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

November 20, 1998
LIC-98-0152

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 1998-014 Revision 0 for the Fort Calhoun Station

Please find attached Licensee Event Report 1998-014 Revision 0 dated November 20, 1998. This report is being submitted pursuant to 10CFR50.73(a)(2)(ii)(A),and (a)(2)(v). If you should have any questions, please contact me.

Sincerely,

S. K. Gambhir
Division Manager
Nuclear Operations Division

EPM/epm

Attachment

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

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 9 |

TITLE (4)
An Emergency Temporary Modification Places the Plant in an Unanalyzed Condition

| 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 |
| 10 | 21 | 1998 | 1998 | -- 014 -- | 00 | 11 | 20 | 1998 | FACILITY NAME | DOCKET NUMBER 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) | 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) | 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) |
|---|---|
| Erick 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 EPIX | | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO EPIX |
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| 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 October 20, 1998, at about 0220, a ventilation duct from Room 81 (the room through which the main steam lines pass) to the Switchgear Rooms had two fire dampers and a drop down panel, credited for mitigation in a Main Steam Line Break (MSLB) accident, which were defeated in a nonconservative direction. This resulted from an Emergency Temporary Modification which was installed to tape shut the drop down panel and block open the fire dampers. This was done to provide additional outside cooling during maintenance on the air conditioning units for the Switchgear Rooms. Later that day the importance of the original configuration was identified. The modification was removed at about 1420 on October 20, 1998, returning the plant to its original analyzed condition.

This event resulted from inadequate procedural control of an emergency temporary modification. Also inadequate information was provided in operating instructions for the affected heating ventilation and air conditioning system. A final root cause is inadequate controls for evaluating and subsequently adjusting maintenance priorities based on the cumulative impact of out-of-service equipment on plant condition.

The plant procedures will be revised as appropriate. A review of the maintenance planning process will be performed to determine the appropriate corrective actions.

BACKGROUND

The Switchgear Rooms (Room 56E and 56W), are designed so that they can be cooled by either of the air conditioning units VA-89 or VA-90, or by outside air. Outside air is supplied from fans located in Room 81. Room 81 is the room through which the main steam and feedwater lines pass, immediately outside of containment. Outside air cooling is supplied through ductwork which runs through the Turbine Building connecting Room 81 to the Switchgear Rooms. Room 81 contains supply fans which draw in outside air for distribution to various parts of the Auxiliary Building. The ductwork supplying outside air to the Switchgear Rooms contains isolation dampers, FD-35 and FD-36, in the ductwork located in the ductwork as it enters the Switchgear Room which are maintained in a normally open condition by fusible links. The fusible links are designed to break at a predetermined temperature of 160 degrees Fahrenheit (F) allowing the dampers to close by gravity. The links, when broken, also open a drop down panel on the duct in the Turbine Building. When this drop down panel opens, pressure is relieved upstream of fire dampers FD-35 and FD-36 to ensure they close. This will minimize the amount of steam intrusion into the Switchgear Rooms. FD-35 and FD-36 also act as a fire barrier. The outside air supply duct also contains fire damper FD-65. FD-65 is located upstream of the FD-35, FD-36, drop down panel configuration. FD-65 was designed for fire protection and was not credited in any other accident analysis.

The normal configuration for switchgear cooling is to have both VA-89 and VA-90 in service cooling their respective portions of the Switchgear Rooms. Outside air is normally supplied to various portions of the Auxiliary Building including the Switchgear Rooms. FD-35 and FD-36 are normally open. The drop down panel is normally closed.

The Heating, Ventilation, and Air Conditioning (HVAC) system (containing FD-35, FD-36, and the drop down panel) being discussed is part of the original plant Non-Radiological Controlled Area (non-RCA) Auxiliary Building HVAC. The HVAC system consists of supply fans VA-45A and VA-45B, exhaust fan VA-41 and associated plenum, duct work, dampers and registers. The system is supplied from outside air via damper VA-42 and returns to the outside via exhaust fan VA-41. This system provides HVAC to Room 81, the Switchgear Rooms (56E and 56W), the Upper Electrical Penetration Room (Room 57), the Lower Electrical Penetration Room (Room 20), and the Compressor Area (Room 19)

The Battery Rooms (Rooms 54 and 55) do not have duct work that is supplied directly from the non-RCA Auxiliary Building HVAC system. However, there is a duct connection to the adjacent Switchgear Rooms. The Battery Room exhaust fans (VA-71A and VA-71B) use the Switchgear Rooms as source of supply air by pulling air from the Switchgear Rooms into the Battery Rooms.

A similar configuration exists for an Auxiliary Building work area (Room 71) and the Cable Spreading Room (Room 70). Either air conditioning units VA-89 or VA-90 can supply HVAC to these rooms using the Switchgear Rooms as the source of supply air.

The following safe shutdown components are located in the Switchgear Rooms 56E and 56W:

- 4160V Buses 1A3 and 1A4, Non-segregated Bus Duct and the Associated Switchgear
- 4160V/480V Transformers T1B-3A, T1B-3B, T1B-3C, T1B-4A, T1B-4B, T1B-4C
- 480V Buses 1B3A, 1B3A-4A, 1B4A, 1B3B, 1B3B-4B, 1B4B, 1B3C, 1B3C-4C, 1B4C and associated switchgear
- Battery chargers Number 1 - EE-8A, Number 2 - EE-8B, and Number 3 - EE-8E
- Panel Mounted 125V Direct Circuit (DC) Distribution Buses EE-8F and EE-8G
- 125V DC Switchgear Control Power Transfer Switches 1A1-1A3-MTS, 1A2-1A4-MTS, 1B3A-4A-MTS, 1B3B-4B-MTS, 1B3C-4C-MTS
- Safety related static inverters EE-8H, EE-8K, EE-8J, EE-8L and Associated Safety related static inverter bypass transformers EE-4N, EE-4Q, EE-4P, EE-4R
- AI-197 - Auxiliary Feed Water (AFW) Auto Actuation Panel Channel "B" and AI-199 - AFW Auto Actuation Panel Channel "D", Foxboro "SPEC 200" instrumentation for automatic actuation of Auxiliary Feedwater and Diverse Scram System Trip (ATWS)
- AI-108A and AI-108B - Switchgear Auto Start Relay Panels A and B
- AI-109A and AI-109B - 480 V Load Shed Channels A and B

The above list of components required for safe shutdown can be considered an all inclusive list independent of the event under consideration. These components will support a normal shutdown or an automatic Engineered Safety Feature (ESF) equipment response to mitigate a Design Basis Accident (DBA).

Each Battery Room (Rooms 54 and 55) contains a station battery, the main battery fuses and the battery connection to the DC distribution panel in the Switchgear Rooms.

The Cable Spreading Room (Room 70) and an Auxiliary Building work area (Room 71) contain DC and vital AC power, and control and instrumentation cabling for the plant.

EVENT DESCRIPTION

On October 16, 1998, air conditioning unit VA-89 tripped due to a loss of freon. VA-89 had been experiencing problems since October 10, 1998. A Work Request was generated for repairs and was dispositioned as priority 3 with a "need date" of October 26, 1998. Since air conditioning unit VA-90 was operating, the VA-89 repair was considered routine. Over the weekend, the on-duty operating crew began to experience problems with the operation of VA-90, which was cooling both Switchgear Rooms. The supply breaker for VA-90 would occasionally open, but would typically reclose after a short period of time.

Earlier, on August 18, 1998, the drop down panel on the supply duct to the Switchgear Rooms was observed to be open by a plant electrician walking in the Turbine Building. Knowing that this was not a normal configuration, the electrician generated a Maintenance Work Request (MWR) to fix the drop down

panel. The MWR was designated as a priority 3 which is expected to be worked within 30 days in accordance with Standing Order (SO) M-101, "Maintenance Work Control." However, the MWR was not converted into a Maintenance Work Order (MWO) and was not scheduled for work as specified in SO-M-101 for a priority 3 item. Consequently, on October 19, 1998, when operational problems were experienced with both VA-89 and VA-90, the drop down panel on the air supply to the Switchgear Rooms was still open and the associated dampers FD-35 and FD-36 were closed due to mechanical failure of the fusible links, eliminating the possibility of outside air cooling of the rooms.

On October 20, at 0050 Central Daylight Time (CDT), VA-90 supply breaker tripped open and would not reclose. The control room operators became concerned about rising temperatures in the Switchgear Rooms and the Battery Rooms. The operating crew utilized the temperature limits included in Operating Instruction (OI) VA-2, "Auxiliary Building Ventilation System Normal Operation," Attachment 12, "Temperature Limits Auxiliary Building Spaces," which identifies a limit of 110 degrees F for the Switchgear Rooms and the Battery Rooms. They also referenced OI-VA-2 Attachment 4, "Battery Room Ventilation System," which specifies a limit of 90 degrees F for the batteries. The turbine building operator logs specify that System Engineering is to be consulted for battery operability if Battery Room temperature exceeds 90 degrees F.

The Shift Supervisor (SS) also expressed a concern about the operation of instrument bus static inverters in the event that Switchgear Room temperatures became excessive. This concern was based on various limits established in the operating manual as discussed above as well as on historical experience with the consequences of losing instrument buses as a result of static Inverter failure. The plant has never experienced the loss of more than one instrument bus at the same time.

According to the Auxiliary Building temperature log, the Switchgear Rooms temperature increased by approximately 9 degrees F (from 86 degrees F to 95 degrees F) in a one hour period after the trip of VA-90. This temperature increase led to the perception that an urgent condition existed that required action in order to prevent exceeding the temperature limits associated with equipment operation.

OI-VA-2, Attachment 12 was consulted for contingency actions which could provide alternate cooling to the Switchgear Rooms. OI-VA-2 gives general guidance to supplement cooling in Auxiliary Building spaces by using portable fans and/or opening doors to adjacent spaces. The SS and the Licensed Senior Operator (LSO) considered using this guidance to cool the Switchgear Rooms but concluded that it was more prudent to place an installed system in service prior to opening the door to the Turbine Building due to the fact that an open door makes the Switchgear Rooms susceptible to the consequences of a steam line break in the Turbine Building. Therefore, the operators concluded that it was more appropriate to place outside air cooling from Room 81 in service by blocking open dampers FD-35 and FD-36 and taping closed the drop down panel. This action could be implemented by means of an Emergency Temporary Modification in accordance with SO-O-25, "Temporary Modification Control."

Section 5.1.5 of SO-O-25 permits the SS to deviate from the procedure when necessary to prevent injury to personnel, damage to equipment, or to increase a margin of safety. Because of the perceived urgency of the situation, the SS felt that he had justification to accomplish the Emergency Temporary Modification by invoking the guidance in section 5.1.5 which permits the installation of an Emergency Temporary Modification with no additional approvals or reviews required.

After determining that an Emergency Temporary Modification was the appropriate action, the crew determined it would be necessary to consider the blocking open of dampers FD-35 and FD-36 to be a fire protection system impairment. The SS attempted to contact the Fire Protection System Engineer to ask about the impact that disabling the dampers would have. This attempt was unsuccessful but the backup Fire Protection System Engineer was contacted. The discussion between the SS and the backup System Engineer centered around the effect that blocking the two dampers open would have on the Switchgear Rooms halon system. The backup System Engineer advised the SS that dampers FD-35 and FD-36 are not credited for the isolation boundary for switchgear halon since they can not be relied upon to close for a fire in the Switchgear Rooms. Other dampers serve this function. The conversation concluded that it would be acceptable to block open the dampers utilizing an hourly fire watch as a compensatory measure. A Fire Protection Impairment Permit was completed in accordance with SO-G-58, "Control of Fire Protection System Impairments."

On October 20, 1998, at approximately 0220 CDT the Emergency Temporary Modification was installed and corresponding documentation to that effect was recorded in the Control Room and SS Logs.

Troubleshooting of VA-90 by plant electricians continued. VA-90 was started and subsequently tripped several times during the morning of October 20.

During the morning of day shift on October 20, 1998, the HVAC System Engineer was informed by the backup System Engineer for Fire Protection that he would need to follow up the events of the previous night by completing a temporary modification package to support the Emergency Temporary Modification. Having knowledge of the dual function of dampers FD-35 and FD-36, the HVAC System Engineer went to the Control Room to learn about the details of the Emergency Temporary Modification from the day shift operating crew. After discussing the issue with the SS, he concluded that the modification might have design basis implications and should be immediately removed. The Emergency Temporary Modification was removed at approximately 1420 CDT on October 20, 1998 (approximately 12 hours after installation).

On October 20, 1998, a Condition Report was generated by the HVAC System Engineer. On October 21, 1998, at 1435 CDT, it was determined with the assistance of Design Engineering that the Emergency Temporary Modification resulted in the plant being in an unanalyzed condition that significantly compromised plant safety. This determination was based on information in Appendix M of the USAR which credits the isolation function of FD-35 and FD-36 in a Main Steam Line Break (MSLB) which is the worst case High Energy Line Break (HELB). This isolation function protects safety related equipment in the

Switchgear Rooms from the consequences of a steam environment. A one (1) hour non-emergency report was made to the NRC Operations Center at 1448 CDT pursuant to 10 CFR 50.72(b)(1)(ii)(A). This report is being made pursuant to 10 CFR 50.73(a)(2)(ii)(A), and 10 CFR 50.73(a)(2)(v).

On October 23, 1998 repairs were completed on dampers FD-35 and FD-36 and the drop down panel to return them to a normal configuration.

SAFETY SIGNIFICANCE

The vulnerability of safe shutdown equipment required to mitigate the consequence of the MSLB was small. The release of steam to the Switchgear Rooms could have been initiated by rupture of main steam or feedwater piping in Room 81, followed by failure of the dampers to mitigate the steam release. The rupture of main steam or feedwater piping is not expected to occur during the lifetime of the plant. Rupture during any twelve-hour time period is very unlikely.

The design and installation of fire damper FD-65 was reviewed as part of the best estimate of the expected plant response to steam intrusion. FD-65 is located upstream of the disabled fire dampers FD-35 and FD-36 in the HVAC supply duct.

Based on the analysis of the damper configuration it is expected that FD-65 would partially close, to about 50 percent, before deformation (induced by differential pressure) would prevent further closure. The resulting throttling would have limited the effect on the steam intrusion into the Switchgear Rooms. The Switchgear Room temperature approaches 135 degrees F at about 30 minutes versus the 145 degrees F without crediting FD-65 action. This provides additional assurance that the static inverters (rated at 134 degrees F) would survive the MSLB event.

In the unlikely instance that a MSLB event occurs and FD-65 fails to mitigate the steam intrusion, the event is not expected to induce extensive equipment failures. In general, the temperature rating of components is not indicative of the equipment failure point. Design margin is expected to allow operation at higher temperatures. The static inverters and battery chargers are the most significant components in terms of steam intrusion and are discussed in the following paragraphs.

The static inverters are the components identified on the plant specific simulator as causing the most significant problems early (if failure is assumed at about 30 minutes) in the event. The static inverters normally operate at 60 percent load or less and the load is not expected to change significantly during an event. The static inverters are expected to operate at temperatures in excess of 134 degrees F (the vendor supplied operating temperature limit). The reduced loading reduces heating and provides additional assurance of operation above 134 degrees F. Condensation is prevented by component temperatures in excess of the ambient temperature.

The other critical components are the battery chargers. The chargers normally operate at approximately 60 percent of rated load. This load is not expected to change significantly during an event unless offsite power is lost. As in the case of the static inverters, the reduced load provides additional assurance of operation above the 120 degrees F design temperature.

If a MSLB should occur, offsite power is expected to be available. 161kV voltage data from October 20, 1998, indicate voltages of greater than 164.5kV. The degraded voltage initiation is 160.7kV. Offsite power is lost if all four static inverters fail. However, the static inverters would be expected to survive the event as would the battery chargers.

In the unlikely event of an MSLB or MFLB coincident with the failure of FD-65 to function and an actual failure of the inverters (at some point after approximately 30 minutes), sufficient time exists prior to inverter failure to begin recovery from the MSLB event. AFW is expected to be in service on the unaffected steam generator. Upon failure of the static inverters, the operators would be expected to check that the Power Operated Relief Valves (PORVs) are closed, as directed in the Emergency Operating Procedures (EOPs). The Reactor Coolant System (RCS) would remain intact with decay heat being removed by the unaffected steam generator. Time is available to work with the plant staff to recover from the equipment failures.

Operator action is expected to be focused on static inverter recovery. The installed manual transfer switch on the static inverters allows powering a 120V vital bus from offsite power (or from Diesel Generators) when equipment access in the Switchgear Room is gained.

Since the operators had a heightened awareness of Switchgear Rooms temperature at the time when the rooms were exposed to the potential for common cause failure, it could have been reasonably expected that the rooms would have been checked in the event of an MSLB or MFLB. This would have allowed the identification of a problem and the opening of the Switchgear Rooms doors to cool the rooms and reduce the humidity. This would help ensure that the equipment survives.

In summary, the probability of a MSLB or MFLB is extremely remote. The steam intrusion event would have likely been partially mitigated by FD-65. The plant and individual component design are such that equipment is not expected to fail if steam intrusion were to occur. The safe shutdown of the reactor would have occurred in the event equipment failures began to occur and time would exist for the operating and plant staff to initiate recovery actions from the equipment failures. As such, there was not a significant risk to the health and safety of the public over this relatively short period of time when the dampers were disabled (approximately 12 hours). For the period of time when the damper isolation function was defeated, the plant was in an unanalyzed design condition where a potential common cause (steam intrusion) could affect both trains of safe shutdown equipment. This would be a condition outside the design basis of the plant where only a single failure of an active component is assumed.

The results of the equipment review indicate that the 4160V switchgear, 480V switchgear, DC distribution buses, DC transfer switches, static inverter bypass transformers, and relay panels (AI-109s and AI-108s) would be expected to operate over the course of the event. The static inverters, battery chargers and AFW Initiation Panels AI-197 and AI-199 cannot be fully demonstrated to be able to function during the event. However, based upon engineering judgement, the equipment is expected to operate during the event.

As a result of this review it was determined that there was no significant risk to the health and safety of the public during the time the fire dampers FD-35 and FD-36 and the associated drop down panel had their HELB function disabled.

CONCLUSION

One of the root causes was identified as inadequate guidance for the implementation of an emergency configuration change to the plant. SO-O-25 provides vague criteria for conditions under which an Emergency Temporary Modification may be used with little or no immediate follow up action required. Recognizing that an Emergency Temporary Modification bypasses the normal controls which are intended to maintain the plant within its design basis, an Emergency Temporary Modification should only be implemented with a full appreciation for the risk that is being accepted when eliminating the normal evaluations and reviews that would be expected for a configuration change to the plant.

A second root cause of the event is identified from the realization that the Emergency Temporary Modification process would not have been utilized by the SS if procedure OI-VA-2 had contained more information about the meaning of the Switchgear and Battery Rooms temperature limits and the impact of the limits on equipment operability. The review of relevant engineering data shows that there was more time to deal with the HVAC problem than operations personnel concluded. Also, OI-VA-2 contained inadequate contingency information regarding a loss of cooling to the Switchgear Rooms. Adequate contingency planning would have prevented the perceived need to enter the Emergency Temporary Modification process.

A final root cause is inadequate controls for evaluating and subsequently adjusting maintenance priorities based on the cumulative impact of out-of-service equipment on plant condition. An effective equipment control program should provide a central location for monitoring all out of service equipment as well as the impact that the out of service components have on operating systems in both normal and emergency conditions. Prioritization of emergent work requests needs to be made considering other equipment that is out of service. Equipment out of service for an extended period should be re-prioritized as necessary when redundant equipment malfunctions.

CORRECTIVE ACTIONS

1. Standing Order O-25 will be rewritten to correct the problems noted in the root cause analysis with this procedure. This action will be completed by December 31, 1998.

2. Operating Instruction OI-VA-2 will be rewritten to correct the problems noted in the root cause analysis with this procedure. This action will be completed by February 28,1999.

3. A comprehensive multi-disciplinary review of the maintenance scheduling process will be conducted. Corrective actions resulting from this review will be appropriately scheduled for implementation. The review will be completed by January 30, 1999. A schedule for completion of the actions will be developed by February 28, 1999.

PREVIOUS SIMILAR EVENTS

LERs 1998-008 and 1997-012 were events where the plant was outside of its design basis due to maintenance or surveillance activities.