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AEP
INDIANA MICHIGAN POWER

November 2, 2000

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

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 315/97-011-03, "Operation Outside Design Bases for ECCS and Containment Spray Pumps for Switchover to Recirculation Sump Suction"

The following commitment is identified in this submittal:

- Emergency Operating Procedure 1 OHP 4023.ES-1.3, "Transfer to Cold Leg Recirculation" will be revised, prior to Unit 1 Mode 4 entry, to transfer more water from the RWST before switchover to recirculation, and to include allowances for containment water level instrument uncertainties.

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

Sincerely,

Joseph E. Pollock

Joseph E. Pollock
Plant Manager

/meb
Attachment

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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)

Operation Outside Design Bases for ECCS and Containment Spray Pumps for Switchover to Recirculation Sump Suction

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	DOCKET NUMBER
									DC Cook - Unit 2	05000-316
08	22	1997	1997	-- 011 --	03	11	02	2000	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1	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)	100		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. E. Barfelz - Regulatory Compliance	616/465-5901, x 1585

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 previous revisions in their entirety. The LER has been rewritten for clarity, and new information has been provided in the Analysis section, as well as updating the Corrective Action section.

In August 1997 it was determined that the Refueling Water Storage Tank (RWST) level instrumentation was not adequate to ensure that enough water had been transferred from the RWST during accident conditions to prevent vortexing in the containment sump and ensure long term cooling of the core and containment. An NRC notification was made at 1943 hours EDT on August 22, 1997 under reporting criteria 10 CFR 50.72(b)(1)(ii)(A) and 10 CFR 50.72(b)(1)(ii)(C) as any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly compromised plant safety and in a condition not covered by the plant's operating and emergency procedures, respectively. Another condition was identified in June 1998 that could have resulted in additional water not being transferred from the RWST due to postulated blockage of the RWST vent. The cause for the identified conditions was lack of complete understanding of instrument design basis, failure to fully address velocity effects, failure to incorporate revised design calculations, and the failure to establish and maintain a quality calculation program.

The RWST level taps were relocated to a drain line off of the RWST to eliminate the velocity effects on the instrument. 2 OHP 4023.ES-1.3, "Transfer to Cold Leg Recirculation" was revised to transfer more water from the RWST before switchover to recirculation, and to include allowances for containment water level instrument uncertainties. A design change was implemented to increase the venting capability of the Unit 2 RWST prior to the unit's restart. A similar design change /procedure revision will be implemented on the Unit 1 RWST prior to Mode 4. The analyses that were performed for the aggregate conditions concluded that while this condition could have prevented full transfer of RWST water to the containment sump, it was 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 Mode 1, 100 percent Rated Thermal Power
Unit 2 Mode 1, 100 percent Rated Thermal Power

Description of Event
While evaluating a proposed procedure change involving switchover from the Refueling Water Storage Tank (RWST) (EIIS:TK) to the containment recirculation sump during a Loss of Coolant Accident (LOCA), it was determined that the level instrumentation (EIIS:LI) for the RWST and containment (EIIS:NH), used to determine when the switchover is required, was not adequate. It was determined that the indicated RWST level could be lower than actual level due to transmitter location and flow induced bias. Additionally, the volume of water in containment, based on containment level indicators used in 1(2) OHP 4023.ES-1.3, "Transfer to Cold Leg Recirculation", might not be sufficient to prevent vortexing during recirculation. If vortexing occurs in the sump, a potential exists for the loss of the Emergency Core Cooling System (ECCS) (EIIS:BQ) and the Containment Spray system (CTS) (EIIS:BE).

This condition was determined to be reportable at 1856 hours EDT on August 22, 1997. An NRC notification was made at 1943 hours EDT on August 22, 1997 under reporting criteria 10 CFR 50.72(b)(1)(ii)(A) and 10 CFR 50.72(b)(1)(ii)(C) as any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly compromised plant safety and in a condition not covered by the plant's operating and emergency procedures, respectively. LER 315/97-011-00, -01 and -02 were subsequently submitted in accordance with 10 CFR 50.73(a)(2)(ii).

Switchover of the suction source, from the RWST to the containment reciculation sump, for the ECCS and CTS pumps (EIIS:P) is based on the inventory remaining in the RWST, as indicated on the RWST level instruments. The RWST level instruments sense pressure in the suction line from the RWST to the pumps, and develop an indicated level for the RWST. It was postulated that the physical location of the instrument tap in the suction line could affect the indicated level. Analysis of the flow induced Bernoulli effects on the RWST level instrumentation, performed during the 1997 NRC Architect Engineer Inspection, revealed that a potential bias of up to 22 percent of indicated level could be induced at peak ECCS flows during accident conditions. This bias could cause the indicated level to be lower than actual tank level, which could have resulted in premature switchover from RWST suction to containment recirculation sump suction.

Additionally, the containment recirculation sump level used as a confirming indication for switchover did not appear to ensure adequate water level to prevent vortexing in the containment recirculation sump. 1(2) OHP 4023.ES-1.3, required containment sump water level greater than 97 percent for switchover to the recirculation mode.

In June 1998, an additional condition was identified which could have affected indicated RWST level. The original design equipped the RWST with an 8 inch vent line and a 10 inch overflow line. Section 6 of the UFSAR states, "Should the 8 inch vent become plugged the 10 inch overflow line would maintain sufficient venting area to prevent any adverse effect on the safety function of the tank". In late 1997, with both units in Mode 5, Cold Shutdown, a drip catch device was found installed on the 10 inch overflow line of both the Unit 1 and Unit 2 RWSTs. Plant staff had originally identified the drip catch issue in March 1997, and the devices were removed. However, in December 1997, the devices were again found installed (see NRC Inspection Report 98004, EEI 50-315/98004-16, EEI 50-316/98004-16). The investigations into the drip catches performed in 1997 concentrated on the control of temporary modifications, and failure to take adequate preventive actions to prevent reoccurrence, but did not evaluate the potential impact on the RWST level instrumentation in the event of an ECCS initiation. As the drip catch devices were known to have been installed on both units in the past when the units were at power, another Condition Report was initiated in June 1998 to specifically address the potential impact of the devices on the RWST level indication.

The investigation found a 1976 calculation of record that showed a differential pressure of 0.2 psi when the 10 inch overflow line was blocked and the 8 inch vent open, assuming a maximum ECCS flow value of 17,800 gallons per minutes

(gpm) out of the tank. The calculation contained several discrepancies, including the maximum ECCS flow value, therefore, a new calculation was performed using corrected inputs to determine what the pressure would be inside the tank at maximum ECCS flow conditions of 18,530 gpm. The new calculation showed that the pressure inside the RWST could be as much as 1.03 psi less than atmospheric at maximum flow. This would cause the indicated RWST level to be less than actual RWST level.

When considered in the aggregate, the identified conditions could have resulted in approximately 46,000 gallons of usable RWST inventory not being transferred to containment at the time of switchover to the containment recirculation sump.

Cause of Event

The cause of the identified conditions was lack of complete understanding of instrument design basis, failure to fully address velocity effects, failure to incorporate revised design calculations, and the failure to establish and maintain a quality calculation program.

The engineering control procedure (ECP) associated with the RWST level instrument indicated that the function of the RWST instrument was to protect the pumps taking suction from the RWST from loss of Net Positive Suction Head (NPSH). The ECP did not recognize that the instrument was also being used to ensure adequate water is transferred from the RWST to containment for long term cooling of the core and containment. In 1993, during an NRC Systems Based Instrumentation and Control Inspection, it was recognized that fluid velocity impacted the accuracy of RWST level due to the location of the instrument tap. A re-analysis was performed; however, not all velocity terms were included. The friction loss associated with entrance losses as water entered the pipe from the RWST and the dynamic head loss associated with the velocity in the pipe were not recognized. This resulted in an actual level that was higher than indicated. Based on the understanding that the function of the instrument was to provide adequate NPSH during injection, as opposed to ensuring adequate water level in containment, the new calculation was seen as resulting in a conservative change and no further actions were taken.

The calculation performed for the RWST internal pressure exemplifies a failure to establish and maintain a quality calculation program. This is attributed to a failure by management to effectively communicate expectations regarding quality requirements for calculation packages, ineffective monitoring of the quality of calculations, and an ineffective review and approval process that allowed calculations to be approved when they contained errors and incorrect or invalid assumptions.

Analysis of Event

The ECCS serves to mitigate the consequences of a LOCA by swiftly providing makeup water to the RCS to maintain the integrity of the reactor core and control it's reactivity. The major components of the ECCS are the Centrifugal Charging pumps (CCPs), Safety Injection (SI) pumps, Residual Heat Removal (RHR) pumps, the Accumulators, and RWST.
The CTS provides spray cooling water to the containment atmosphere to prevent containment pressure from exceeding its design value following a LOCA. Additionally, the CTS removes radioactive iodine isotopes from the containment atmosphere following a LOCA.

The RWST provides the initial water source for the ECCS pumps following any accident that produces a SI Signal. The borated solution in the RWST ensures that sufficient negative reactivity is injected into the core by the ECCS in the event of a LOCA, steam line break or feedwater line break accident, and is designed to ensure adequate NPSH is maintained for all ECCS and CTS pumps during the injection phase of an accident. The RWST is sized to ensure that an adequate amount of water is available in the containment recirculation sump following an accident to ensure proper operation of the RHR and CTS after suction is realigned to the containment recirculation sump.

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Following the transfer to cold leg recirculation, both ECCS and CTS draw water from the containment recirculation sump. To prevent damage to the pumps, the water level in the active sump must remain above that required to prevent damage to the pumps which would make them inoperable. Pump damage can occur either due to vortexing or inadequate NPSH. At the time of discovery for all of these conditions, the active containment sump level to prevent damage due to vortexing was 602 feet 10 inches. The level to assure adequate NPSH is several feet below that. Therefore, the level of 602 feet 10 inches becomes the minimum level at which the ECCS/CTS pump suction operability could be assured under full flow conditions, i.e., both safeguards trains operating at maximum flow.

An evaluation was performed by Westinghouse and addressed the impact on safety of the "as found" conditions at Cook that existed just prior to the voluntary shut down in September 1997. The analysis was documented in a Justification for Past Operation (JPO) and applies to all past operating cycles for both Units 1 and 2. The JPO was initially issued in February 1999. Revision 1 was issued in March 1999 to include the additional loss of RWST water due to the postulated blocked vent. Review of the JPO determined that the conditions identified here would have potentially affected 3 key parameters - peak containment pressure, recriticality, and containment sump level. It was concluded that peak containment pressure would have remained below the 16.1 psig pressure value to which the containments were tested during construction of the plants (reference: LER 315/98-014-03). It was also concluded that recriticality would not have occurred during any cycle on either unit if rod insertion is credited (recently added to licensing bases, reference: Donald C Cook Amendments 236 and 218 for Units 1 and 2).

As part of the JPO, the sump level analysis performed in 1998 was reviewed. The 1998 analysis demonstrated adequate sump inventory for a range of nine small and large breaks from .5 inches up to 10.48 square feet, and showed that the most limiting break LOCA scenario in terms of establishing and maintaining adequate sump level was a 2.75 inch Control Rod Drive Mechanism (CRDM) housing rupture. However, it was determined that the analysis should be reperformed to account for all known conditions, including the postulated blockage of the RWST vent. The re-analysis was performed using 2 different sets of assumptions regarding operation of the containment air recirculation/hydrogen skimmer (CEQ) fans. The first assumed both CEQ fans to be operable, which would result in additional ice melt and an increase in available sump inventory to offset the additional loss of RWST inventory. The result was that sump level remained above the minimum required level. The second re-analysis was performed assuming the limiting single failure of a CEQ fan. This results in the water level in the active sump dropping to 4 inches below the minimum required. This is considered acceptable for the most limiting break since ECCS pump flows would be less for this 2.75 inch CRDM (EIIS:JD) housing rupture than for a large break and the sump level would remain above the level at which air ingression would occur. Therefore, no air ingression is expected and no reduction in NPSH margin needs to be taken. It was therefore concluded, considering the effect of all known conditions on indicated RWST level, that adequate sump level would have been available to support continued operation of the ECCS pumps in the recirculation mode.

Based on the analyses that were performed, it has been concluded that the combined conditions that could prevent full transfer of RWST water to the containment sump were of minimal safety significance.

Corrective Actions

The RWST level taps were relocated to a drain line off of the RWST for both units. This eliminates the velocity effects from the suction location.

A review of other level measurement systems that interface directly to the flowpath was performed; no further issues were identified.

The engineering design standards were revised to ensure appropriate considerations of flow induced bias in level instrument installations or modifications.

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The instrument uncertainty engineering guide EG-IC-004 was revised to detail flow induced Bernoulli effects.

As part of the Emergency Operating Procedure Upgrade Project, 2 OHP 4023.ES-1.3, "Transfer to Cold Leg Recirculation" was revised to transfer more water from the RWST before switchover to recirculation, and to include allowances for containment water level instrument uncertainties. A similar procedure revision will be made to 1 OHP 4023.ES-1.3 prior to Mode 4.

The ECCS System Description, SD-12-ECCS-100, was revised to address the requirement for containment elevation required to ensure NPSH and vortexing requirements.

A review was performed to validate all footnote values used in the EOPs. The purpose of the validation was to identify the design basis for each value used and ensure the value was consistent with the plant design basis. The required EOP footnotes have been reissued in Engineering Control Procedure (ECP) 1-2-00-14, Revision 16. Revision 16 to the ECP also includes the minimum containment level for operation in the recirculation mode and the RWST level required for transition to cold leg recirculation.

A design change was implemented to increase the venting capability of the Unit 2 RWST prior to the unit's restart. A similar design change will be implement on the Unit 1 RWST prior to Mode 4.

Submittal AEP:NRC:1260GH, "Enforcement Actions 98-150, 98-151, 98-152 and 98-186, Reply to Notice of Violation October 13, 1998," dated March 19, 1999, responded to identified programmatic weaknesses in the control of instrument uncertainty calculations and the plant Design and Licensing Basis, including calculations. Corrective actions relative to overall instrument uncertainty and calculation programs have been carried out under Restart Action Plans 03A and 03C.

Previous Similar Events

The following LERs are similar to this event:

LER 05000-315/ 97-018-01 - Failure to Maintain Particulate Retention Requirements for the Containment Recirculation Sump Results in a Condition Outside the Design Bases

LER 05000-315/ 97-023-01 - Design Change Introduces Possibility of Single Failure Which Could Result in Loss of Both Trains of ESF Ventilation

LER 05000-315/ 00-003-00 - Containment Internal Concrete Structures Do Not Meet Design Load Margins

The above represents three examples of CNP's failure to adequately control its design basis. Additional examples of CNP's failure to control its design basis have been reported. This event, and the additional similar events, occurred prior to the implementation of corrective actions to correct and prevent recurrence of the breakdown in the CNP design process.