ENCLOSURE 2

U.S. NUCLEAR REGULATORY COMMISSION

REGION IV

Docket No: 50-285
License No: DPR-40

Report No: 50-285/97-11

Licensee: Omaha Public Power District
Fort Calhoun Station FC-2-4 Adm.
P.O. Box 399, Hwy. 75 - North of Fort Calhoun
Fort Calhoun, Nebraska

Facility: Fort Calhoun Station

Location: Blair, Nebraska

Dates: May 19-23, 1997

Inspector: W. Walker, Senior Resident Inspector

Approved: W. D. Johnson, Chief, Project Branch B

Attachment: Supplemental Information

EXECUTIVE SUMMARY

Fort Calhoun Station
NRC Inspection Report 50-285/97-11

This special announced inspection included aspects of the implementation and maintenance of your Technical Specification program. Specifically, the inspection focused on the events associated with the control rod withdrawal to bring the reactor to a critical condition on May 12, 1997.

Operations

- The inspector concluded that there was a weakness in the operating crew briefing prior to the approach to criticality in that information concerning the potential to have control rods fully withdrawn without being critical was not discussed (Section O1.1.1).

- Operating Procedure OP-2A had a weakness in that it did not provide guidance on actions to take if the reactor was not critical with all control rods fully withdrawn (Section O1.1.2).

- The reactor was maintained in a safe condition, but operators delayed driving in Group 4 control rods while discussing the situation of having all rods fully withdrawn without having reached criticality (Section O1.1.2).

- A noncited, minor violation was identified for an inadequate plant startup procedure. The procedure did not provide operator instruction for addressing a noncritical reactor condition with all Group 4 rods fully withdrawn (Section O1.1.2).

- The licensed operators failed to follow procedures when they did not change the plant startup procedure to document the necessary adjustments made to the boron concentration and control rods to achieve criticality. This was a violation of Technical Specification 5.8.1 (Section O1.1.2).

Report Details

Background

On April 21, 1997, the reactor was manually tripped due to the rupture of a 12-inch extraction steam line from the high pressure turbine to a low pressure feedwater heater. On May 12 during the startup from the forced outage, the licensee performed steps to bring the reactor critical. On the morning of May 12, the inspector reviewed the control room log book and noted that reactor criticality was not reached with all rods fully withdrawn. The estimated critical condition as predicted by the licensee was Group 4 control rods withdrawn 85 inches. The inspector questioned the licensee concerning the sequence of events which had occurred during the approach to criticality.

I. Operations

O1 Conduct of Operations (92901)

O1.1 Reactor Criticality Controls

a. Inspection Scope (92901)

The inspector reviewed the circumstances and operator actions associated with the May 12, 1997, approach to criticality.

b. Observations and Findings

On May 12, 1997, at approximately 4 a.m. during performance of activities to bring the reactor to a critical condition, a determination was made that the reactor was not critical when all rods were fully withdrawn. The estimated critical position as calculated was that the reactor would be critical with Group 4 control rods withdrawn 85 inches.

The following is a sequence of events for the approach to criticality on May 12, 1997.

Time	Description
0249	Withdrew Group 1 control rods to 90 inches (1/M prediction did not indicate criticality within the next withdrawal)
0302	Withdrew Group 2 control rods to 90 inches (1/M prediction of criticality between Group 3 control rods at 90 inches withdrawn and Group 4 at 90 inches withdrawn)
0317	Withdrew Group 3 control rods to 90 inches (1/M predicted criticality beyond all rods out)
0330 (approx)	Withdrew Group 4 control rods to achieve criticality. The licensee discussed the potential to reach all rods out on

Group 4 control rods and not be critical. A decision was made to continue based on knowledge that the rod worth curve was not exact and, if under-predicted, could allow criticality prior to all rods out.

0332 (approx) Group 4 control rods withdrawn to 110 inches, start up rate and power were monitored. Group 4 control rods were withdrawn in 2-inch increments while monitoring indications. Behavior was indicative of being close to critical (power at 1.0E-05 percent and very slowly increasing, but startup rate was not a constant positive value).

0347 Withdrew Group 4 control rods to all rods out position. Behavior was indicative of being close to critical (power at 1.0E-05 percent and very slowly increasing, but startup rate was not a constant positive value).

0400 (approx) The shift supervisor, reactor engineer, and licensed senior operator discussed reactor indications and confirmed that criticality was not achieved as indicated by:

- No constant positive startup rate (indications still read negative occasionally).
- Power was not steadily increasing without control rod motion.
- Power was less than 1.0E-04 percent.

At this point, discussions on how to proceed involved:

- How much to dilute: this should be enough to bring Group 4 control rods to 85 inches withdrawn, which was .26 percent delta-rho or 30 ppm. This was derived from the Technical Data Book Figure II.B.2.b. This was the target estimated critical position.
- How far to insert Group 4 control rods: this should be approximately twice the added reactivity of the dilution or 40 inches withdrawn. This was also derived from Technical Data Book Figure II.B.2.b.
- Calculating the amount to dilute (850 gallons water). The licensee used Operating Instruction OI-CH-4, "Chemical and Volume Control System Makeup Operations."

- The need for a new estimated critical condition: This was not necessary since the calculation would result in the same value as before of 1395 ppm and Group 4 control rods at 85 inches withdrawn.

0405	Inserted Group 4 control rods to 40 inches withdrawn.
0410(approx)	Began dilution addition of 850 gallons of water.
0450(approx)	Chemistry sample determined new boron concentration.
0500(approx)	Restarted approach to criticality. New base count for 1/M plot was taken for Group 4 control rods at 40 inches withdrawn. Withdrew Group 4 control rods to 65 inches withdrawn.
0515(approx)	1/M predicted criticality between 85 and 100 inches withdrawn. Withdrew Group 4 control rods to achieve criticality.
0524	Criticality was achieved with Group 4 control rods withdrawn 94.5 inches. Comparison of estimated critical condition and actual critical condition is as follows:

- Total deviation between predicted and actual critical condition = 0.35 percent delta-rho
- This was less than administrative review limit (0.5 percent delta-rho) and less than the Technical Specification limit (1.0 percent delta-rho)

O1.1.1 Operator Performance Issues Associated with the Approach to Criticality

a. Inspection Scope (92901)

The inspector reviewed the estimated critical condition calculation and the approach to criticality briefing. In addition, interviews were conducted with the shift supervisor, the licensed senior operator, and the reactor engineer who provided direct oversight of bringing the reactor to a critical condition.

b. Observations and Findings

The inspector performed a review of the estimated critical condition calculation and verified that the calculation as performed indicated that the reactor would reach criticality with Group 4 control rods withdrawn 85 inches. During the review of the estimated critical condition worksheet, the inspector noted that the potential existed to reach all rods out without the reactor being in a critical condition. The

inspector questioned the shift supervisor and the reactor engineer concerning whether during the approach to criticality briefings this potential for reaching all rods out without being critical was discussed. The reactor engineer and the shift supervisor stated that this was not discussed; however, the reactor engineer stated he was aware of the possibility. The inspector considered it a weakness that the operating crew and especially the licensed senior operator were not reminded that the possibility existed to be in an all rods out condition without being critical.

The inspector discussed with the reactor engineer the count rate predictions obtained when Group 3 control rods were at 90 inches which indicated that the reactor would go critical beyond all rods out on Group 4. The reactor engineer stated that discussions were held with the operating crew regarding this and a decision was made to continue. This decision was based on the knowledge that the rod worth curve was not exact and criticality could be achieved prior to reaching all rods out on Group 4.

The inspector reviewed the estimated critical condition worksheets from the previous three approaches to criticality and no anomalies were noted.

c. Conclusions

The inspector concluded that there was a weakness in the operating crew briefing prior to the approach to criticality in that information concerning the potential to reach all rods out on Group 4 control rods without being critical was not discussed.

O1.1.2 Procedure Usage During Rod Withdrawal to Criticality

a. Inspection Scope (92901)

The inspector reviewed Operating Procedure OP-2A, "Plant Startup," and Standing Order SO-O-1, "Conduct of Operations." The review was conducted to evaluate operator performance and adherence to procedures during the rod withdrawal to criticality.

b. Observations and Findings

The inspector performed a review of the Operating Procedure OP-2A, "Plant Startup." Attachment 2, "CEA Withdraw to Criticality Mode 2," provides instructions on performing the rod withdrawal to criticality. Step 10e states, "withdraw Group 3 control rods to 90 inches, and verify Group 2 all rods out and Group 4 at approximately 14 inches." Step f states, "wait 5 minutes while monitoring count rate." Step g states, "withdraw Group 4 as required to achieve criticality." The next step is number 11 which states, "when reactor power is greater than 1.0E-4 on all wide range nuclear instrumentation channels then place

each zero power mode bypass switch on the reactor protection system cabinets to off." The inspector found that the procedure did not address the reactor condition encountered, that is, not critical with all Group 4 rods fully withdrawn. This was a minor violation per Section IV of the NRC Enforcement Policy and is described in this report because of its impact on the cited violation below. This violation constitutes a violation of minor significance and is being treated as a noncited violation consistent with Section IV of the NRC Enforcement Policy.

The inspector also performed a review of Standing Order SO-O-1,"Conduct of Operations." Step 7.3.1 states "it is the responsibility of the on-duty shift supervisor to direct all scheduled and planned reactor power changes in accordance with approved procedures." Step 7.3.2C states "all scheduled or planned power changes will be made in accordance with the applicable operating procedure and operating instructions." Additional guidance is provided in the Standing Order under the Procedure Adherence section (12.1.2). Section 12.1.2B states in part that, if while performing a procedure it is discovered that the anticipated response was not received, the following actions should be carried out:

- Place the system/component in a safe condition.
- Contact the shift supervisor and inform him of the situation and status of the component/system.
- Evaluate the situation to determine the cause of the unexpected response and initiate a temporary or permanent procedure change in accordance with G-30, "Procedure Change And Generation," to allow usage of the procedure for the current situation.

The inspector determined that, when the licensee failed to reach criticality with all Group 4 rods out, the anticipated response (i.e., criticality) was not received. The failure to immediately place the reactor in a safe, stable condition and then to initiate a procedure change before continuing to perform reactivity adjustments was a violation of Technical Specification 5.8.1 (50-285/97011-01).

c. <u>Conclusions</u>

Operating Procedure OP-2A had a weakness in that it did not provide guidance on actions to take if the reactor was not critical with all control rods fully withdrawn. The inspector determined that the licensed operator actions to drive Group 4 control rods back into the core when all rods were out and criticality had not been reached were technically sound and maintained the reactor in a safe condition. However, the operators delayed driving in Group 4 rods from 3:47 a.m. until 4:05 a.m. while discussing the situation. The operators violated procedures when they failed to stop and change the procedure to document the necessary adjustments made to the boron concentration and control rods to achieve criticality.

II.Management Meetings

X1 Exit Meeting Summary

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection on May 23, 1997.

ATTACHMENT
SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

J. Bishop, Assistant Plant Manager
C. Brunnert, Manager, Quality Assurance and Quality Control
D. Dryden, Station Licensing Engineer
T. Dukarski, Supervisor, System Chemistry
S. Gambhir, Division Manager, Production Engineering
J. Gasper, Manager, Nuclear Projects
W. Gates, Vice President, Nuclear
S. Gebers, Manager, Radiation Protection
B. Hansher, Supervisor, Station Licensing
R. Jaworski, Manager, Design Engineering, Nuclear
R. Phelps, Manager, Station Engineering
R. Ridenoure, Supervisor, Operations
H. Sefick Manager, Security Services
C. Stafford, Principal Reactor Engineer
J. Tills, Manager, Nuclear Licensing
D. Trausch, Manager, Nuclear Safety Review Group

NRC

W. Walker, Senior Resident Inspector

INSPECTION PROCEDURES USED

IP 92901: Followup - Operations

ITEMS OPENED AND CLOSED

Opened

50-285/97011-01	vio	failure to follow procedures during approach to criticality (Section O1.1.2)