



UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 REGION II
 101 MARIETTA STREET, N.W.
 ATLANTA, GEORGIA 30303

Report No.: 50-395/85-27

Licensee: South Carolina Electric and Gas Company
 Columbia, SC 29218

Docket No.: 50-395

License No.: NPF-12

Facility Name: Summer

Inspection Conducted: May 14 - 16, 1985

Inspectors:	<u>Frank Jape</u>	<u>5/23/85</u>
	P. T. Burnett	Date Signed
for	<u>Frank Jape</u>	<u>5/23/85</u>
	tterson	Date Signed
Approved by:	<u>Frank Jape</u>	<u>5/23/85</u>
	F. Jape, Section Chief	Date Signed
	Engineering Branch	
	Division of Reactor Safety	

SUMMARY

Scope: This special, announced inspection entailed 22 inspector-hours on site in the review of the below insertion limit criticality event.

Results: One violation was identified - failure to follow procedures - paragraph 5.a.

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 PDR ADOCK 05000395
 Q PDR

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *J. G. Connelly, Jr., Deputy Director, Operations and Maintenance
- *B. G. Croley, Group Manager, Technical and Support Service
- *K. W. Woodward, Manager, Operations
- *M. R. Browne, Manager, Technical Support
- *M. D. Quinton, Manager, Maintenance Services
- *A. R. Koon, Associate Manager, Regulatory Compliance
- *G. A. Loignon, Associate Manager, Performance and Results
- *J. S. Woods, Associate Manager, Nuclear Analysis
- G. J. Taylor, Associate Manager, Nuclear Computer Services
- B. C. Williams, Supervisor of Operations
- *S. F. Fipps, ISEG

Other licensee employees contacted included shift supervisors, control room supervisors, shift technical advisors, and office personnel.

Other Organizations

- *B. W. MacIntire, Westinghouse Site Service Manager
- J. Huckabee, Westinghouse Engineer

NRC Resident Inspector

- *C. W. Hehl, Senior Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on May 16, 1985, with those persons indicated in paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee. The following new items were identified during this inspection.

Violation 395/85-27-01: Failure to follow procedures - paragraph 5.a.

Inspector Followup Item 395/85-27-02: Followup on corrective actions to improve accuracy of ECCs - paragraph 5.b.

The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector during this inspection.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Unresolved Items

Unresolved items were not identified during the inspection.

5. Review of Licensee Event (92705)

At 1700 hours on May 11, 1985, the V. C. Summer Station was made critical with the control rods below the insertion limit imposed by Technical Specification 3.1.3.6. For zero power, that limit is C bank at 118 steps. The position observed was 69 steps on C bank. The predicted critical position was 65 steps on D bank. Since the control rod banks are operated in 100 step overlap, the total error in rod position was 124 steps. By a variety of calculations, the reactor vendor, Westinghouse, has estimated the reactivity error to range from 500 to 950 percent millirho (pcm), according to the licensee. Using the figure in the station curve book for rod worth at middle of core life in the xenon-free condition, the inspector estimated the reactivity error to be 841 pcm. The source or sources of the reactivity error have not been identified. Unlike the positive rate trip event of February 28, 1985, (see inspection report 395/85-12) in which improperly calculated xenon concentration was identified as the major cause of the reactivity error, this startup was being conducted in the xenon-free condition. The reactor had been shutdown for maintenance for twelve days prior to criticality. Later, independent calculations by Westinghouse led to critical positions on D bank of 35 to 75 steps. Control bank worth curves, boron worth, and fission product worth data are supplied to the licensee by Westinghouse, who is reviewing their calculations for error on a priority basis. On May 16, 1985, a Westinghouse engineer was on site to perform an in-depth analysis of the estimated critical condition (ECC calculation procedure used by the licensee). He reported to the inspectors that the procedure in use was technically sound and adequate. He did suggest one minor change to the procedure, but indicated that the change would not account for the reactivity error.

On May 11, 1985, the ECC was improperly calculated by the control room supervisor (CRS), but a combination of errors led to nearly the same result as a proper calculation. The wrong revision of the ECC procedure, GOP-Appendix-C, was used. Contrary to SAP-200, item 6.9.7.c, the version used was neither duplicated from nor compared with the controlled master copy, which had undergone pen and ink changes to correct errors in signs on May 8, 1985. Use of the correct version of the procedure might have led to a proper calculation of the required boron concentration (756.5 parts per million (ppm)) for criticality with D bank at 65 steps. Instead a value of 749.5 ppmB was obtained. The difference of 7 ppmB, about 65 pcm, was not a major contributor to large differences between predicted and observed critical rod position.

The licensee had recently instituted the practice of placing the chart recorder for the source-range and intermediate-range nuclear instruments on high speed during startups. Evaluation of that chart record confirmed that only a modest startup rate was attained, less than 0.1 decade per minute, and that the reactor was critical for only about five minutes, or just sufficient time to confirm that the reactor was, in fact, critical.

Once criticality below the insertion limit was determined, the operators promptly complied with procedural requirements to initiate emergency boration and fully insert the control banks. Emergency boration was continued for two minutes. Within 15 minutes the shutdown margin was recalculated and determined to be satisfactory according to entries in the operations log book.

To confirm the log book entries, shutdown margin surveillance tests (STP-134.001) for May 1985 were reviewed. All log book entries between 1 and 12 of May were confirmed, and all were acceptable with one exception. The test performed on May 10, 1985, at 0130 used an out-dated procedure, Revision 3 vice Revision 4. The procedure bore a stamp asserting that the procedure had been compared with the controlled copy, which was apparently not the case. The shutdown margin was acceptable however.

The licensee had instituted the practice of performing an inverse multiplication approach to criticality using Appendix D to the General Operating Procedure (GOP). That procedure was being performed at the time of this event. Review of the completed procedure confirmed that it consistently predicted criticality with C rod bank less than 135 steps withdrawn. The acceptance criterion for an ECC is +/- 50 steps of prediction. In this case the lower limit was D bank at 15 steps, which is equivalent to C bank at 143 steps. The procedure was performed by the STA, who calculated the inverse multiplication data and plotted these values against control rod bank position. On the plot, inverse multiplication was on the vertical axis and bank position was on the horizontal axis.

Because the rods are operated in overlap, rod position was indicated along a double line rather than a single line (see figure 395/85-27-01). It is clear from the records, of which figure 395/85-27-01 is an annotated copy, that the STA did not properly extrapolate the plotted data to critical rod position. The procedure requires that for each extrapolation a line should pass through the last two plotted points to the horizontal, zero-value, axis. From that point a vertical line should have been drawn down to the predicted critical rod position. Instead the STA continued along the same slope of the line schematically representing rod position as if using a nomograph. Hence, the recorded predictions were neither consistent nor meaningful. Proper performance of the procedure should have prevented the event.

GOP Appendix D was used for the successful startup on May 12, 1985. However, review of the completed procedure revealed that it had not been performed with verbatim compliance. The procedure requires that the source channel with the higher countrate be used to monitor inverse multiplication by taking three one-minute counts using the counter scaler. The counts should then be averaged, converted to counts per second, the inverse

multiplication (inverse count rate ratio) calculated and plotted against control rod position. Instead the countrate data were obtained for both channels using either the panel countrate meter or the chart recorder. However, the data sheet was completed only for the channel having the lower countrate. As performed, the procedure did provide an adequate monitoring of the approach to criticality.

a. Regulatory Action

The failure to follow procedures SAP 200 and GOP, Appendices C and D, collectively have been identified as one violation with multiple examples: Violation 395/85-27-01: Failure to follow procedures. It was noted that with the exception of improper use of GOP Appendix D on May 11, 1985, the failure to follow procedures had little or minor effect on this startup event.

b. Ability to Restart

The corrective action to produce better parametric data to assure more accurate calculations of ECCs is not expected to be complete until June 10, 1985. In the interim a restart after a scram can be safely performed by use of the existing procedure for approaching criticality using the inverse multiplication technique provided there is verbatim compliance with the procedure. In addition, Westinghouse is currently qualifying a three-dimensional computer simulation of the reactor, which when used with the recent operating history of the reactor is expected to provide acceptable ECCs. The computer program is currently being tested against the results of the two most recent startups, and is expected to be available to the licensee on demand. This item is identified as Inspector followup item 395/85-27-02, Followup on corrective actions to improve accuracy of ECCs.

Attachment:
Figure 395/85-27-01

ATTACHMENT

FIGURE 395/85-27-01
INVERSE COUNT RATE RATIO PLOT

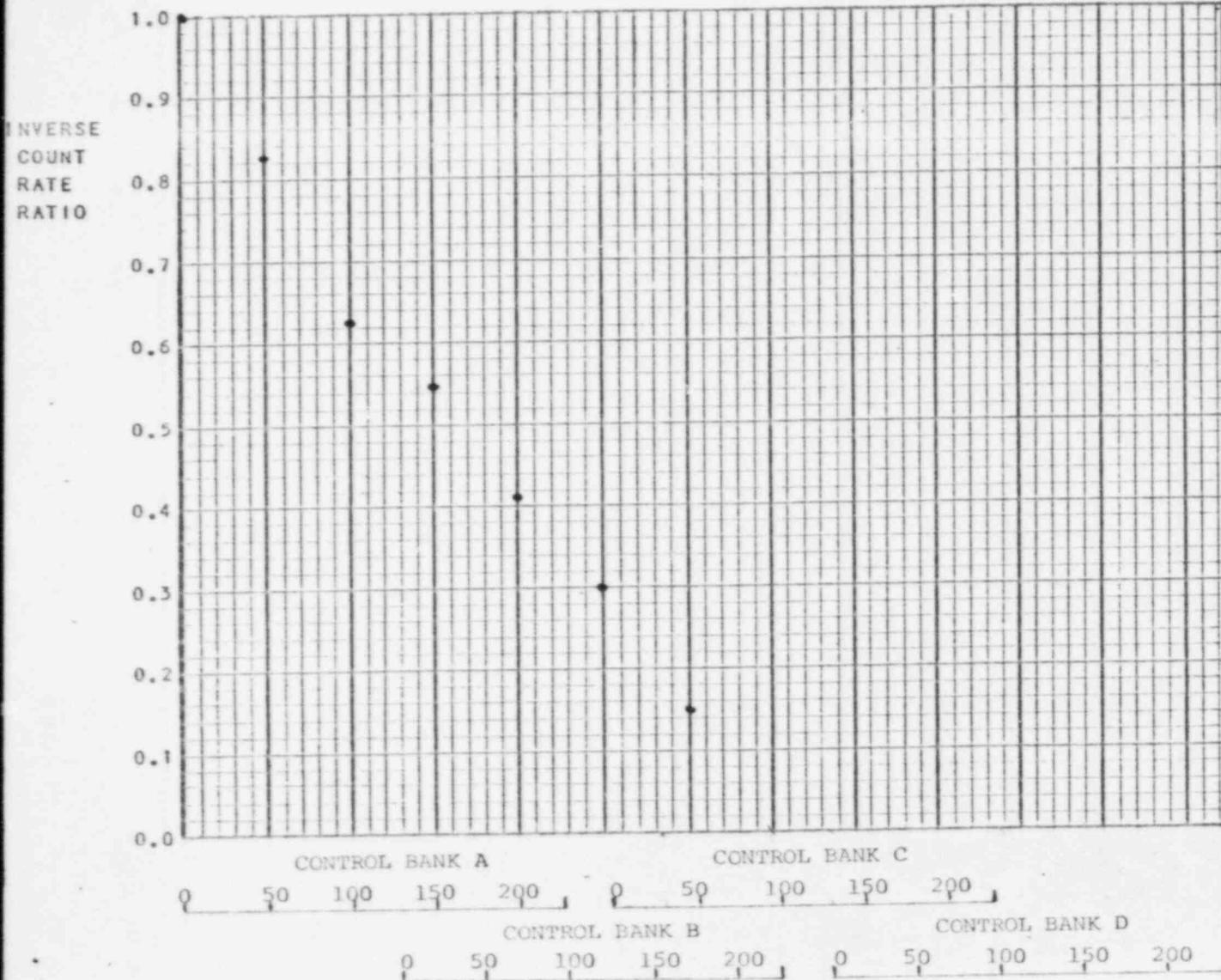
DATE: 5-11-85
TIME: 1600
C_B: 744 ppm
C₀: 1746 cps

CALCULATED ECP
BANK D AT 65 STEPS

ACTUAL CRITICAL HEIGHT
BANK C AT 69 STEPS

GOP-APPENDIX-D REVISION 1 6/15/84

	ROD HEIGHT	AVE C ₁ (CPS)	C ₀ /C ₁	ICRR ECP	*
1	A @ 0	1746	1.0	- - -	
2	A @ 50	2113.5	.826	C @ 50	C @ 35
3	A @ 100	2768.7	.6306	C @ 25	C @ 10
4	A @ 150	3149.6	.554	D @ 210	D @ 100
5	A @ 200	4256.7	.410	D @ 20	C @ 90
6	B @ 122	5722.7	.305	D @ 75	C @ 135
7	B @ 172	11086.0	.1575	D @ 30	C @ 95
8	B @ 197				
9					
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19					
20					



* ACTUAL ICRR ECP IF THE PLOT IS CORRECTLY READ

SHIFT SUPERVISOR

DATE: 5-11-85
TIME: 1700