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

January 21, 1997
LIC-97-0004

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 96-016 Revision 0 for the Fort Calhoun Station

Please find attached Licensee Event Report 96-016 Revision 0 dated January 21, 1997. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(v)(D) and 10 CFR 50.46(a)(3)(ii). If you should have any questions, please contact me.

Sincerely,

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

NRC FORM 366 (4-95) 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 4/30/98

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Fort Calhoun Station Unit No. 1	05000285	1 OF 6

TITLE (4): Inadequate Procedural Guidance for Resetting an Engineering Safety Feature

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
										05000
12	20	96	96	-- 016 --	00	01	21	97		05000

OPERATING MODE (9): 1
POWER LEVEL (10): 100

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)
	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)	X	OTHER
	20.2203(a)(2)(iii)		50.36(c)(1)	X	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)
Robert F. Mehaffey, Principle Engineer Electrical I&C	(402) 533-6505

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)

Engineering analysis identified a scenario in which High Pressure Safety Injection (HPSI) can be diverted during a small break Loss of Coolant Accident (LOCA) by resetting Engineered Safety Feature (ESF) actuation signals in accordance with plant procedures. If ESF is reset with Reactor Coolant System (RCS) pressure in the range of 360 to 1200 psia with HPSI operating, Safety Injection (SI) leakage cooler control valves could open resulting in a diversion of HPSI away from the RCS and into the waste system. A conservative judgement has been made that the amount of HPSI diversion could have prevented the fulfilment of a safety function needed to mitigate the consequences of an accident. This report is being submitted pursuant to 10 CFR 50.46(a)(3)(ii).

The first cause of this event was a lack of depth in evaluation and review of NRC Inspection and Enforcement (IE) Bulletin 80-06, "Engineered Safety Feature (ESF) Reset Controls." Additionally, the fact that the original plant design which included a feature which allows the leakage cooler valves to open upon ESF reset is the other cause of this event.

An operations memorandum was issued to notify the operators of the issue and to direct the necessary precautionary measures to prevent this from occurring. The response to IE Bulletin 80-06 will be resubmitted and the necessary modifications and procedural revisions will be completed.

BACKGROUND

The Safety Injection (SI) piping at the Fort Calhoun Station (FCS) is designed such that the high pressure and low pressure SI headers connect to the Reactor Coolant System (RCS) cold legs through check valves which isolate the SI system from the RCS during normal operation (See Figure 1). Associated with the SI piping upstream of the four check valves are four Pressure Control Valves (PCV), PCV-2909, PCV-2929, PVC-2949 and PCV-2969. The design function of these four valves is to limit pressure buildup in the SI piping due to leakage from the RCS passing through the backseated check valves. The pressure control valves are normally operated in an automatic mode in which a pressure in the associated piping of 400 pounds per square inch gage (psig) will cause the valves to open, relieving the pressure to a common downstream header. This header can be manually drained to the Reactor Coolant Drain Tank (RCDT) or, if pressure increases above 360 psig, a relief valve (SI-222), that lifts at 360 psig, will automatically divert flow to the RCDT. The four pressure control valves are configured to close when the SI header pressure is reduced to less than 350 psig.

When Engineered Safeguards Features (ESF) are actuated in response to an accident, signals are sent to the control circuits for PCV-2909, PCV-2929, PVC-2949 and PCV-2969 which cause them to go to their fail-closed position by de-energizing a solenoid, overriding the automatic control function. This is desirable since the increase in pressure in the SI headers, due to the operation of High Pressure SI (HPSI) pumps, could cause all four pressure control valves to open, subsequently opening SI-222 and resulting in a diversion of high pressure SI flow to the RCDT and away from the RCS.

Inspection and Enforcement (IE) Bulletin 80-06, "Engineered Safety Feature (ESF) Reset Controls" identified a concern that reset of ESF actuation signals during the course of an accident could cause some plant components to return to a normal (pre-accident) mode of operation. This could potentially compromise the protective function of the component without the plant operators specifically intending to change component status. The Omaha Public Power District (OPPD) was requested to review the drawings for all systems serving safety-related functions to determine whether or not safety-related equipment remained in its emergency mode upon reset of ESF actuation signals. It was also requested that, for equipment that did not stay in its emergency mode after ESF reset, proposed modifications, design changes or other planned corrective action be described.

EVENT DESCRIPTION

In June of 1996 a corrective action document, Condition Report (CR) 199600737, was generated by an Operations Engineer who was concerned about the accuracy of OPPD's response to IE Bulletin 80-06 after noticing the repositioning of valves during ESF

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resets in the simulator. CR 199600737 prompted an engineering re-analysis of the issues identified in Bulletin 80-06. This analysis was completed and reviewed in December of 1996. The analysis, like the original review, identified components which may change operational mode after an ESF reset but, unlike the original review, examined the operational and design basis consequences of ESF reset using engineering tools and expertise which were not available in 1980. The analysis discovered a scenario in which an ESF reset could result in an operational problem during the performance of the EOPs following an accident. The EOPs did not provide adequate guidance to assure consistent response by operations personnel.

The scenario assumes a Small Break Loss of Coolant Accident (SBLOCA) with minimum ESF equipment available, i.e. one high pressure SI pump. The RCS leakage path is of such a size that RCS pressure drops to the range of approximately 360 to 1200 psia and that HPSI flow is able to match the loss of inventory through the hole. This will result in RCS stabilizing and ultimately permitting the operators to reset the ESF signals. Resetting the ESF signals may be desirable in order to establish RCS letdown flow and enable other functions that may have been terminated by the ESF actuation. However, resetting the ESF signals could result in the opening of valves PCV-2909, PCV-2929, PCV-2949 and PCV-2969 in one of two ways. One, once the ESF signal has been reset, the valves would be able to open automatically at 400 psig in response to SI header pressure. Or, two, since the electro-pneumatic (E/P) positioners are not environmentally qualified, the positioners could fail and open the valves.

The second scenario described above provides the limiting conditions for HPSI flow diversion. That is, should the E/P positioners for the PCV valves fail, the valves would open and HPSI flow diversion would occur at 360 psig, the setpoint of relief valve SI-222. HPSI flow diversion at 360 psig is more limiting for this scenario than a diversion at 400 psig.

Whichever pressure the PCV valves open at results in the opening of SI-222, creating a diversion path for HPSI flow. This flow diversion may result in less injection to the RCS than that assumed in the LOCA analysis. SI flow may be inadequate without closing valves PCV-2909, PCV-2929, PCV-2949 and PCV-2969. The diversion may or may not be immediately obvious to operators; however, the resulting loss of RCS inventory will be obvious. Confusion could result since HPSI flow indication would not have been affected by the diversion. That is, flow instrumentation is upstream of the point of diversion.

This issue was presented to the Plant Review Committee (PRC) on December 20, 1996. At 1227 Central Standard Time (CST) the PRC concluded that a condition existed that could have prevented the fulfilment of a safety function needed to mitigate the consequences of an accident. At 1417 Eastern Standard Time (EST), a four-hour non-emergency

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notification was made to the Nuclear Regulatory Commission pursuant to 10 CFR 50.72(b)(2)(iii)(D). This report is being submitted pursuant to 10 CFR 50.73(a)(2)(v)(D) and 10 CFR 50.46(a)(3)(ii). An operations memorandum was issued that same day to notify the operators of the possibility of valve operation after ESF reset and to direct the necessary precautionary measures to prevent this from occurring.

SAFETY SIGNIFICANCE

OPPD's fuel vendor, Westinghouse, has performed an engineering assessment to determine the safety significance of this historical equipment problem on the small break LOCA analysis. The HPSI flow rate reduction resulting from the opening of these valves has been provided as a function of pressure. Although the HPSI flow rate reduction varies with pressure, in the range of pressures where most of the HPSI flow is delivered in the postulated small break LOCA transients for FCS, the average flow reduction is approximately 125 gallons per minute (gpm) (17 pounds per second (lb/sec)). Since the flow diversion is caused by relief valve SI-222 opening, there is no diversion of flow below 360 psig because the valve would have reseated. As a result there is no impact on the large break LOCA or long term core cooling recirculation mode flows where the RCS pressure would have been well below 360 psig long before the subject higher pressure HPSI flow diversion could occur.

For assessing the impact on small break LOCA, it is necessary to determine how early the operators would have reset the ESF actuation signal. For purposes of this assessment, ESF actuation signal reset is assumed to occur 2 hours, or more, following the initiation of the transient. This as a reasonable assumption in light of past operational experience following a type of small break LOCA that occurred at the FCS on July 3, 1992 (See FCS LER 92-023). This eliminates any impact on the 3 inch or 4 inch break size LOCA transients, because they are below the pressure of 360 psig well before 2 hours have passed. Although the Peak Cladding Temperature (PCT) time for the 2 inch break LOCA is already passed at 2 hours, a second core uncovery following the HPSI flow diversion is possible.

A conservative estimate of the PCT impact of the flow diversion on the 2 inch break transient has been generated. It shows that, with the 2 inch break, PCT would have been 2056 degrees Fahrenheit (F), which is substantially higher than the currently reported value of 1540 F, but, still below the 10 CFR 50.46 regulatory limit of 2200 F.

Breaks smaller than 2 inches, but above the size which can be handled by normal charging pump flow have been evaluated and will not result in substantially higher PCT values than calculated above for the 2 inch break.

Given the calculated PCT impact on the 2 inch break, and the conclusion that smaller and larger breaks would not likely result in more limiting calculated PCTs, it has been concluded that the HPSI flow diversion would not have resulted in a challenge to the margin of safety provided by the limits of 10 CFR 50.46.

CONCLUSION

OPPD's technical review and response to Bulletin 80-06 resulted in the identification of a number of components that may not have remained in emergency mode following the reset of ESF signals. Valves PCV-2909, PCV-2929, PCV-2949 and PCV-2969 were identified as being in this group. All of the components identified as potentially changing operating mode following ESF reset were evaluated as to whether modification or other corrective action was needed, as required by the bulletin. At the time the submittal was made, the engineering staff determined that no modification was necessary for the control circuits for PCV-2909, PCV-2929, PCV-2949 and PCV-2969 for two reasons. The first reason was that at the time it was thought that they performed a non-critical function. Since the original review occurred over 15 years ago it is hard to be certain what the original reviewers considered. It has been surmised that they were only considering the large break loss of coolant scenario. The large break LOCA is not impacted by the position of these valves. The second reason was that Emergency Procedure EP-35, "Reset of Engineered Safeguards," identified to the operators that the valves would change position upon ESF reset. EP-35 was superseded by Abnormal Operating Procedure AOP-23 "Reset of Engineered Safeguards" which was later supplemented by Emergency Operating Procedure (EOP) floating steps. Neither AOP-23 nor the EOP floating Steps identified that these valves would open on ESF reset. The lack of adequate depth of review has been identified as the first cause of this problem.

A second cause was the fact that the original plant design included a feature which allows the leakage cooler valves to open upon ESF reset. Clearly, if the design had not included this feature, this issue would not have been a problem.

Several factors contributed to this event. The plant engineering staff was less qualified than it currently is and the reviewers failed to consider the scenarios previously discussed. In addition, there was not a process to control ongoing commitments at the time of this review, therefore, the information in EP-35 was not carried forward into the revisions that resulted in the EOPs and AOPs.

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CORRECTIVE ACTIONS

An operations memorandum was issued the day of the notification to the NRC to inform the operators of the possibility of this valve operation after ESF reset and to direct the necessary precautionary measures to prevent this from occurring.

OPPD is an accredited member of the National Academy for Nuclear Training. Engineering qualification has been significantly improved for the engineering staff as a result of achieving accreditation. Engineering analysis and review processes were upgraded and enhanced in the early 1990's as the result of internal review and auditing of the engineering department. A program has been in place since the late 1980's to capture ongoing commitments. In addition to these actions OPPD will take the following measures to correct this problem.

1. OPPD's design engineering group has completed a review of ESF equipment as directed by IE 80-06. The PCV valves previously noted were identified in this recent review and in the original review. No other significant problems were noted during the review. OPPD will amend its response to bulletin IE 80-06 to correct inaccuracies in the original submittal by February 28, 1997. OPPD will evaluate the desirability of a modification to valves PCV-2909, PCV-2929, PCV-2949 and PCV-2969. The conclusion to this evaluation will be stated in the response previously mentioned.

2. The EOPs and AOPs will be modified to incorporate the administrative controls currently discussed in the Operations Memorandum to prevent PCV-2909, PCV-2929, PCV-2949 and PCV-2969 from opening after ESF reset. These revisions will be completed by February 28, 1997.

PREVIOUS SIMILAR EVENTS

No LER reportable events similar to this have occurred at the Fort Calhoun Station.

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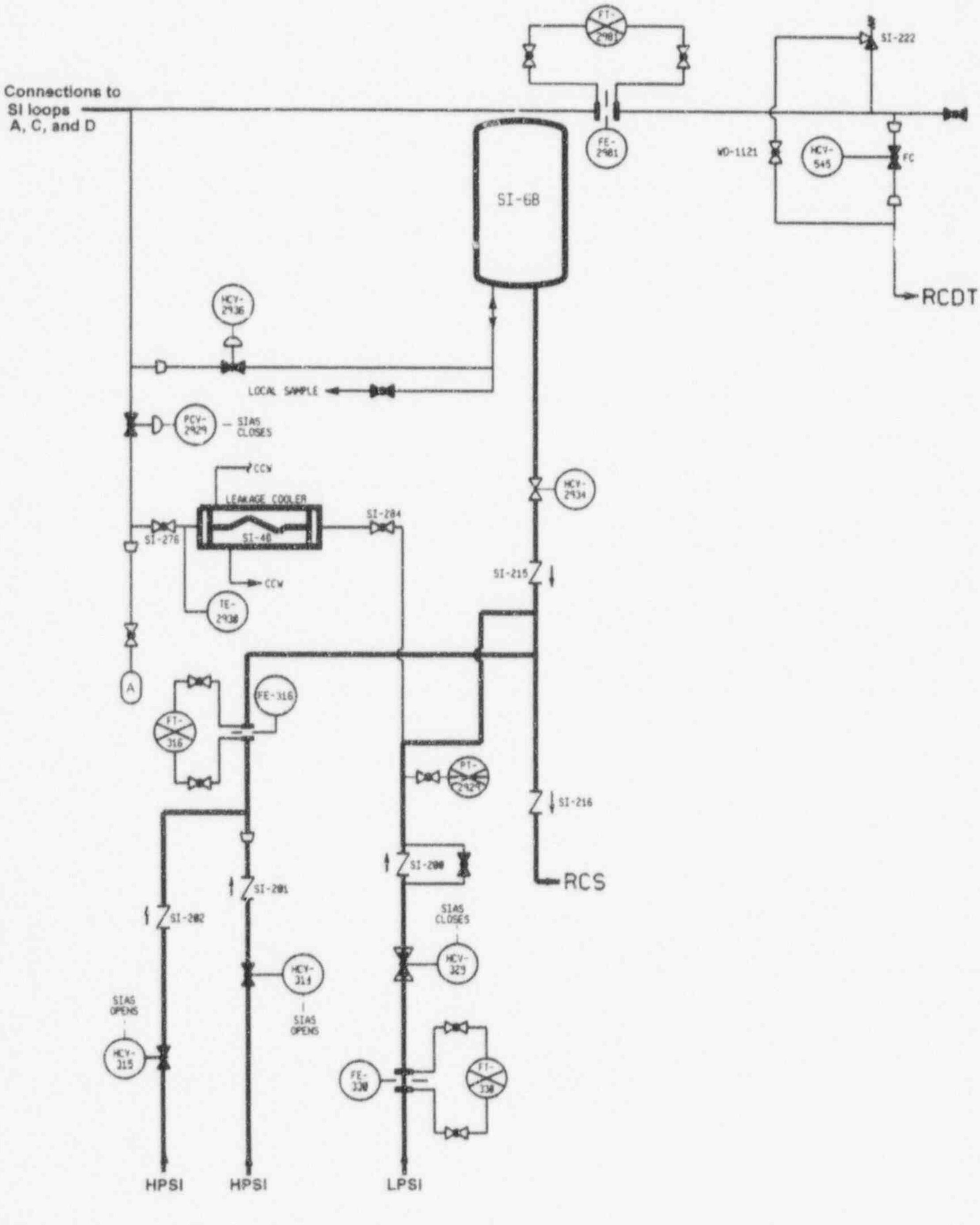

Figure 1