (DBA) hydrogen release to the pressurizer enclosure. This analysis assumed 100 percent of the core radiolysis, 10 percent of the sump radiolysis, 10 percent of the metal-water reaction hydrogen, and 10 percent of a 2-inch break steam flow is directed into the pressurizer enclosure. A 2-inch break was selected to delay operation of the CEQ fans until the ice bed melted out. The 1998 analysis results show a relatively stable hydrogen concentration of approximately 3.2 volume-percent after 14 hours (which is less than the flammable limit of 4 volume-percent).

As stated above, the results of this analysis were confirmed by the 1999 analysis which also showed that the long term hydrogen concentration remains below 4 volume-percent.

Steam Generator (SG) Compartment Analysis

Like the pressurizer enclosure, the maximum hydrogen concentration in the SG enclosure was obtained by using a 2-inch DBA hydrogen release to the steam generator enclosure. Analysis of the SG enclosure was performed with a nominal hydrogen skimmer flow of 207 cfm per SG pair. This analysis input value is the as-found skimmer flow of 237 cfm for SGs 2 & 3 minus the measurement uncertainty of 30 cfm. Even with the reduced flow, SG enclosure hydrogen concentration remains below 3 volume-percent. As with the Pzr enclosure analysis, the results of this compartmental analysis were confirmed by the 1999 analyses.

General Containment Analysis

This analysis was performed in 1999 to assess the potential for reaching the lower flammability limit in containment compartments for various LOCA scenarios under a degraded operational condition for the CEQ system. The analysis was performed to bound all previous cycles where the CEQ system may have been degraded, and assumed a core wide clad oxidation fraction of 1 percent.

Specifically, the hydrogen source terms that were considered were:
- Zirconium (ZR) clad oxidation
- Core radiolysis
- Sump water radiolysis
- Dissolved hydrogen existing from solution in the RCS
- Corrosion of metal in containment

In this evaluation, a 200 percent cold leg break and a 3 inch small break LOCA were analyzed. These two sequences are the limiting break sizes determined by the existing analyses for peak cladding temperature and maximum clad oxidation.

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In these accident scenarios, the postulated hydrogen source term resulting from clad oxidation is released to the containment atmosphere over an interval that is consistent with the postulated accident condition including the blowdown, ECCS water addition through accumulator injection and the refilling of the RCS. The analysis also modeled the annulus compartment as four separate nodes - the east and west fan rooms, the instrument room and the pipe annulus region. This resulted in a better representation of the lower compartment containment sprays and the CEQ system. Since the analysis is a justification of past operation, the analysis models the 10 minute time delay in initiation of the CEQ fans, conservatively assumes that only one train of fans operates, and uses the degraded flow values from as-found testing.

For all large break LOCAs, the hydrogen concentrations do not exceed 3 volume- percent anywhere in containment, maintaining the concentration well below the lower flammability limit of hydrogen. The analyses also shows that for all small break LOCAs the hydrogen concentration remains below 4 volume-percent in all areas.

Based on the results of the original 1998 analysis performed for the pressurizer enclosure and SG enclosures, and the 1999 analysis performed for the overall containment, it has been determined that the hydrogen concentrations would have been maintained below 4 volume-percent in all areas of containment. Therefore, the identified condition was of minimal safety significance.

Ice Condenser Bypass
The mispositioned valve 1-VMO-101 would not only affect the hydrogen skimmer system flows following a LOCA event, but would also affect the post-LOCA ice condenser performance by creating a bypass flow path. The effect on ice condenser bypass is fully addressed in LER 315/98-037-01, submitted on May 24, 1999, and will not be discussed here.

Corrective Actions
The actuator to valve orientation problem with 1-VMO-101 was corrected, and the actuator stops were changed to ensure that valve testing would detect valve seating. Flow testing of the system was conducted to ensure proper orientation of the valve actuator. Reviews were performed to identify other valves where this condition might occur, and three additional valves were identified. These valves were examined, and the actuators were found to be properly oriented.

The maintenance procedure was enhanced to ensure that the valve shaft keyway is used to set the actuator and valve orientation and not the extension shaft keyway.

The motor operated valve program procedure was revised to provide instruction for valve disk seating identification.

To improve the flow conditions from the pressurizer doghouse, a modification was installed. The modification replaced a section of 6 inch diameter pipe serving the pressurizer doghouse with an 8 inch diameter pipe. The new pipe section was placed between the 6 inch pressurizer doghouse balancing valve and the 12 inch diameter main pipe.

The CEQ system for each unit was rebalanced. System calculations were performed to account for differences between the test conditions and the anticipated containment configuration during the postulated accident. Post-modification testing, system calculations, and accident analyses demonstrate that the CEQ system satisfies its design basis.

Previous Similar Events
LER 316/97-009-00