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AUTH.NAME AUTHOR AFFILIATION
SCHOEPF,P. Indiana Michigan Power Co.
BLIND,A.A. Indiana Michigan Power Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 97-017-01:on 970908,condition outside design basis resulted in TS required shutdown.Caused by lack of thorough review.New analsyes have been completed & containment has been validated.W/971117 ltr.

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Indiana Michigan
Power Company
Cook Nuclear Plant
One Cook Place
Bridgman, MI 49106

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November 17, 1997

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Docket No. 50-315

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

97-017-01

Sincerely,

A. A. Blind
Site Vice President

/mbd

Attachment

c: A. B. Beach, Region III
E. E. Fitzpatrick
P. A. Barrett
S. J. Brewer
J. R. Padgett
D. Hahn
Records Center, INPO
NRC Resident Inspector

NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	Page 1 of 5
Donald C. Cook Nuclear Plant - Unit 1	50-315	

TITLE (4)
Condition Outside Design Basis Results in Technical Specification Required Shutdown

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
09	08	97	97	-- 017 --	01	10	08	97	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)	74		20.2201(b)		20.2203(a)(3)(i)		50.73(a)(2)(iii)		73.71(b)
			20.2203(a)(1)		20.2203(a)(3)(ii)		50.73(a)(2)(iv)		73.71
			20.2203(a)(2)(i)		20.2203(a)(4)		50.73(a)(2)(v)		OTHER
			20.2203(a)(2)(ii)		50.36(c)(1)		50.73(a)(2)(vii)		(Specify in Abstract below and in Text, NRC Form 366A)
			20.2203(a)(2)(iii)		50.36(c)(2)		50.73(a)(2)(viii)(A)		
			20.2203(a)(2)(iv)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)(B)		
			20.2203(a)(2)(v)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Mr. Paul Schoepf, Safety Related Mechanical Engineering Superintendent	616/465-5901, x2408

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
X	YES	NO		01	16	98

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

On September 8, 1997, at 2000 hours, with Unit 1 at 74 percent Rated Thermal Power, it was discovered that under certain scenarios the volume of water resident in the active sump volume of the containment may not be adequate to support long term Emergency Core Cooling System (ECCS) or Containment Spray (CTS) pump operation during the recirculation phase of a LOCA event. This was determined to be reportable under 10CFR50.72(b)(1)(ii)(B), as a condition outside the design basis. A Technical Specification required shutdown was undertaken, which is reportable under 10CFR50.72(b)(1)(i)(A). This LER is being submitted in accordance with 10CFR50.73(a)(2)(ii) and 10CFR50.73(a)(2)(i)(A). On September 10, 1997 Unit 1 entered Mode 5, cold shutdown, and remains in cold shutdown.

The root cause of this event was determined to be lack of thorough review. The previously performed engineering reviews did not evaluate the impact of flow diversions into the inactive sump volumes of the containment. New analyses have been completed and the containment analysis has been validated to confirm that, for both postulated large and small break LOCAs that could occur during future operation, an adequate volume of water would be resident in the containment structure and that adequate communication exists in the containment subcompartment boundaries to ensure sufficient drainage to the containment recirculation sump.

The analysis of this event has not yet been completed for all past cycles. Analyses performed for the most recent operating cycle confirms that adequate water volume would have been available in the active sump during the recirculation phase of a LOCA event. An update to this LER will be submitted upon completion of the analyses for all operating cycles. It is expected that the analyses will be completed by December 10, 1997 and this LER will be updated by January 16, 1998.

Conditions Prior to Event

Unit 1 was in Mode 1 at 74 percent Rated Thermal Power

Description of Event

During the development of a revision to procedure OHP 4023.ES-1.3, Transfer to Cold Leg Recirculation, an effort was made to retrieve the calculation of record for the Refueling Water Storage Tank (RWST) inventory transfer to containment. The calculation could not be located, and preparation of an alternate calculation was started.

During preparation of the alternate calculation and evaluation of the current containment analysis, it became apparent the potential existed that under certain scenarios, the volume of water resident in the active sump volume of the containment may not be adequate to support long term Emergency Core Cooling System (ECCS) or Containment Spray System (CTS) pump operation during the recirculation phase of a Loss of Coolant Accident (LOCA). The containment drainage system is designed to ensure that the water entering the containment from a breach of the Reactor Coolant System (RCS), ECCS injection and ice condenser melt flows back to the active containment sump volume and the recirculation sump. The ongoing analysis was unable to confirm that an adequate quantity of water would be resident in the containment structure and that adequate communication existed in the containment subcompartment boundaries to ensure sufficient drainage to the containment active sump and the recirculation sump. Without adequate drainage into the recirculation sump, a low level could result which would jeopardize long term operation of the ECCS and CTS pumps due to potential vortexing and air entrainment.

This evaluation originally was based upon a large break scenario. However, during the reconfirmation analysis, it was determined that a small break scenario could also result in an inadequate volume of water resident in the active sump volume of containment. During original design analysis, the large break scenario was considered to be the bounding analysis. The original containment analysis did not include containment filling calculations for the small break scenarios.

On September 8, 1997, at 1655 hours, Unit 1 commenced a conservative shutdown when it became apparent that analysis might not be able to confirm sufficient volumes of water would be resident within the containment. Unit 2 also commenced a shutdown at this same time, which is covered in LER 316/97-005-01. At 2000 hours that same day it was determined that adequate volumes of water may not exist in containment to support long term operation of the ECCS and CTS pumps and the unit entered Technical Specification (T/S) 3.0.3 due to both trains of ECCS and CTS being inoperable. An Unusual Event (UE) was officially declared at 2000 hours on September, 8, 1997 under the potential loss of containment barrier. The shutdown was uneventful and Unit 1 entered Mode 5, cold shutdown, on September 10, 1997. The UE was terminated on September 10, 1997 when both units entered Mode 5.

Cause of Event

The root cause of the condition was determined to be lack of thorough review. The previously performed engineering reviews did not evaluate the impact of flow diversions into the inactive sump volumes of the containment. Assumptions were made that small break LOCA scenarios did not need to be reviewed with respect to recirculation sump performance and that additional evaluations were not needed to supplement this simplified methodology.

Cause of Event (cont'd)

The containment recirculation sump level calculations were initially performed in 1977, and used a simplistic approach to determine the adequacy of expected post-accident sump levels. These calculations merely assumed a transfer of useable Refueling Water Storage Tank volume into the active containment sump. This methodology may have been based in part on the expectation of generation of additional inventory due to rapid melting of the ice condenser ice beds during a large break LOCA.

The cause of this condition was investigated by a team, using the fault tree method. The team identified four contributors to the recirculation sump inventory issue. These consist of:

- Loss of inventory to the inactive sump through the containment spray header in the accumulator/fan rooms
- Loss of inventory to the inactive sump through the upper containment stairwell drains into the pipe annulus
- Loss of inventory through unsealed penetrations in the crane wall
- The lack of knowledge on the part of the staff including plant operating crews, regarding the nature of the response of plant systems to events requiring the utilization of containment spray to the point of operation in the recirculation mode.

The following is a brief discussion of each contributor.

Loss of Inventory to Fan/Accumulator Rooms

Loss of inventory to the accumulator/fan rooms is a consequence of the design of the CTS system and the containment of each unit. The CTS system is designed to provide a flow of approximately 300 gpm per train to spray nozzles in the accumulator/fan rooms of the containment. The accumulator /fan rooms are directly above and drain to the pipe annulus. The annulus area is outside the crane wall and is not part of the active sump volume. This design is not a part of the original Westinghouse design for the CTS system. In the Westinghouse design, all spray flow is directed into the upper volume of containment. Water deposited into the annulus does not communicate with the active sump until post-accident containment water level is well above the minimum containment elevation required for long term Residual Heat Removal (RHR) and CTS pump operation. When the Westinghouse design was modified to include spray into the accumulator/fan rooms the implications of this change were not thoroughly reviewed.

Loss of Inventory to the Upper Containment Stairwell Drains

Inventory from CTS is lost not only through the accumulator /fan room spray nozzles, but also through upper containment spray flow down the stairwells near the Containment Hydrogen Skimmer Fans. Water entering the stairwells flows into drains which direct flow into the pipe annulus. As previously noted, water deposited into the annulus does not immediately communicate with the active sump volume.

Loss of Inventory Through Unsealed Penetrations in the Crane Wall

In addition to the above pathways for inventory loss from the active sump, unsealed penetrations existed through the crane wall, through which water could flow from the active sump into the inactive sump. Documentation showed that it was the intent of the original design that these penetrations be sealed. The failure to seal these penetrations resulted from improper implementation of the design expectations.

Cause of Event (cont'd)

Lack of Knowledge on the Part of the Staff Regarding the Response of Plant Systems

Through review of this issue, it was determined that there had been a lack of knowledge on the part of the plant staff regarding the effect of the inactive sump on the recirculation sump inventory during accident scenarios involving utilization of containment spray in the recirculation mode of operation. Specifically, information regarding loss of recirculation sump inventory had to be reconstituted by review of various pieces of design information, and therefore, had not been available to operating crews and personnel developing operator training in a form that would support operator awareness of the subject.

These contributors were evaluated for corrective actions along with the root cause.

Analysis of Event

This event was reported on September 8, 1997 at 2057 hours via ENS under the provisions of 10CFR50.72(b)(1)(ii)(B), as a condition outside the design basis. A Technical Specification required shutdown was undertaken, which is reportable under 10CFR50.72(b)(1)(i)(A). This LER is therefore submitted in accordance with 10CFR50.73(a)(2)(ii) and 10CFR50.73(a)(2)(i)(A).

After substantial analysis it was concluded that during recent operation of Unit 1, there would have been sufficient water in the containment active sump following a LOCA to assure ECCS and CTS pump operability at all times. This analysis considered volume of water transferred from the Refueling Water Storage Tank, contribution to volume from ice melt, and water lost to various containment volumes which are not part of the active sump, and concluded that adequate containment levels would be sustained. Thus, it was concluded that the conditions described did not adversely impact the operability of the ECCS/CTS pumps. The evaluation of the impact of this condition on adequate sump level to assure ECCS and CTS operability is limited to plant operations since 1992, when Revision 2 of procedure OHP 4023.ES-1.3, Transfer to Cold Leg Recirculation, went into effect, until September 8, 1997, the last day both units of Cook Nuclear Plant were operated prior to this operability assessment.

Analyses to support operability prior to the issue of Revision 2 of OHP 4023.ES-1.3 are in progress, but have not yet been completed. The long term cooling post LOCA concerns, such as preventing recriticality and maintaining containment integrity, are also being evaluated. The additional evaluations should be completed by December 10, 1997.

In conclusion, from 1992 to the present time, analysis has determined that adequate sump level was available to support ECCS and CTS pump operation. Therefore, this condition has no safety significance for this particular aspect during the specific time period evaluated. Additional information regarding safety significance will be provided once all analyses are completed. It is expected that an update to this LER will be submitted by January 16, 1998.

Corrective Action

New analyses have been completed and the containment analysis has been validated to confirm that, for both postulated large and small break LOCAs that could occur during future operation, an adequate volume of water would be resident in the containment structure and that adequate communication exists in the containment subcompartment boundaries to ensure sufficient drainage to the containment recirculation sump. These analyses included extensive reviews of loss of inventory to various containment volumes and concluded these losses could be tolerated.

Corrective Action (cont'd)

A T/S change has been submitted which increased ice condenser ice weights, which in turn increase sump water volume following a LOCA. This T/S change is currently under review by the NRC and will be implemented upon approval. Surveillance requirements have already been updated to increase required ice weights, since this is conservatively above current T/S requirements. The ice condenser ice weights are being aligned to the new requirements prior to startup of the unit as part of normal surveillances.

OHP 4023.ES-1.3, Transfer to Cold Leg Recirculation, has been revised to optimize the amount of water transferred from the RWST prior to entering the recirculation phase following an accident. These revisions are awaiting approval of the ice condenser ice weight T/S amendment before being issued.

Openings in the crane wall which provided a path for diversion of flow from the active to the inactive sump have been sealed. Operability assessments, studying impact since initial plant operation, are ongoing.

The cause of this condition was determined to be lack of thorough review since the previously performed engineering reviews did not evaluate the impact of flow diversions into the inactive sump volumes of the containment. Engineering/design information was not readily available, which clearly described salient design features of the containment with respect to loss of water inventory during post-LOCA scenarios to compartments which are not part of the active sump volume and with respect to intended integrity of specific compartments. As this information became available during investigation of this issue, it was shared with our staff through various communiques providing updates on resolution of Architect Engineer inspection issues. To permanently capture this information, appropriate containment systems Design Basis Documents are being revised to clearly reflect these design features.

With regard to the specific issue of "lack of a thorough review," the quality of calculations is the subject of a separate Condition Report (CR) which was written to address calculation deficiencies identified during an assessment which followed the Architect Engineer inspection. Investigation of this CR, which is ongoing, includes consideration of programmatic calculation deficiencies, including their thoroughness.

As discussed in the NRC's confirmatory action letter to the Cook Nuclear Plant, dated September 19, 1997, we are assessing the problems identified during the recent AE Design Inspection to determine whether these types of problems exist in other safety related systems and whether they affect system operation. In the longer term, we will evaluate our programs for improvements to assure these kinds of engineering problems are promptly identified, thoroughly evaluated, and resolved. The results of our reviews and assessments, as well as necessary preventive actions, will be communicated separately to the NRC.

One example of ongoing assessments pertinent to this investigation includes walkdowns of the containments to ensure that no conditions exist that may prevent the containment systems from accomplishing their intended function. While this assessment is ongoing, to date, no deficiencies have been identified which would have prevented the containment systems from performing their function.

Failed Component Identification

Not Applicable

Previous Similar Events

315/97-011-01