Omaha Public Power District
444 South 16th Street Mall
Omaha NE 68102-2247

December 17, 1996
LIC-96-0186

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

Reference: Docket No. 50-285

Subject: Licensee Event Report 96-014 Revision 0 for the Fort Calhoun Station

Please find attached Licensee Event Report 96-014 Revision 0 dated December 17, 1996. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B). If you should have any questions, please contact me.

Sincerely,

James W. Chase Jr

S. K. Gambhir
Division Manager
Production Engineering

EPM/epm

Attachment

c: Winston and Strawn
L. J. Callan, NRC Regional Administrator, Region IV
L. R. Wharton, NRC Project Manager
W. C. Walker, NRC Senior Resident Inspector
INPO Records Center

IE22 1/1

NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 4/30/98

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 THE 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.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Fort Calhoun Station Unit No. 1	05000285	1 OF 7

TITLE (4)

Reactor Cooldown in Excess of Limits Due to Starting Reactor Coolant Pumps

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
11	17	96	96	-- 014 --	00	12	17	96		05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	5
POWER LEVEL (10)	0

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

20.2201(b)	20.2203(a)(2)(v)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)
20.2203(a)(1)	20.2203(a)(3)(i)	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 in 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)
Erick P. Matzke, Station Licensing Engineer	(402) 533-6855

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 November 17, 1996, Reactor Coolant System (RCS) cooldown limits were exceeded when Reactor Coolant Pumps (RCPs) were jogged during a plant startup. A RCP was started to sweep steam generator tubes of entrapped gases. When the first RCP was started, RCS temperature decreased from 130 degrees Fahrenheit (F) to 111 degrees F in three minutes. Technical Specification (TS) 2.1.2 only allows a cooldown of 10 degrees F per hour (F/hr) when RCS temperature is less than 135 degrees F. It does not allow for exceptions for RCP startup transients at this time, even though this represents a mild transient in which none of the 10 CFR 50, Appendix G, criteria are expected to be exceeded.

The root cause of this event was a lack of depth in review during evaluation of Technical Specification Amendment 161 and a failure to recognize or adequately evaluate the effect of a decrease in operating margin (allowable cooldown rate lowered to 10 F/hr) on plant operations.

As a result, a number of corrective actions will be implemented including, revising both the plant startup procedure and operating instruction for starting reactor coolant pumps to provide additional guidance to prevent excessive RCS cooldown, and evaluating the feasibility of providing additional operational margin in the cooldown limits.

BACKGROUND

The Reactor Coolant System (RCS) consists of two heat transfer loops connected in parallel to the reactor vessel. Each loop contains one Steam Generator (SG), two Reactor Coolant Pumps (RCPs)(RC-3A, RC-3B, RC-3C, and RC-3D), connecting piping and instrumentation. A pressurizer is connected to one of the reactor vessel outlet (hot leg) pipes by a surge line. Pressurizer relief and safety valves are provided which discharge to a quench tank to condense and cool the valve discharges. All components of the RCS are contained within the containment building.

The RCS is designed to remove heat from the reactor core and internals and transfer it to the secondary (steam generating) system by the controlled circulation of pressurized, borated water which serves both as a coolant, neutron moderator and neutron absorber.

In order to prevent stresses in the RCS that may cause brittle fracture, heatup and cooldown limitations are applied and defined in Technical Specification (TS) 2.1.2. These limits are based upon Section III of the American Society of Mechanical Engineers (ASME) Code, Appendix G-2215. The heatup and cooldown limits for the Fort Calhoun Station (FCS) are as follows:

Heatup: 75 degrees Fahrenheit (F) per hour (F/hr) when the RCS temperature is less than or equal to 335 degrees F.
100 degrees F/hr when the RCS temperature is greater than 335 degrees F.

Cooldown: 10 degrees F/hr when the RCS temperature is less than 135 degrees F.
30 degrees F/hr when the RCS temperature is between 135 degrees F and 285 degrees F, inclusive.
100 degrees F/hr when the RCS temperature is greater than 285 degrees F.

If any of these limits are exceeded, TS 2.1.2(5) states:

(a) That immediate actions must be taken to restore temperature within the limit.
(b) Perform an analysis to determine the effects of the out of limit condition on the fracture toughness properties of the RCS.
(c) Determine that the RCS remains acceptable for continued operation or be in cold shutdown within 36 hours.

EVENT DESCRIPTION

On November 17, 1996, with the plant in mode 5, FCS was conducting a plant startup following the refueling outage. Plant conditions at the time were as follows. Shutdown

cooling was in service with RCS temperature at 130 degrees F and RCS pressure at 200 pounds per square inch absolute (psia). The RCS was intact, however, the primary side of the SG tubes had not been swept of entrapped air following the refilling of the RCS, which had occurred several days earlier. The RCPs had not been run since the RCS had been closed and filled following fuel loading. Pressurizer level was 60 percent. The secondary side of both SGs were in wet layup. SG 'A' had been in layup for several days. SG 'B' had been drained and then refilled to layup (fill water temperature was estimated to be less than 70 degrees F) to improve secondary water chemistry conditions on November 16, 1996. A large volume containment purge was in progress with containment temperature at approximately 75 degrees F.

The "Plant Startup" procedure, OP-2A, step 13, directs the operators to "jog" the RCPs to sweep entrapped air from the SG tubes. The operators use the instructions in procedure OI-RC-9 "Reactor Coolant Pump Operation" to perform the evolution. Prior to performing the evolution the operators conducted a prejob briefing of the task. They discussed the requirements of the controlling procedure, OP-2A, and referred to Technical Data Book Figure III.25 "RCS Pressure and Temperature Limits." The figure also provides the Net Positive Suction Head (NPSH) curve for the RCPs. Several days earlier, control room operators had selected two Core Exit Thermocouple (CET) temperature indicators as inputs for recorder YR-4102 and were using them to indicate current RCS temperature. CET temperature indication is used by plant operators as the best available indication of bulk RCS temperature while on shutdown cooling.

The control room operators expected some temperature decrease to occur when the RCP(s) were started. They thought that current plant conditions were similar to other plant startups. They did not consciously consider the 10 F/hr cooldown limit.

At 0633, with the RCS at 130 degrees F, the first RCP pump, RC-3C, was started per OP-2A. The RCP pumped the cooler water, contained in the stagnant RCS piping and SG U-tubes, into the reactor vessel core. The RCP was operated for three minutes and nine seconds which resulted in some additional cooling of the RCS by the SGs, which had previously been filled with cold water. Following the start of RC-3C, RCS temperature quickly decreased to 117 degree F and then continued to decrease at a slower rate until it reached 111 degree F by 0636 when the pump was stopped.

The remaining RCPs were started, one at a time, and run for approximately three minutes each, RC-3B at 0646, RC-3A at 0652, and RC-3D at 0658. These subsequent pump starts resulted in RCS temperature stabilizing at 104 degree F by 0701. The RCS temperature decrease was observed by a control room operator when the first pump was started and the decrease was not unexpected. The Licensed Senior Operator (LSO) directing the pump starts recognized the decrease in RCS temperature due to the first pump start after the second pump was started. At that time the operators understood it

to be a "normal" temperature decrease, to be expected when sweeping SG U-tubes.

During the shift turnover which took place about 0700, the oncoming and current control room operators reviewed and discussed the temperature changes and concluded that the TS cooldown limits had been exceeded. The STA notified appropriate plant management of the TS violation. Condition Report 199601476 was written to document this event.

This report is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B).

When shutdown cooling is in service, procedure OI-SC-1 "Shutdown Cooling Initiation" directs that two Low Pressure Safety Injection (LPSI) Loop injection valves be opened. Normally this provides cooling flow from SDC for two of the four RCS loops. Therefore, when air is entrapped in the steam generator U-tubes, RCS flow is limited to the reactor vessel and piping associated with the shutdown cooling system. Since the primary side of the SG tubes had not been swept of the entrapped air and no RCP was in operation, much of the water contained in the RCS loop piping and steam generator U-tubes was stagnant. That is, there was little circulation between the RCS loop piping and the steam generators. As a result, the temperature of the water in these sections of the system, especially the water contained within the SG U-tubes, was at a lower temperature than the temperature of the RCS as measured by the CETs. The water contained within the SG U-tubes was probably at or near equilibrium temperature with the secondary side coolant.

The temperature differential between SG secondary and primary system coolant in the reactor vessel, could have been as high as 60 degrees F, when the first RCP was started, on November 17. When the RCP was started to sweep the SG U-tubes, the cooler water contained within the loop piping and SG tubes was circulated through the RCS and into the reactor core where the CETs monitored the drop in temperature of the fluid in the reactor vessel.

SAFETY ASSESSMENT

In accordance with TS 2.1.2(5)(b) OPPD directed the performance of an analysis by ABB-Combustion Engineering (ABB-CE) to address the effects of the cooldown on the reactor vessel. This analysis was completed on November 18, 1996. It determined that the temperature transient was within the 10 CFR 50 Appendix G fracture toughness limits for the reactor coolant system. It also concluded that sufficient margin existed between the RCS pressure during the transient and the limiting Updated Safety Analysis Report (USAR) Appendix G pressure for this transient. Therefore, this event was determined not to be significant with respect to the integrity of the reactor vessel and reactor coolant system.

CONCLUSIONS

A root cause investigation conducted to determine the reasons for this event concluded that the root cause of the event was a lack of depth in review during evaluation of Technical Specification Amendment 161 and a failure to recognize or adequately evaluate the effect of a decrease in operating margin (allowable cooldown rate lowered to 10 F/hr) on plant operations. As a result a RCS cooldown greater than TS limits was experienced.

In addition the following problems contributed to the event:

1) Due to the incomplete evaluation of the effect of amendment 161 on all facets of plant operation, there was no procedural instruction or training provided to compensate for the affects of reduced operating margin on RCS temperature during SG sweeps. Simulator training had been provided on the other aspects of plant heatups and cooldowns.

2) Control Room operators and supervision did not recognize similar RCS cooldown violations in excess of TS limits during previous outages. As a result, corrective actions had not been previously implemented.

CORRECTIVE ACTIONS

Following the cooldown event and prior to the next start of a RCP for plant heatup on November 18, 1996, Operations and System Engineering discussed how to avoid an additional cooldown event. It was decided to take local pyrometer readings of the SGs in order to estimate the secondary side bulk temperature. A calculation was then performed to predict the RCS temperature change following start of the RCP for startup. This method was determined to be helpful in determining the potential effects of a RCP start on RCS temperature. The subsequent pump start caused an observed temperature decrease of 5 degrees F.

In addition the following long term corrective actions will be implemented to reduce the potential of this type of event occurring in the future.

1) OP-2A and OI-RC-9 will be revised to add strict procedural controls to prevent exceeding plant cooldown limits when sweeping the SG tubes. These controls will include, among others, appropriate cautions, a pre-job briefing by the Shift Supervisor, measurement of secondary side SG temperatures and calculation of the maximum expected RCS cooldown. These procedural revisions will be completed by March 31, 1997.

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

2) OPPD will review previous plant startups where conditions were similar to this event to determine if any other cooldown incidents that violated TS limits similar to this event occurred. This review will be completed by January 31, 1997. OPPD will ensure that the requirements of TS 2.1.2(5)(b) are met in a timely fashion for any violations that may be noted as a result of this review.

3) Technical Specification amendment 161 will be reviewed to ensure its changes have been fully implemented in appropriate plant procedures. A sample of other Technical Specification amendments will be reviewed to ensure they were adequately implemented. This will be completed by March 31, 1997.

4) OPPD will review other evolutions or tests conducted in Modes 4 and 5 for the potential for excessive cooldown of the RCS. This review will be completed by June 30, 1997 and appropriate procedures changes, if necessary, will be completed by September 30, 1997.

5) In order to provide additional assurance that changes to TSs will not unexpectedly impact plant operations, OPPD will evaluate the TS amendment process (prior to submittal to the NRC) to identify any changes that may be needed to improve the verification and validation of proposed changes. The review and any needed procedure changes will be completed by May 31, 1997.

6) OPPD will evaluate the feasibility of obtaining additional operating margin in the Technical Specification cooldown limits for the subject conditions. The feasibility study will be completed by March 31, 1997.

7) OPPD will evaluate the feasibility of adding SG secondary side temperature indication. The feasibility study will be completed by September 30, 1997.

8) Training on this event will be completed for the licensed operators during the next regularly scheduled training sessions. This will be completed by April 14, 1997. Additionally, this event and emphasis on RCS cooldown and heatup limits while in modes 4 and 5 will be incorporated into the initial licensed operator training program by July 31, 1997.

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TEXT CONTINUATION

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PREVIOUS SIMILAR EVENTS

An effort was made to identify other instances where RCS cooldown limits may have been exceeded during previous plant outages. The control room log and RCS temperature recorders from the April 1995 refueling outage were reviewed to determine if RCS cooldown limits were exceeded during the startup following the 1995 refueling outage. The review determined that during SG U-tube sweeping operations in the 1995 refueling outage, an RCS cooldown of 13 degrees F was experienced. This cooldown was also greater that the limits established by the Technical Specifications.

In addition during the startup following a forced outage in June 1996, when RCPs were started to sweep the SGs a cooldown of 15 F/hr occurred.

The failure to recognize these cooldowns that were in excess of TS limits is believed to be due to causes that are similar to those identified in this report.