APPENDIX A

U. S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-285/88-15 Operating License: DPR-40

Docket: 50-285

Licensee: Omaha Public Power District (OPPD)
1623 Harney Street
Omaha, Nebraska 68102

Facility Name: Fort Calhoun Station (FCS)

Inspection At: FCS, Blair, Nebraska

Inspection Conducted: April 6 - May 13, 1988

Inspectors: R. P. Mullikin 6/1/88
for P. H. Harrell, Senior Resident Reactor Inspector Date

for R. P. Mullikin 6/1/88
T. Reis, Resident Reactor Inspector Date

Approved: T. F. Westerman 6/1/88
T. F. Westerman, Chief, Reactor Project Section B Date

Inspection Summary

Inspection Conducted April 6-27, 1988 (Report 50-285/88-15)

Areas Inspected: Routine, unannounced inspection including followup on the status of the instrument air accumulator assemblies and followup on an onsite event.

Results: Within the two areas inspected, two potential violations (failure to meet the established design criteria for the instrument air system, paragraph 3; and the apparent failure to maintain containment integrity, paragraph 4) were identified.

DETAILS

1. Persons Contacted

*R. Andrews, Division Manager, Nuclear Production
*W. Gates, Plant Manager
*M. Core, Supervisor, Maintenance
*J. Fisicaro, Supervisor, Nuclear Regulatory and Industry Affairs
*J. Gasper, Manager, Administrative and Training Services
*R. Jaworski, Section Manager, Technical Services
*R. Kellog, Acting Manager, Technical Support
*T. Patterson, Supervisor, Technical
*S. Swearngin, System Engineer, Instrument Air System
*C. Simmons, Plant Licensing Engineer
*S. Trausch, Supervisor, Operations
*K. Morris, Division Manager, Quality Assurance and Regulatory Affairs
*J. O'Connor, Plant Engineer
*A. Richard, Manager, Quality Assurance
*R. Scofield, Supervisor, Outage Projects

*Denotes attendance at the monthly exit interview.

The NRC inspector also contacted other plant personnel, including operators, technicians, and administrative personnel.

2. Plant Status

The reactor was operating at 100 percent power during this inspection period. The next refueling outage is scheduled for September 1988.

3. Followup on the Status of the Instrument Air Accumulator Assemblies

This inspection was performed to follow-up on licensee activities for testing of accumulator assemblies for air-operated, safety-related valves. This inspection was focused to review the status of the accumulator assemblies for valves required to function by changing position during various design basis accidents (e.g., loss-of-coolant accident, seismic event, or steam generator tube rupture) that require plant shutdown.

Each accumulator assembly is comprised of a check valve, accumulator, valve operator, and interconnecting tubing. The valve operator is normally repositioned by using air pressure from the instrument air system. The instrument air system is a nonseismically installed system supplied by three nonvital air compressors. The accumulator assemblies were designed and installed to provide an air pressure storage system to reposition the valves in the event the normal air supply is lost. The accumulator assemblies are safety-grade installations designed to fulfill their intended safety function following a design basis accident (DBA).

In the recent past, NRC inspectors have reviewed the installation of the accumulator assemblies to verify that the assemblies were designed and installed in accordance with the appropriate regulatory requirements.

Each of the inspections and reviews performed by NRC personnel is discussed below:

a. During a safety system outage modification inspection (SSOMI) performed by NRC Headquarters personnel in September and October 1985, the SSOMI team identified an apparent deficiency related to the accumulator assemblies for the component cooling water supply to the reactor coolant pump containment isolation valves, HCV-438B and HCV-438D. The details of the deficiency are documented as Deficiency 2.2-1 in NRC Inspection Report 50-285/85-22, issued on January 21, 1986.

The deficiency noted that the licensee had altered the hardware installation so Valves HCV-438B and HCV-438D were changed from a fail closed to a fail open mode. Because the "failed" position was changed, the licensee relied on the air pressure in the accumulator assembly to shut the valves in the event containment isolation was required. The SSOMI team noted that the calculation associated with Modification MR-FC-81-21B, the design document that changed HCV-438B and HCV-438D from fail closed to fail open valves, assumed zero leakage from the accumulator assembly, and therefore concluded that the size of the accumulator was sufficient to hold HCV-438B and HCV-438D shut until an operations individual could manually shut the valves. The SSOMI team disagreed with the no-leakage assumption made in the calculation because the licensee had not performed any testing to determine the actual leakage from the accumulator assembly.

On April 15, 1986, the licensee provided a response to Deficiency 2.2-1. The response stated that, "although the system leakage was not quantified in the original calculation, the amount of allowable leakage can be inferred from the margin between the minimum pressure required and the system pressure following actuation of the valve. The amount of margin in the original calculation was such that system leakage was a moot point. The revised preliminary calculation, using the correct parameters, indicates that the margin is approximately 40 percent." The response also stated that a new revised calculation would be completed and placed in the file.

On August 7, 1986, a working meeting was held in the Region IV offices between the NRC and the licensee. At this meeting, the corrective action programs provided by the licensee in the response dated April 15, 1986, were discussed and it was determined that the response to Deficiency 2.2-1 was inadequate. As a result of the discussions, the licensee agreed to submit a revised response to the deficiency.

On April 10, 1987, the licensee submitted a revised response. The revised response stated that the licensee had initiated a program to

provide comprehensive evaluation of systems which depend on accumulator assemblies for proper functioning during an accident event. The revised response stated that the program would include the following elements.

- Identify CQE (safety-related) valve operators that are equipped with air accumulators.

- Determine the operating criteria of the valve during each applicable postulated accident. This will include parameters such as operating pressure and temperature, time duration after an initiating event when valve operation will commence, and the length of time that the valve operator must function.

- Develop criteria for functional testing each valve operator which was identified according to the above criteria.

- Develop appropriate surveillance testing to ensure that the systems continue to function as required.

The revised response stated that at the completion of the evaluation described above, a systematic program would be initiated to perform testing of the installed accumulator assemblies to verify that the equipment could reliably perform the required accident function. The revised response also noted that a schedule for completing air accumulator testing would be provided by August 1987.

On December 23, 1987, the licensee submitted an update of the previous response for the items identified by the SSOMI team. In this updated response, the licensee stated that because of the unforeseen requirement to perform more extensive evaluations with respect to the corrective actions, the date for providing the schedule for completing air accumulator testing has been extended to July 1988. Consequently, at the time of this inspection, the licensee still has yet to submit a schedule for testing the accumulators. This item remains open pending submission of the required schedule as committed by the licensee in its April 10, 1987, revised response. (285/8815-01)

Also, in response to Deficiency 2.2-1 identified by the SSOMI team, the licensee issued Operations Support Analysis Report (OSAR) 87-10 dated April 6, 1988, to determine the following:

- The valves serviced by an accumulator assembly that are essential to ensure a safe plant shutdown or to mitigate the consequences of a DBA coincident with the loss of offsite power.

- Describe the function of the essential valves and accumulator assembly following a DBA.

- Evaluate the need to reposition the essential valves following a DBA.

- Determine the postaccident operating conditions for the essential valves and ensure that the conditions are within the design basis for the facility.

- Establish the maximum time interval the essential valves must be repositioned and/or the number of times the essential valves require recycling.

- Develop criteria for functionally testing the essential valves to verify the valves will perform their intended safety function.

Based on the results of OSAR 87-10, the licensee determined that various actions would be required to ensure that essential valves would comply with their design basis and would be able to perform their intended safety function. A detailed discussion of the status of each essential valve is provided later in this inspection report.

b. On September 26, 1983, the licensee submitted a 10-year inservice inspection (ISI) plan for the period of 1983 to 1993. Based on concerns identified by NRC personnel in the licensee's submittal, an onsite meeting was held in October 1987 to resolve the concerns. One of the areas of concern involved the licensee's inservice testing (IST) program for the check valves installed in accumulator assemblies. At the meeting, the licensee agreed to submit a revision to the IST program to include the accumulator check valves and on December 16, 1987, the IST program revision was submitted by the licensee for NRC review and approval. This revision has not yet been approved by the NRC.

Subsequent to the submission of the revised IST program, the licensee determined, based on the results of the analysis performed by OSAR 87-10, that additional accumulator check valves should be included in the IST program. However, the licensee has not yet submitted a proposed revision to include the newly identified check valves in the IST program. The licensee stated that a new revision would be made prior to the end of the 1988 refueling outage. This item remains open pending a submission of a revised program by the licensee and review and approval by the NRC. (285/8815-02)

A detailed discussion is provided later in this inspection report that identifies the valves that have been included in the IST program and also identifies which valves need to be included in the program.

c. On July 6, 1987, the licensee experienced an event where water from the fire water system entered the instrument air system. As a result

of this event, Emergency Diesel Generator 2 failed to start on demand during the performance of a surveillance test on September 23, 1987. The details of the event are provided in NRC Inspection Report 50-285/87-27.

As a result of the followup inspections performed by NRC inspectors on the water intrusion event, a Notice of Violation and Proposed Imposition of Civil Penalty was issued on February 22, 1988. Subsequent to the issuance of the Notice, a meeting was held at the NRC Headquarters Office on November 13, 1987. At the enforcement conference, the licensee made numerous commitments to address the concerns identified by the NRC inspectors. One concern addressed by the licensee was the testing of the check valves installed in accumulator assemblies. The commitments made by the licensee during the enforcement conference for testing of check valves were submitted to the NRC in a letter dated November 20, 1987. In the letter, the licensee stated that the accumulator check valves would be tested and that the IST program would be revised to ensure periodic testing of the check valves in the future (the status of the IST program was discussed in paragraph 2.b above and the status of the testing of the check valves is discussed later in this inspection report. The status provides a detailed description of which valves have been tested and the results of the testing).

In addition to the testing of the accumulator check valves, the NRC identified concerns related to the seismic installation of the accumulator assembly components that include the accumulator, tubing, valve operator, and check valve. In response to this concern, the licensee submitted a letter, dated November 20, 1987, that provided the seismic calculations completed by the licensee. The NRC is currently reviewing the calculations submitted by the licensee to verify the adequacy of the calculations (the status of the seismic qualification for each valve accumulator assembly is provided in a detailed discussion later in this inspection report). This item remains open pending a review of the seismic calculations by NRC personnel. (285/8815-03)

The licensee submitted a response to the notice of violation and proposed imposition of civil penalty, dated April 27, 1988, to the violations identified in NRC Inspection Report 50-285/87-27. (At the time this inspection was concluded, the response was under review by the NRC Region IV office.)

d. On April 18, 1988, the licensee issued a Safety Analysis for Operability (SAO). The licensee issued the SAO to address conditions related to specific essential valves for verification that the plant could continue to operate safely. The SAO issued on April 18, 1988, was a revision to previous SAOs that had been issued by the licensee. The revised SAO considered all data related to the operability of essential valves that was available at the time, and applies to the valves discussed below.

A detailed discussion of the status of each accumulator assembly installed with essential valves is provided below. The discussion for each valve includes: (a) a description of the valve and the function of the accumulator assembly, (b) actions performed to verify accumulator size, (c) function testing performed on the accumulator assembly, (d) IST program status for the accumulator assembly check valve, and (e) seismic qualification status of the accumulator assembly.

For each essential valve discussed below, a review was performed to verify that the currently existing conditions did not require entry into a limiting condition for operability (LCO) as defined by the Technical Specifications (TS). This review was performed based on the current information available with respect to the present status of each essential valve. Based on this review, it appeared that none of the conditions of the essential valves described below require entry into an LCO.

(1) Safety injection and refueling water tank (SIRWT) level control bubblers (A/FIC-383, B/FIC-383, C/FIC-383, D/FIC-383)

(a) These bubblers are used to detect the level in the SIRWT. In the event of a loss-of-coolant accident (LOCA) and safety injection is initiated, the safety-injection pumps will transfer water from the SIRWT into the reactor coolant system. When the level in the SIRWT reaches approximately 16 inches, as detected by the level bubblers, a recirculation actuation signal (RAS) is initiated. A RAS will shut the SIRWT outlet valves, open the containment sump isolation valves, shut the safety injection and containment spray pumps recirculation valve to the SIRWT, and stop the low-pressure safety-injection (LPSI) pumps. The purpose of the RAS is to switch suction of the high-pressure safety-injection (HPSI) and containment spray (CS) from the SIRWT to the containment sump. If air system pressure is lost to the bubblers, the accumulator assemblies maintain pressure for bubbler operation to prevent premature initiation of a RAS.

(b) A preliminary calculation has been completed by the licensee to verify that the accumulators are of sufficient size to provide a backup source of air pressure in the event the normal instrument air pressure is lost. The results of the preliminary calculation indicate that the accumulator size is adequate and the licensee is in the process of issuing a formal calculation to verify the size of the accumulators is adequate. This item remains unresolved pending the issuance of a formal calculation by the licensee and a review of the calculation by the NRC. (285/8515-04)

(c) A functional test of the accumulator assembly was performed in April 1988 to verify that the check valves would maintain sufficient pressure in the accumulator for a period of 12 hours to ensure proper operation of the bubblers. The 12-hour operational period for the accumulators was established by the analysis done in OSAR 87-10. When the installed check valves were tested, the licensee determined that the check valves would not maintain accumulator pressure for the required 12-hour period. Upon discovery of the inadequacy of the installed check valves, the licensee replaced the check valves with new check valves that had been bench tested and verified to have zero leakage. The April 18, 1988, SAO addressed the operability of the SIRWT level detectors. The evaluation concluded that the detectors were operational based on the fact that the installed check valves had been replaced with new check valves and that the preliminary calculation indicated that the accumulators were properly sized. Based on the conclusions contained in the SAO, the licensee stated that no action was required at that time. However, a test to verify that the accumulator assembly will function for a period of 12 hours has not been performed by the licensee for any of the SIRWT level detectors. The licensee stated that the functional test would be completed during the 1988 refueling outage. This item remains open pending a satisfactory functional test to verify the accumulator assembly will provide a 12-hour supply of air pressure to the bubblers. (285/8815-05)

The significance of this issue is that when the licensee tested the originally installed check valves, it was determined that the check valves leaked excessively. The check valves had not been previously tested. Based on the results of the tests, it appeared that the accumulator assemblies could not perform their intended safety function in the event that a LOCA occurred in conjunction with the loss of instrument air pressure. The worst case scenario would occur if two or more level detectors lost air pressure, causing a premature initiation of a RAS. If a premature initiation of RAS was initiated, the suction of the HPSI and CS pumps would be switched from the SIRWT to the containment sump. If the sump did not contain sufficient water to provide adequate flow through the pumps, the HPSI pumps would self-destruct due to overheating. The loss of the HPSI and CS pumps would significantly impact the ability to maintain sufficient core cooling flow to prevent gross fuel damage. The loss of the CS pumps would impact the ability to lower the containment pressure during a post-LOCA event.

Section 9.12.5 of the Updated Safety Analysis Report (USAR) establishes the design criteria for the performance of the SIRWT bubblers and provides an evaluation of the established design. Section 9.12.5 of the USAR states, in part, that the level controller in the SIRWT requires a supply of air to function properly. These controllers are required to transfer the suction of the HPSI and CS pumps to the containment sump after the water supply in the SIRWT reaches the low-level setpoint. To make these instruments independent of the instrument air system during the accident, each is equipped with an air storage tank which floats on the instrument air system. If the pressure in the instrument air system drops, a check valve in the line to the air storage tank closes which isolates the tank from the system and provides a supply of air to the controller.

However, in this case, the accumulator assemblies for the SIRWT level controllers failed to meet the established design criteria in that testing performed on the accumulator assembly check valves indicated that the valve leaked excessively and would not perform its intended design function. This is one example of a potential violation of the failure to meet plant design criteria (285/8815-06). (This condition was identified and reported to the NRC as 10 CFR 50.72 report on April 15, 1988.)

The NRC inspectors consider this matter potentially significant, even though the probability of experiencing a LOCA concurrent with the loss of instrument air is extremely low. Systems and components must be installed and maintained to ensure that they can continue to fulfill the established design criteria.

(d) The check valves associated with the SIRWT bubbler accumulators were included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of these check valves in the IST program will ensure that the valves are verified to be functional each quarter.

(e) The licensee performed a calculation to verify that the accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 10, 1987.

(2) Component cooling water to the reactor coolant pumps' containment isolation valves (HCV-438B and HCV-438D)

(a) Valves HCV-438B and HCV-438D are designed to shut to isolate containment in the event containment isolation is required in conjunction with a loss of pressure in the component cooling water (CCW) system. Valves HCV-438B and

HCV-438D fail open on a loss of air pressure and rely on their individual accumulator assemblies to hold the valve shut, if required, when containment isolation is required.

(b) In response to a deficiency identified by the SSOMI team, the licensee performed a calculation to verify that the accumulator was properly sized to perform its intended safety function. The SSOMI team subsequently reviewed the calculation performed by the licensee and determined that the calculation was not adequate to establish that the accumulator was sufficiently sized. Based on this review, the licensee performed an SAO to verify that the plant could continue to operate safely.

The results of the SAO concluded that the valves, as currently installed, do not represent a significant degradation of plant safety. The basis for this conclusion was that the pressure in the CCW system would always be greater than containment pressure during a LOCA. If CCW system pressure is lost concurrent with a LOCA, Valves HCV-438B and HCV-438D would be held shut by the accumulator assemblies for 30 minutes. (The valves were tested during the 1987 outage and verified to be operable for 30 minutes.) When CCW system pressure is lost, the raw water (RW) system, the backup cooling water source for CCW, will automatically initiate to provide cooling to the components normally supplied by the CCW system.

However, in the event of a CCW line break inside containment Valves HCV-438B and HCV-438D would shut for 30 minutes, as verified by the licensee's tests, and would then potentially reopen due to the unverified adequacy of the accumulator assemblies. Further, if a line break occurred, the valves cannot be manually shut due to the high radiation levels at the valve location during a LOCA. If Valves HCV-438B and HCV-438D reopened, RW would be pumped into containment, causing the boric acid solution in the containment sump to become diluted. The diluted boric acid solution could potentially cause the reactor to become critical when pumped into the vessel by HPSI pumps

When questioned by the NRC inspectors, the licensee stated that the original design basis for the plant did not require that an analysis be performed for a LOCA concurrent with a CCW line rupture in containment. This matter will be discussed with NRR to verify that such an analysis is not required. Therefore, this item remains unresolved (285/8815-07). (This condition was identified and reported by the licensee as a 10 CFR 50.72 report on April 6, 1988.)

(c) During the 1987 refueling outage, the accumulator assemblies for Valves HCV-438B and HCV-438D were functionally tested and verified to be operable for 30 minutes. Subsequent to the testing, the licensee established, during preparation of OSAR 87-10, that the design criteria for the accumulators required that Valves HCV-438B and HCV-438D be held shut for a period of 1000 hours. The licensee could not verify that the accumulator assemblies could meet this new design criteria, so an SAO was issued. The discussion provided above references the results of the SAO evaluation, and the NRC inspector's concerns.

(d) The check valves associated with Valves HCV-438B and HCV-438D were not included in the revised IST program submitted by the licensee on December 16, 1987. These check valves will be included in a revision to the IST program which the licensee stated will be completed prior to the end of the 1988 refueling outage.

(e) The licensee performed a calculation to verify that the accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 20, 1987.

(3) Loop injection valves from the discharge of the charging pumps (HCV-238 and HCV-239)

(a) Valves HCV-238 and HCV-239 are normally open valves that provide a path for continuous makeup water flow from the volume control tank to the reactor coolant system via the charging pumps. The valves are required to be shut in the event a LOCA occurs and hot-leg injection is required. The valves are shut to divert flow from the charging pump through the pressurizer auxiliary spray line. The valves fail open on a loss of air pressure and are required to be held in the shut position by the accumulators in the event hot-leg injection is initiated.

(b) The licensee has not performed any calculations to verify that the accumulators are properly sized to perform their intended safety function. An SAO has been issued to address the indeterminate status of the size of the accumulators. A discussion of the SAO is provided below.

(c) The licensee performed functional testing of the accumulator assemblies during the 1987 refueling outage. The test performed by the licensee verified that the accumulator assemblies would perform their design functions for a period of 25 hours. However, during the preparation of OSAR 87-10, the licensee established a design criteria

that required the accumulator assemblies to operate indefinitely. Based on the newly established criteria, the licensee determined that the accumulator assemblies could not be considered operable. (This condition was identified and reported by the licensee as a 10 CFR 50.72 report on April 6, 1988.)

The licensee issued an SAO to address the inoperability of Valves HCV-238 and HCV-239. The conclusions of the SAO indicate that Valves HCV-238 and HCV-239 cannot meet the established design basis. Therefore, the licensee has established an alternate means of establishing hot-leg injection by using the path through SI-186, HCV-347, and HCV-348. Valve SI-186 is a normally closed, locked manual valve. Valves HCV-347 and HCV-348 are motor-operated valves. The licensee has established interim measures to ensure that hot-leg injection is established as soon as a LOCA occurs by having the auxiliary building operator open Valve SI-186. An operations memorandum was issued to instruct the operator to open Valve SI-186 as soon as possible because the valve is inaccessible in a post-LOCA situation due to high radiation levels.

(d) The check valves associated with the accumulator assemblies were included in the revised IST program submitted by the licensee on December 16, 1987. In the revised IST program, the licensee proposed that the check valves would be tested quarterly. However, the check valves are located inside the bioshield inside containment, so it is not apparent how the licensee intends to test the check valves quarterly when the plant is at 100 percent power. This item remains open pending a review of this apparent discrepancy in the licensee's IST program submittal. (285/8815-08)

(e) The licensee has not performed calculations to verify the accumulator assemblies are seismically qualified. For this reason, an SAO was issued, as described above, to address the inoperability of the valves. The licensee stated that calculations would be performed during the next refueling outage to seismically qualify the accumulator assemblies. This item remains open pending completion of the calculations and a review of the calculations by the NRC. (285/8815-09)

(4) Auxiliary spray isolation valve (HCV-240)

(a) Valve HCV-240 is used to provide a hot-leg injection path into the reactor coolant system via the auxiliary spray line for the pressurizer. Valve HCV-240 is normally shut

and fails shut on the loss of air pressure. The accumulator assembly was installed to hold the valve open during hot-leg injection. (This condition was identified and reported as a 50.72 report on April 6, 1988.)

(b) The licensee has not performed a calculation to verify that the size of the accumulator is adequate. For this reason, the licensee issued an SAO to address the inoperability of the valve. A discussion of the SAO is provided below.

(c) The licensee performed functional testing of the accumulator assembly during the 1987 refueling outage and verified the accumulator assembly would function for a period of 25 hours. However, during the preparation of OSAR 87-10, the licensee established a design criteria that required the accumulator assembly to operate indefinitely. Based on the newly established criteria, Valve HCV-240 was declared inoperable. The licensee issued an SAO to address the inoperability of the valve. The conclusions of the SAO are the same as those discussed above for Valves HCV-238 and HCV-239. In addition to the conclusions made by the SAO for HCV-238 and HCV-239, a solenoid-operated valve, HCV-249, is installed in parallel with Valve HCV-240. Valve HCV-249 can be used to provide hot-leg injection. (This condition was identified and reported as a 50.72 report on April 6, 1988.)

(d) The check valve associated with the accumulator assembly was included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of the check valve in the IST program will ensure that the valve is verified to be functional each time the plant is placed in the cold shutdown mode.

(e) The licensee has not performed a calculation to verify that the accumulator assembly was seismically qualified. The accumulator assembly was seismically qualified based on engineering judgement. The licensee stated that a calculation would be performed during the next refueling outage to verify that the accumulator assembly is seismically installed. This item remains open pending the preparation of a seismic calculation for the accumulator assembly and a review of the calculation by the NRC. (285/8815-10)

(5) SIRWT outlet valves (LCV-383-1 and LCV-383-2)

(a) Valves LCV-383-1 and LCV-383-2 are used to isolate the SIRWT from the safety-injection and containment spray pumps suction header when pump suction is switched from the SIRWT to the containment sump upon receipt of a RAS. These

valves shut to minimize the possibility of contaminated water in the containment sump from entering the SIRWT. The valves fail open on a loss of air pressure and are held shut by the accumulator assemblies.

(b) The licensee has not performed a calculation to verify that the accumulator size is adequate to operate Valves LCV-383-1 and LCV-383-2. In this case, both valves share a common accumulator.

Section 6.2.5 of the USAR states, in part, that the safety-injection system has been designed to meet the single-failure criterion. However, the accumulator assembly for Valves LCV-383-1 and LCV-383-2 does not meet the single failure criterion in that one accumulator supplies backup air pressure for both valves. This is another example of a potential violation of the failure to install a component that complies with the established design criteria. (285/8815-06)

The NRC inspectors noted that the licensee identified the need to install an additional accumulator during the preparation of OSAR 87-10, and that the licensee is currently planning to install the additional accumulator in the near future.

(c) The licensee did not functionally test the accumulator assembly for Valves LCV-383-1 and LCV-383-2. Although the licensee had not previously established a duration criteria for accumulator assembly operation during the preparation of OSAR 87-10, the licensee determined that the design criteria for the accumulator assembly was to hold Valves LCV-383-1 and LCV-383-2 shut for a period of 1000 hours. When the licensee determined that design criteria, a modification was installed to provide a nitrogen supply system to the valve operators to supplement the accumulator assembly.

When the nitrogen system was installed, new check valves that had been bench tested and verified to have zero leakage were installed in the accumulator assembly. The nitrogen bottles were located within the plant such that the bottles would be accessible during a LOCA. By placing the bottles in this location, operations personnel could always replace depleted bottles to ensure that a continuous source of pressure is available to hold Valves LCV-383-1 and LCV-383-2 shut for 1000 hours.

By installing the nitrogen supply system, the licensee had established a method for ensuring that Valves LCV-383-1 and LCV-383-2 met the newly established design criteria. (This

LCV-383-2 met the newly established design criteria. (This condition was identified and reported as 10 CFR 50.72 report on April 6, 1988.)

(d) The check valves associated with the accumulator assembly were included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of these check valves in the IST program will ensure that the valves are verified to be functional each quarter.

(e) The licensee performed a calculation to verify that the accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 20, 1987.

(6) Safety-injection and containment spray pumps' recirculation isolation valves to the SIRWT (HCV-385 and HCV-386)

(a) Valves HCV-385 and HCV-386 are normally open to allow water being pumped by the safety-injection and containment spray pumps to recirculate back to the SIRWT to prevent deadheading the pumps. When a RAS is generated, the valves shut to prevent the contaminated water in the containment sump from being pumped into the SIRWT. The accumulator assemblies installed on these valves are intended to hold the valves shut during the containment recirculation mode of operation of the safety-injection system.

(b) In response to Deficiency 2.2-1 identified by the SSOMI team, the licensee evaluated the accumulator installation for Valves HCV-344 and 345. During the evaluation, the licensee noted that both valves shared a common accumulator. Because the installation did not meet the design requirement to satisfy the single-failure criteria, another accumulator was installed. The modification provided one accumulator for each valve. After the modification was completed, the licensee performed a calculation to verify the size of the accumulators for the valves was adequate. The calculation verified that sufficient accumulator capacity existed. (The modification completed by the licensee is detailed in Licensee Event Report (LER) 87-018, dated August 28, 1987.)

(c) A functional test was performed on the accumulator assemblies during the 1987 refueling outage. The test verified that the accumulator assemblies would function for a period of 4 hours. However, during the preparation of OSAR 87-10, the licensee established that the accumulator assemblies are required to maintain pressure for a period of 12 hours, then shut the valves and hold them shut for a period of one hour. The one hour period was established to allow the auxiliary building operator sufficient time to

manually shut the valves. To ensure that operations personnel are aware of the need to shut the valves, a change was made to Procedure EOP-20, "Functional Recovery Procedure." This change directs operations personnel to shut the valve as soon as a RAS is initiated. By manually shutting the valve, the licensee meets the design criteria that states the valves must be held shut for a period of 1000 hours following the initiation of a RAS.

(d) The check valves associated with the accumulator assemblies were included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of these check valves in the IST program will ensure that the valves are verified to be functional each quarter.

(e) The licensee performed a calculation to verify that the accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 20, 1987.

(7) Radiator exhaust dampers for the emergency diesel generators (YCV-871E and YCV-871F)

(a) Dampers YCV-871E and YCV-871F are normally shut to prevent outside air from entering the emergency diesel generator (EDG) rooms. When the EDGs are started and reach 100 rpm, the air-operated motors open the dampers to provide air flow across the radiator. The air flow provides cooling for the EDGs. Once the dampers are open, they will remain open without the presence of air pressure. On a loss of air pressure, the dampers will remain in the normally closed position. The accumulator assemblies were installed to provide a backup source of air pressure to ensure that the dampers are opened when the EDGs are started. If the dampers did not open, the EDGs would overheat and could potentially cause damage to the engines.

(b) The accumulators were supplied by the manufacturer of the air-operated motors and were sized by the manufacturer to ensure that a sufficient volume of air was available to operate the motors. The licensee has performed a calculation to verify that the accumulator size is adequate to open the dampers.

(c) Repairs and a functional test of the accumulator assemblies was performed by the licensee when a damper failed to open during a routine surveillance test performed on September 23, 1987. The subsequent functional test indicated that the accumulator assemblies were capable of performing their

intended design function. (The failure of the damper to open was previously reported in LER 87-25, dated November 30, 1987.)

(d) The check valves associated with the accumulator assemblies were included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of these check valves in the IST program will ensure that the valves are verified to be functional each quarter.

(e) The licensee performed a calculation to verify that the accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 20, 1987.

(8) HPSI header isolation valve used for initiation of long-term core cooling (HCV-2987)

(a) Valve HCV-2987 is used to divert a portion of HPSI flow from the cold leg, when the valve is open, to the charging pump header for hot-leg injection, when the valve is shut. The valve is normally open and will fail as-is on a loss of air pressure. Air pressure is required to open and to shut the valve. The opening and shutting of the valve is accomplished by the use of an air accumulator.

(b) A calculation to verify the size of the accumulator has not been performed. The accumulator was supplied by the valve manufacturer and was specifically designed for use with this valve type.

(c) Functional testing of the accumulator assembly has not been performed. During performance of a test to verify accumulator assembly adequacy, the licensee identified a problem with the air intensifier installed in the accumulator assembly. The air intensifier is a mechanism that boosts the instrument air pressure from approximately 90 psig to 300 psig for valve operation. Since no spare parts were available to repair the intensifier, the licensee disconnected the instrument air supply line to the accumulator assembly and connected a temporary nitrogen supply system. The nitrogen system supplies the 300 psig motive force to the valve actuator. This temporary modification will ensure that the valve can perform its intended safety function. During the next refueling outage, the licensee intends to return the valve to its normal configuration and perform tests to verify valve operability (the details of the problems with HCV-2987 and the actions taken by the licensee are provided in LER 88-002, dated February 5, 1988.)

(d) The check valve associated with the accumulator assembly was included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of the check valve in the IST program will ensure that the valve is verified to be functional each time the plant is placed in a cold shutdown mode.

(e) The licensee performed a calculation to verify that the accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 20, 1987.

(9) HPSI header isolation valves (HCV-304, HCV-305, HCV-306, and HCV-307)

(a) These valves are used to establish hot-leg injection flow to the reactor coolant system (RCS). By shutting or throttling the valves, flow is diverted into the RCS hot-leg. The valves are normally open and require air pressure for operation. On a loss of air pressure, the accumulator assembly will open the valve, if the valve is shut. Once the valve is open, the position cannot be changed by the accumulator assembly. These valves are not accessible for manual operation during a LOCA due to the high radiation levels.

When reviewing the status of the accumulator assemblies for these valves, the licensee identified that, in the current design configuration, the valves cannot be shut by the accumulator assemblies once air system pressure is lost. Without the capability to shut the valves, no assurance can be provided that the proper amount of hot-leg injection flow can be obtained. The valves are required to be shut only if one diesel generator fails to operate or if one loop motor-operated injection valve fails to shut. (Details of this matter are provided in OSAR 87-10.)

The nuclear steam supplier, Combustion Engineering, recommended in 1978 that the licensee provide a remote manual means of operation for the valves to ensure that the valves can be operated, if required. However, these modifications have not been pursued by the licensee. The licensee is now in the process of obtaining an evaluation from Combustion Engineering to determine whether or not hot-leg injection can be achieved with the currently installed system configuration. This item remains unresolved pending the completion of the evaluation by Combustion Engineering and the completion of licensee actions identified in the evaluation. (285/8815-11)

(b) A calculation to verify that the accumulator has sufficient capacity has not been performed by the licensee. However, a functional test has been successfully performed, and based on the results of the test, the licensee stated that the accumulators could perform their intended safety function.

(c) The licensee performed a functional test of the accumulator assemblies during the 1987 refueling outage to verify that the assemblies operated properly. The test confirmed that the assemblies were fully operable.

(d) The check valves associated with the accumulator assemblies were included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of these check valves in the IST program will ensure that the valves are verified to be functional each time the plant is placed in the cold shutdown mode.

(e) The licensee performed a calculation to verify that each accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 20, 1987.

(upply valves to the turbine-driven auxiliary feedwater
Pump (CV-1045A and YCV-1045B)

(a) Valves YCV-1045A and YCV-1045B are installed to provide steam to the turbine-driven auxiliary feedwater pump from Steam Generators A and B, respectively. The valves are normally shut and fail open on a loss of air pressure. The accumulator assemblies were installed to shut the valves in the event of a loss of air pressure concurrent with a steam generator tube rupture to prevent the release of radioactive material to the environment.

(b) The licensee performed a calculation on accumulator sizing in response to a deficiency identified by the SSOMI team. The calculation indicated that the accumulator sizing was adequate. Subsequent to the performance of the calculation, the SSOMI team reviewed the results and determined that the calculation was inadequate. The licensee revised the calculation to incorporate the comments noted by the SSOMI team. Currently, the accumulators are considered to be adequately sized to perform their intended safety function.

(c) Functional testing of the accumulator assemblies was performed during the 1985 refueling outage. During this testing, the licensee determined that the accumulator assemblies could hold Valves HCV-1045A and HCV-1045B shut

for 30 minutes. The design criteria states that the valves should be held shut indefinitely. To ensure the valves stay shut, the licensee has provided instructions in EOP-04, "Steam Generator Tube Rupture," to direct operations personnel to manually shut the valve within 30 minutes of the initiation of a steam generator tube rupture.

(d) The check valves associated with the accumulator assemblies were included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of these check valves in the IST program will ensure that the valves are verified to be functional each quarter.

(e) The licensee performed a calculation to verify that the accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 20, 1987.

(11) CCW isolation valves to the containment air cooling and filtering units (HCV-400A, B, C, and D; HCV-401A, B, C, and D; HCV-402A, B, C, and D; and HCV-403A, B, C, D)

(a) These are isolation valves for CCW flow to the containment air cooling and filtering units. Valves HCV-400A and C, HCV-401A and C, HCV-402A and C, and HCV-403A and C also function as containment isolation valves.

The valves can be normally open or normally shut, depending on the containment cooling requirements. The valves require air pressure for operation. The accumulator assemblies were provided to ensure that all valves open in the event that a containment isolation actuation signal is initiated concurrent with a loss of air system pressure.

(b) The licensee has not completed calculations to verify that the accumulators are properly sized. A functional test has been performed, as described below, that verified the accumulator sizing was adequate.

(c) Functional testing on the accumulator assembly for each valve has been completed. The testing verified that the accumulator assembly would move the valve to the open position. Based on the testing, the licensee determined that the accumulator assemblies were operational.

The licensee has not performed functional testing to verify that the valves can be shut in the event containment isolation is required. A discussion of whether or not an analysis is required to be performed to address a CCW line rupture in containment concurrent with a LOCA was provided

in paragraph 3.d of this inspection report. The status of these valves will be reviewed by NRC when the review is performed for Valves HCV-438B and HCV-438D. Accordingly, the review of these valves will be tracked under the unresolved item (285/8815-07) issued to track the review of HCV-438B and HCV-438D.

(d) The check valves associated with the accumulator assemblies were included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of these check valves in the IST program will ensure that the valves are verified to be functional each time the plant is in the cold shutdown mode.

(e) The licensee performed a calculation to verify that the accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 20, 1987.

(12) Spent fuel pool charcoal filter bypass valve (HCV-712A)

(a) Valve HCV-712A is normally open to bypass the charcoal filter during normal plant operations. Whenever spent fuel movement is performed at the spent fuel pool, Valve HCV-712A is shut so that the ventilation air flow passes through the charcoal filter to prevent contamination from being released to the environment. The valve fails as-is on a loss of air system pressure. The accumulator assembly is designed to provide motive force to shut the valve if the valve is in the open position. Once the valve has been shut, it will remain in the shut position.

(b) The licensee has not performed a calculation to verify that the sizing of the accumulator is adequate. A functional test was performed, as described below, which verified the adequacy of the accumulator size.

(c) During the 1987 refueling outage, the licensee performed a functional test of the accumulator assembly. The test involved shutting Valve HCV-712A under full-flow conditions and verifying that the valve remained closed for 4 hours. Based on the results of the testing, the licensee established the operability of the accumulator assembly.

(d) The check valve associated with the accumulator assembly was included in the revised IST program submitted by the licensee on December 16, 1987. Inclusion of this check valve in the IST program will ensure that the valve is verified to be functional each quarter.

(e) The licensee performed a calculation to verify that the accumulator assembly was seismically qualified. The licensee submitted the calculation to the NRC for review on November 20, 1987.

The SAO issued by the licensee for these specific essential valves has been forwarded to the NRC for review. In addition, the seismic calculations submitted on November 10 and 20, 1987, to verify that the specific accumulator assemblies described above were seismically qualified are under review by the NRC. Therefore, these matters will be considered an open item pending completion of the review by the NRC. (285/8815-11)

4. Followup on an Onsite Event

On April 19, 1988, the licensee identified a situation that represented a loss of containment integrity. At the time of discovery, the plant was at 100 percent power and had been operating at power since the last refueling outage that ended June 6, 1987.

During a walkdown being performed by a maintenance engineer to verify the adequacy of Procedure ST-CONT-3, "Containment Isolation Valves Leakage Rate Test-Type C," the engineer noted that a tubing cap was not installed. The cap should have been installed on one leg of the test tee for Pressure Transmitter PC-743, a pressure transmitter used to annunciate a containment high pressure condition in the control room. PC-743 is connected to containment penetration M-38 via a 1-inch line which is reduced to 3/8-inch tubing for connection of the transmitter. The engineer identified the problem while performing a walkdown in response to Violation 285/8710-07 cited by the NRC resident inspector in NRC Inspection Report 50-285/87-10, issued in May 1987. The violation was related to Procedure ST-CONT-3 not accurately reflecting the as-built installation of the piping and valves connected to containment penetrations. Procedure ST-CONT-3 provides instructions for the local leak rate testing of mechanical penetrations.

Without the cap installed on the test tee, containment integrity was violated in that the 3/8-inch tubing connecting PC-743 and Penetration M-38 provided an unrestricted path from inside to outside containment. The licensee performed a preliminary calculation to determine the leak rate through the 3/8-inch tubing, at a containment pressure of 52 psig, the maximum containment pressure experienced in a post-LOCA event. The leak rate was determined to be approximately 4.1 cubic feet per minute (cfm). The leak rate calculation was performed based on a mixture of air water, and steam. This is the mixture that would be expected after a loss-of-coolant accident occurred.

The licensee also performed a preliminary calculation to determine whether or not the radiation levels at the site boundary would exceed the levels established by 10 CFR Part 100 at a calculated leak rate of 4.1 cfm. The results of the preliminary calculation indicated that the radiation levels

would not exceed the established Part 100 limits. The preliminary calculation indicated the thyroid dose over a 2-hour period would be 258.6 Rem. The Part 100 limit is 300 Rem. The preliminary calculation also indicated that the whole body dose would be 6.4 Rem over a 2-hour period. The Part 100 limit is 25 Rem. Based on the results of the preliminary calculation, it appears that the radiation levels would not exceed the established Part 100 limits. The licensee stated that the preliminary calculation would be formally issued in the near future. This item remains open pending completion of the calculation and a review of the calculation by NRC personnel to verify its adequacy. (285/8815-13)

The licensee performed a calculation to determine the value of the leak rate through the test tee to determine whether or not containment integrity was violated as defined by the TS. The flow rate calculation was performed based on the leakage of dry air from containment, through the piping and tubing, and out the test tee. Dry air was used because the TS limit for La, where La is defined as the design basis leakage rate of 0.1 percent weight of the containment atmosphere per 24 hours at a pressure of 60 psig, is based on the leakage of dry air. The licensee's calculation of the leakage via the instrument line indicates the TS limits for B&C type leakage was exceeded by a factor of approximately seven (418,000 standard cubic centimeter (SCCM) calculated as compared to TS limits of 62,451 SCCM). This item represents a potential violation of the containment integrity requirement of TS LCO 2.6. (285/8815-14)

Upon discovery of this problem by the licensee, the test tee cap was immediately reinstalled. The licensee immediately instituted a walkdown of all other penetrations to verify that no other problems existed. No other problems were identified. The licensee reported the loss of containment integrity to the NRC Headquarters duty officer on April 19, 1988, via the emergency notification system in accordance with the requirements of 10 CFR Part 50.72. The licensee also immediately notified the NRC resident inspector. Licensee management stated that a licensee event report would be submitted within 30 days of the discovery of the event in accordance with 10 CFR Part 50.73.

In followup to this event, the licensee also determined that additional plant instrumentation was affected by the failure to install the test tee cap. Three other pressure instruments are also connected to penetration M-38 via the common piping that connects to PC-743. The licensee determined that the three instruments were also inoperable because the open-ended tubing would prevent a pressure increase in the piping and thus would prevent the three pressure instruments from sensing a pressure increase in containment. Two of the instruments, A/PC-742-1 and A/PC-742-2, are used to initiate safety injection, containment isolation, and steam generator isolation signals in the event of a high pressure condition in containment. The two instruments provide redundant initiation for one of the four channels installed to detect a containment high pressure event. There are an additional six pressure instruments which perform the same function as A/PC-742-1 and A/PC-742-2. A third instrument, A/PC-765, is used to initiate a reactor trip via the reactor

protection system in the event of a high containment pressure. An additional three instruments are provided at other containment penetrations to initiate the same reactor trip signal. Because additional instrumentation remained functional to initiate automatic response to a containment high pressure condition, the required redundancy for the three inoperable instruments connected to Penetration M-38 was maintained as defined by the TS.

To establish when the cap may have been removed, the licensee performed a documentation search. The results of the search indicated that the local leak rate test was performed on Penetration M-38 in March 1987 in accordance with Procedure ST-CONT-3 and that no other work had been performed on the pressure transmitter since then. The search also revealed that Maintenance Order (MO) 872526 had been issued in May 1987 to verify that all caps associated with local leak rate testing activities had been reinstalled. MO 872526 was issued for verification of cap installation as a result of a loss of containment integrity identified by the licensee in September 1974. (The licensee submitted Licensee Event Report (LER) 50-285/74-14 to provide details of the loss of containment integrity.)

A followup inspection was performed by the NRC inspectors to review the actions taken by the licensee and to verify that the actions were completed. The NRC inspectors noted that the program established by the licensee to verify that all penetration assemblies were returned to normal prior to exiting the cold shutdown mode was not a commitment made in LER 50-285/74-14, but instead was a program established by licensee self-initiative. However, the cap that was found not to be installed had not been included on the MO as an item for verification. Therefore, based on the documentation review performed by the licensee, it appeared that the cap had not been reinstalled when the local leak rate test was performed in March 1987.

The NRC inspectors then performed a followup of this event. The followup included a tour of the plant to verify that selected penetrations were properly sealed to prevent a loss of containment integrity, a review of Procedure ST-CONT-3 to verify that appropriate instructions had been provided for testing of Penetration M-38, and a review of MO 872526 that provided instructions for a verification that all test caps were installed. During this review, the NRC inspectors noted that the selected penetrations inspected during the plant tour were in an acceptable condition.

A review of Procedure ST-CONT-3 indicated that the instructions provided to the technicians were inadequate in that Procedure ST-CONT-3 requires that the cap on the test tee be removed prior to performance of the leak rate test; however, no instructions are provided to the technician to ensure the cap is replaced. A review of MO 872526 indicated that the technicians were instructed to verify that the test fitting used inside containment to perform the local leak rate test had been removed; however, no instructions were provided for verification that the normally installed

test caps had been replaced. The licensee could not determine why a verification of cap installation had not been provided on MO 872526.

Since Violation 285/8710-07 has already been issued to address the inadequacies of Procedure ST-CONT-3, no additional violation will be issued to cite the specific problems associated with the instructions provided for testing of Penetration M-38. Licensee management stated, in response to Violation 285/8710-07, that Procedure ST-CONT-3 would be upgraded prior to the next refueling outage. It is expected that the upgrade of Procedure ST-CONT-3 will include revision of the instructions for testing Penetration M-38. Further, licensee management stated that an in-depth review would be performed to ensure that the instructions provided for verification of normal penetration assembly status prior to startup from a refueling outage would be performed.

In addition, during a review of this event, the NRC inspector noted that the containment isolation valve, A/HCV-742, for Penetration M-38 was an air-operated valve and that the valve did not have an accumulator assembly installed. In an event where containment isolation of Penetration M-38 is required, concurrent with the loss of instrument air pressure, it is not evident how Valve A/HCV-742 could be shut, considering the valve fails open on a loss of air pressure. The licensee stated that the NRC had previously approved the installation and failure mode of Valve A/HCV-742. The NRC inspector will forward the information discussed above to personnel in NRC Headquarters for review to verify that the installation and failure mode complies with established design criteria appropriate to the Fort Calhoun Station. This item remains unresolved pending a review by NRR. (285/8815-15)

4. Exit Interview

The NRC inspectors met with Mr. R. Andrews, Division Manager, Nuclear Production, and other members of the licensee's staff on April 22, 1988, and obtained supplemental information until May 13, 1988, at the end of this inspection. At this meeting, the NRC inspectors summarized the scope of the inspection and the findings.

APPENDIX B

PROPOSED ENFORCEMENT CONFERENCE AGENDA

OMAHA PUBLIC POWER DISTRICT

June 8, 1988

I.	Introduction and Purpose of Meeting	L. J. Callan
	° Adequacy of Accumulator Assemblies and Associate Analysis Justifying Continued Plant Operation	
	° Containment Integrity	
II.	Licensee Presentation	OPPD Staff
III.	NRC Comments	L. J. Callan
IV.	Licensee Response	OPPD Staff
V.	Closing Comments	L. J. Callan