



OPPD

Omaha Public Power District

444 South 16th Street Mall

Omaha NE 68102-2247

June 4, 1997

LIC-97-0080

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 97-004 Revision 0 for the Fort Calhoun
Station

Please find attached Licensee Event Report 97-004 Revision 0 dated
June 4, 1997. This report is being submitted pursuant to 10 CFR
50.73(a)(2)(ii). If you should have any questions, please contact me.

Sincerely,

S. R. Gambhir
Division Manager
Engineering & Operation Support

EPM/grc

Attachment

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

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LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)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 (7-6 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.

FACILITY NAME (1)

Fort Calhoun Station Unit No. 1

DOCKET NUMBER (2)

05000285

PAGE (3)

1 OF 6

TITLE (4)

Diesel Generator Outside of Design Basis due to a Violation of Appendix R

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
05	05	97	97	-- 004 --	00	06	04	97	FACILITY NAME	DOCKET NUMBER 05000
									FACILITY NAME	DOCKET NUMBER 05000
OPERATING MODE (9)		4	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more) (11)							
POWER LEVEL (10)		0	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)		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 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)
Randall J. Mueller, Supervisor Electrical and I&C Engineering	(402) 533-6513

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)

YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

During an April 1997 review of the equipment credited for Control Room/Cable Spreading Room fire safe shutdown, it was determined that the Diesel Generator No. 2 (DG-2) speed sensing circuit's analog output was not capable of being isolated from the Control Room/Cable Spreading Room. A fire in the Control Room could have caused a short circuit of the tachometer or applied 120 VAC or 130 VDC voltage across the speed sensing switch tachometer loop output terminals, which could have damaged the speed switch built-in power supply. In addition to providing output to the tachometer circuit, the speed sensing switch also provides power to four set-point relays. Three of these four relays function to prevent the secondary air start motor from engaging if the engine exceeds 40 rpm, disengage the air start motors and open the DG-2 outside air dampers at 100 rpm, and flash the generator field at 750 rpm. Since the speed sensing switch has a common built-in power supply for the tachometer circuit as well as for the set-point relays, its damage could have resulted in not only the tachometer circuit becoming inoperable, but also could have deenergized or rendered the set-point relay circuits inoperable. This could have adversely affected the operation of the DG-2. The issue does not involve any common mode failure, only DG-2 is credited for meeting the Appendix R requirements.

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BACKGROUND

Speed sensor YE-6148 provides DG-2 engine speed indication (in rpm) and input to DG-2 speed based auxiliary component control functions. The engine speed indication is part of the instrumentation used by the Operators for proper engine operation and manual engine control, when necessary. The speed sensing device provides a 0-1500 rpm analog speed indication on three control panel tachometers. These are Control Room panel AI-30B Diesel Sequencer Safety and Test Panel B in the Control Room, AI-133B Diesel Generator No 2 - Local Control Panel, and D2 - Local Control Panel.

The control portion of the speed sensor operates certain DG-2 auxiliaries and annunciation/annunciation interlocks at specific engine speeds. The control actions are:

1. De-energize the engine immersion heater (engine pre-warm before starting) at 40 rpm.
2. Prevent the secondary air start motor from engaging if the engine exceeds 40 rpm.
3. Disengage the air start motors at 100 rpm.
4. Deenergize the governor booster pump motor at 100 rpm.
5. Open the DG-2 outside air dampers at 100 rpm.
6. Flash the generator field at 750 rpm.
7. Stop VA-52B, the DG-2 room ventilation fan.

The following are annunciation/annunciation interlocks that have speed sensing inputs:

1. Engine Stop Light (40 rpm)
2. Engine Start/Stop Computer Input (40 rpm)
3. Engine Running Computer Input (100 rpm)
4. Lube Oil Pressure Alarm Interlock (750 rpm)
5. Jacket Water Pressure Alarm Interlock (750 rpm)
6. Fuel Oil Pressure Alarm Interlock (750 rpm)

The DG-2 Speed Sensing circuit is comprised of a Syncro-Start Products, Inc. Model ESSB speed switch that uses a magnetic pickup speed sensor to measure engine speed and generate the necessary analog speed signal and control functions. The analog speed output is a 0-1.0 mA current-instrument loop (Y-6148). The control functions are generated by three relays that de-energize at the engine speeds defined above to provide the necessary control and indication functions. The speed sensing circuit uses 130 VDC power from

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Station Battery No. 2 to power the indication and control circuit. A smart fire induced failure could have rendered the control circuits and relays inoperable. However, the ability to predict how the control relays would fail is uncertain.

EVENT DESCRIPTION

During a review of the equipment credited for a Control Room or Cable Spreading Room fire safe shutdown (to determine the need for early action to protect the equipment before the Control Room is evacuated), it was determined that the DG-2 speed sensing circuit's analog (tachometer) output was not capable of being isolated from the Control Room or Cable Spreading Room. A fire in the Control Room could have caused a short circuit of the tachometer or it could have applied 120 VAC or 130 VDC voltage across the speed sensing switch tachometer loop output terminals, which could damage the speed switch built-in power supply or associated control circuits. In addition to providing output to the tachometer circuit, the speed sensing switch also provides power to four set-point relays. Three of these four relays, at their adjusted set-points, function to prevent the secondary air start motor from engaging if the engine exceeds 40 rpm, disengage the air start motors and open the DG-2 outside air dampers at 100 rpm, and flash the generator field at 750 rpm. Since the speed sensing switch has a common built-in power supply for the tachometer circuit as well as for the set-point relays, damage to the speed sensing switch could have resulted in not only the tachometer circuit becoming inoperable, but also could adversely affected set-point relay operation. This could have adversely affected the operation of DG-2.

On May 5, 1997, this information was brought to the Plant Review Committee (PRC) for a reportability review. At 1036 Central Daylight Time (CDT), the PRC determined that this condition constituted a condition where the plant could have been outside of the plant design basis during operation. A four-hour non-emergency report was made to the NRC Operations Center pursuant to 10 CFR 50.72(b)(2)(i) on May 5, 1997, at 1232 Eastern Daylight Time (EDT). This report is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(B).

SAFETY ASSESSMENT

A fire in the Control Room and/or Cable Spreading room, could have shorted the DG-2 speed sensing switch tachometer located on panel AI-30B in the Control Room or it could have applied 120 VAC or 130 VDC across the speed sensing switch tachometer loop output terminals. In the worst case scenario, this could have damaged the speed sensing switch built-in power supply or the

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associated relay control circuits and could have adversely affected the operation of the diesel. Loss of the DG-2 could have impacted the ability to safely shut down the plant. However, the following scenario provides high confidence that despite the lack of Control Room tachometer isolation, DG-2 would have fulfilled its design basis function. The scenario is as follows:

Abnormal Operating Procedure (AOP)-6 requires Operators to trip the reactor during an uncontrolled fire in the Control Room and/or Cable Spreading room before evacuating the Control Room. After the evacuation of the Control Room, AOP-6 requires Operations to isolate bus 1A4 from its normal source, run the diesel to full speed and power the loads from the diesel bus within ten minutes. Fort Calhoun safe shut down analysis (EA-FC-89-055) takes credit for no spurious operations occurring within the first ten minutes of the fire event. The analysis considers the ten minute criteria to be conservative because, for a spurious operation to occur, time would be required for the fire to build and then burn through cable jacketing and insulating material. At the immediate evacuation of the Control Room, DG-2 would have been started and powered before the speed sensing switch would have been damaged. Therefore, it would not have affected the operability of DG-2.

The ability to predict the exact failure mode of the speed sensing switch control relays following a hot short of the tachometer cabling is uncertain. Therefore, it is not possible to know exactly what troubleshooting or repair measures would be required to be taken if the diesel were not started locally prior to tachometer cable damage. However, the Operators are knowledgeable of measures that can be taken to start and operate the diesel should it not function as called out via the "Fire Emergency" procedure AOP-6. This knowledge provides an additional level of assurance that DG-2 could have been started and operated if desired. Specifically, the operators could have overridden the damaged air start motor circuitry, if necessary, by manually opening of solenoid valve SV-2. Doing so allows an associated air valve to open and provides air to the air start motors to start the diesel. Similarly, a local push-button is provided to flash the generator field. This push-button overrides the speed sensing control relay field flash and could have been used to flash the field should the field flash control relay been adversely affected.

Additionally, a fire in the Cable Spreading Room would have actuated the halon system. This would have eliminated the possibility of the DG-2 speed sensing circuit from being damaged, and therefore, would not have affected the operability of DG-2.

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Based on the above discussion, it was determined that although Fort Calhoun was not in compliance with the Appendix R requirement due to lack of isolation of the DG-2 Control Room located tachometer, there is a high confidence that DG-2 would have been operational as described above. The issue does not involve any common mode failure, only DG-2 is credited for meeting the Appendix R requirements.

CONCLUSIONS

The root cause was determined to be a lack of depth in preparing and evaluating the original design. The switch that isolates the DG-2 controls from the Control Room is 183-MES/D2. The original fire safe shutdown analysis incorrectly concluded that the 183-MES/D2 switch isolated required circuits necessary to run the diesel from the alternate shutdown panel, including the tachometer circuit.

Reliance on the fact that the 183-MES/D2 switch isolates required circuits necessary to operate the diesel from the alternate shutdown panel (FSAR), despite having an opportunity to later review the issue, was a contributing cause. Specifically, in 1978, OPPD contracted with an A/E firm to review the adequacy of plant design as it relates to fire safe shutdown. Their report, which identified the deficiencies of Fort Calhoun to meet the alternate shutdown capabilities, relied heavily on the FSAR and also did not identify the need to isolate the diesel speed switch circuitry (tachometer) located in the Control Room.

CORRECTIVE ACTIONS

1. A modification was completed on May 7, 1997 to provide the ability to isolate the Control Room located tachometer from the DG-2 speed sensing circuit prior to reaching 300°F from the April 21, 1997 forced outage. Associated AOP-6 instructions were included to isolate the Control Room tachometer circuit.

In addition to the corrective actions already taken the following additional corrective measure will be taken:

1. A cable analysis will be performed (or data will be located from a previous analysis and will be verified) to determine the list of equipment which must be isolated from the Control Room/Cable Spreading Room during a Design Basis fire. If additional items are identified, they will be dispositioned at that time. The analysis (verification)

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will be completed by June 30, 1997.

PREVIOUS SIMILAR EVENTS

There have been no other events similar to this at Fort Calhoun Station.