Nebraska Public Power District

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CNSS948297

September 6, 1994

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Dear Sir:

Cooper Nuclear Station Licensee Event Report 94-015 is forwarded as an attachment to this letter.

Sincerely,

R. L. Gardner
Plant Manager

RLG/nc

Attachment

cc: L. J. Callan
G. R. Horn
J. H. Mueller
S. J. Jobe
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INPO Records Center
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IE22

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

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
COOPER NUCLEAR STATION	05000298	1 OF 5

TITLE (4) Excessive Heatup/Cooldown During RPV Stratification Events

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
08	04	94	94	-- 015 --	00	09	06	94	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N
POWER LEVEL (10)	0

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

	20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
	20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
	20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER
	20.405(a)(1)(iii)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
	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 (Include Area Code)
Donald L. Reeves, Jr.	(402) 825-3811

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

On December 14, 1993, and again on March 2, 1994, Technical Specifications LCO 3.6.A.1 requirements were not met in that reactor coolant temperature changed by greater than 100°F when averaged over a one hour period.

During the plant trips which occurred on these dates, both reactor recirculation pumps tripped resulting in a loss of forced circulation. Despite attempts to enhance natural circulation in the vessel, significantly cooler water accumulated in the bottom head, resulting in bottom head coolant temperature dropping by greater than 100°F/hour.

During the December 14 event, when the rate of depressurization was increased to achieve cold shutdown, enhanced core boiling increased coolant circulation and caused the bottom head metal and coolant temperatures to exceed a 100°F/hour heatup rate.

The non-compliance with Technical Specification LCO requirements was not previously recognized or reported for either event.

A. Event Description

DECEMBER 14, 1993, EVENT

The plant was operating at 100% power when at 0134 several annunciators associated with a failure of the Reactor Feedwater Pump master controller and a low reactor vessel water level alarmed. Initially, operators attempted to decrease reactor power by reducing reactor recirculation pump speed. Following this, Reactor Recirculation Pump B was manually tripped to more rapidly lower power. In spite of these efforts, an automatic scram occurred on RPV low water level. All control rods inserted and the appropriate PCIS group isolations were received, including isolation of RWCU. Due to expected level shrink and loss of feedwater control, RPV level continued to lower to the Level 2 setpoint. This caused HPCI and RCIC to initiate and Reactor Recirculation Pump A to auto trip. Normal RPV level was quickly restored and HPCI, RCIC and RFP B were secured within 4 minutes of the scram. RWCU was returned to service at 0200. This transient was previously reported in more detail in LER 93-038.

Following the loss of forced circulation, reactor recirculation pumps could not be restarted due to prestart temperature differential limits having been exceeded. As the reactor coolant was stratifying, cooldown rates on the bottom head drain, vessel bottom head, and vessel above skirt junction exceeded 100°F/hour. Procedure 2.4.2.2.4, Reactor Vessel Cold Water Stratification, was entered at 0225.

At 0430 the inboard MSIVs were closed to limit the bulk cooldown rate of the RPV per General Operating Procedure 2.1.7, Scram Recovery During Power Operation - MSIVs Open. At 0811 CRD flow was lowered to 5 gpm in accordance with subsequent actions in Abnormal Procedure 2.4.2.2.4, Reactor Vessel Cold Water Stratification, to reduce thermal stratification. Direction was given to proceed to cold shutdown and at 1055 the MSIVs were opened and a cooldown rate established. This rate, based on saturation temperature for reactor pressure, was established at approximately 55°F/hour over the first hour and approximately 15°F/hour over the second hour. However, the reactor depressurization enhanced core boiling and increased coolant circulation in the stratified RPV. The increase in coolant circulation resulted in heatup rates on the bottom head drain and vessel bottom head exceeding 100°F/hour. On December 15, 1993, at 0414 the RHR B loop was placed in shutdown cooling. Procedure 2.4.2.2.4, Reactor Vessel Cold Water Stratification, was exited at 0516. The plant entered into cold shutdown at 0610.

A. Event Description (continued)

MARCH 2, 1994, EVENT

At 1747 the reactor scrammed from 97% power on high flux due to a momentary reactor pressure increase caused by a partial closure of the main turbine governor valves due to a DEH system malfunction associated with 24 volt power supplies. The pressure increase caused a reduction in reactor core void fraction and a subsequent rapid shrinking of reactor vessel level. RPV level decreased to below the Level 3 and Level 2 setpoints. The appropriate group isolations were received which included RWCU. HPCI and RCIC initiated and both reactor recirculation pumps auto tripped. RPV level was restored with reactor feedwater and both HPCI and RCIC were immediately secured. This transient was previously reported in more detail in LER 94-004.

Following the loss of forced circulation, prestart temperature differential limits were exceeded and a reactor recirculation pump could not be restarted. As the reactor coolant was stratifying, the cooldown rate at the bottom head drain exceeded 100°F/hour.

Acting on lessons learned from the December 14, 1993 event, operators lowered RPV pressure from approximately 600 psig to approximately 500 psig with the main turbine bypass valves to satisfy the reactor recirculation pump prestart limits. Circulation driven by the RPV depressurization restored temperature limits and Reactor Recirculation Pump A was restarted at 1848.

At 0842 on March 3, 1994, the RHR B loop was placed in shutdown cooling. At 1041 the plant entered into cold shutdown.

B. Plant Status

December 14, 1993, Event: Plant was operating at 100% power.

March 2, 1994, Event: Plant was operating at 97% power.

C. Basis for Report

These bottom head coolant and metal temperature cooldown and heatup rates are being reported under 10CFR50.73(a)(2)(i)(B), violation of Technical Specification requirements.

D. Cause

At the time of occurrence, operators did not recognize that the heatup and cooldown rate limit was exceeded. The operators understanding was that Technical Specification 3.6.A.1 applied to average coolant temperature during normal heatup and cooldown only and did not apply to bottom head temperatures or vessel metal temperatures during off-normal conditions.

Plant startup, shutdown and scram recovery procedures were inadequate concerning RPV temperature monitoring. The procedures prompted the operator to observe bottom head drain and reactor recirculation loop suction temperatures, but did not address RPV metal temperatures, specifically the bottom head region. The abnormal procedure dealing with stratification was also inadequate in that it focused primarily on the determination of whether or not a 145°F differential temperature existed between the dome and bottom head drain, but did not alert the operator to other vessel temperature concerns.

Although licensed operator training emphasized heatup and cooldown rates during controlled startups and shutdowns, and EOP training cautions that the Technical Specification limits might be exceeded during RPV depressurization, the focus of the training still remained on the saturated bulk average coolant temperature of the vessel.

The root cause for not entering the LCO is the nonconservative interpretation of Technical Specification LCO 3.6.A.1 - "The average rate of reactor coolant temperature change during normal heatup or cooldown shall not exceed 100°F/hr when averaged over a one-hour period". Operations did not understand that the LCO applied to bottom head temperatures during off-normal conditions. The Technical Specification LCO was not applied correctly in the decision making process.

E. Safety Significance

Detailed reactor vessel stress analyses have been performed for both steady state and transient conditions with respect to material fatigue. The results of these analyses have been compared to allowable stress limits and determined to be acceptable. The specific conditions analyzed included numerous cycles of normal startup and shutdown with heating and cooling rates of 100°F/hour applied continuously over a temperature range of 100°F to 546°F. The expected number of normal heatup and cooldown cycles to which the vessel will be subjected is based on this analysis. Of concern with these specific events was that a technical specification violation was not recognized and reported in a timely manner.

F. Safety Implications

Evaluation of the transient has demonstrated that the cumulative usage factor for the bottom head is well within the allowable code, that abnormal shutdown events have had an insignificant effect on the cumulative usage factor, and that the total number of transient cycles experienced by the RPV to date are below allowable limits. It is concluded that these abnormal shutdown events do not constitute an unanalyzed condition and that they are not an unreviewed safety concern.

G. Corrective Action

These industry phenomena will be further reviewed by Nebraska Public Power District in conjunction with the BWR Owner's Group committee being formed to address lower plenum stratification.

Operator Requalification Classroom and Simulator Training has been conducted which concentrated on performance of actions to minimize RPV stratification with emphasis on Technical Specification heatup and cooldown temperature monitoring requirements.

During the March 2, 1994 event, the operators had difficulty expediting the restart of a reactor recirculation pump. The procedure which requires data collection and hand calculation was considered cumbersome. Operations has initiated a Software Design Change Request to develop and implement a dynamic computer display which will calculate the required data continuously to enable faster reactor recirculation pump recovery. A change to the Reactor Water Cleanup operating procedure was submitted to expedite restoration of RWCU. RWCU flow is required to provide accurate bottom head drain temperatures which is needed for support of reactor recirculation pump recovery.

A corrective action plan has been developed and is being implemented to address the programmatic, procedural and training concerns identified during the investigation of these two events.

H. Similar Events

Previous similar events involving loss of both recirculating pumps and subsequent stratification have occurred but were not reported for the same reasons as specified herein. The cummulative effect of these stratification events has been included in the fatigue evaluation.