UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

Report Nos.: 50-348/85-39 and 50-364/85-39

Licensee: Alabama Power Company
600 North 18th Street
Birmingham, Al 35291

Facility Name: Farley 1 and 2

Docket Nos.: 50-348 and 50-364 Licensee Nos.: NPF-2 and NPF-8

Inspection Conducted: September 23-27, 1985

Inspector: P.T. Burnett — October 17, 1985 Date Signed

Approved by: F. Jape, Section Chief — 10/17/85 Date Signed
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope: This routine, unannounced inspection involved 34 inspector hours onsite in the review of post-refueling startup tests and surveillance tests.

Results: No violations or deviations were identified.

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## REPORT DETAILS

1. Persons Contacted

   Licensee Employees

   E. W. Carmak, Reactor Engineering Supervisor
   *R. D. Hill, Manager of Operations
   *W. MacDonald, Reactor Engineer
   *R. Marlow, Technical Supervisor
   *D. N. Morey, Assistant Plant Manager - Operations
   *W. G. Ware, SAER Supervisor
   J. D. Woodard, Plant Manager

   Other licensee employees contacted included office personnel.

   NRC Resident Inspectors

   *W. H. Bradford, Senior Resident Inspector
   *B. R. Bonser, Resident Inspector

   *Attended exit interview.

2. Exit Interview

   The inspection scope and findings were summarized on September 27, 1985 with those persons indicated in paragraph 1 above. The licensee identified as proprietary only that information contained in the Westinghouse reports reviewed by the inspector. That information is not repeated in this report. The licensee made one commitment that will be tracked as an Inspector Followup Item:

   - 348/364/85-39-01, Procedures will be modified to confirm a negative moderator temperature coefficient above 70% rated thermal power following measurement of the ARO, zero-power, moderator temperature coefficient - paragraph 5.a(2).

3. Licensee Action on Previous Enforcement Matters

   Not inspected.

4. Unresolved Items

   Unresolved items were not identified during this inspection.

5. Post-Refueling Startup Tests (61702,,61708,61710, 61711,72700)

a. Unit 1, Cycle 7

The following completed engineering test procedures (ETP) and surveillance test procedures (STP) were reviewed:

(1) FNP-1-STP-112 (Revision 9), Rod Drop Time Measurement, demonstrated that each rod cluster control assembly (RCCA) had a drop time to dash pot entry less than the 2.2 second maximum allowed by Technical Specification 3.1.3.4.

(2) FNP-1-ETP-3601 (Revision 2), Zero Power Test Procedures, was performed on May 25-26, 1985.

The measured all-rods-out (ARO) critical boron concentration was 2066 ppmB, which was in good agreement with the predicted value of 2072 ppmB.

The reactivity computer checkout was based upon two measurements of positive periods, having corresponding reactivities or 19.8 and 37.3 percent millirho (pcm), and one negative period with a reactivity of -16.2 pcm.

The ARO moderator coefficient was derived from the measurement of the isothermal temperature coefficient measured at a boron concentration of 2060 ppmB. The resulting moderator coefficient of 4.5 pcm/degree F was less than the 5pcm/degree allowed by Technical Specification 3.1.1.3.a, but more than the predicted value of 4 pcm/degree.

Technical Specification 3.1.1.3.a further requires that the moderator coefficient be negative above 70% power. Discussions with licensee personnel revealed that procedures did not address this requirement. Nevertheless, the requirement had not been ignored. The fuel vendor, Westinghouse, at the request of the licensee had provided rod withdrawal limit curves to reduce boron concentration and assure a non-positive coefficient at 70% power. a licensee engineer then evaluated the curves and limiting boron concentrations, and demonstrated that, even with the most rapid startup, power defect and xenon buildup would make an unacceptable combination of rod position and boron concentration impossible. At the exit interview the licensee agreed with the position that assurance of conformance to a limiting condition of operation should not rest on the initiative of an individual, but should be a part of a procedure even when there is no corresponding surveillance requirement. To that end, the licensee made the following commitment to be implemented prior to the next operating

cycle: Procedures will be modified to confirm a negative moderator temperature coefficient above 70% rated thermal power following measurement of the ARO, zero-power, moderator temperature coefficient (inspector followup item 348/364/85-39-01).

To perform rod bank worth measurements, the licensee first designated control bank B, the anticipated highest worth bank, as the reference bank. Starting from the ARO condition, boron dilution was initiated and bank B was inserted incrementally to compensate for the continuously increasing reactivity. The reactivity change associated with each increment of bank B insertion was measured using the reactivity computer. That is, the incremental reactivity changes were determined graphically from the reactivity computer recorder trace of reactivity versus time. In reviewing the chart record and performing an independent analysis of the reactivity increments, the inspector concluded that the reactivity computer had been used within its calibrated range. Some ending, after incremental motion, reactivities were more negative than the -16.2 pcm limit of the reactivity computer calibration. However, the majority of the trace used to determine the slope and intercept fell within the calibrated span. A photocopy of a portion of the chart record (attachment 1) is enclosed with this report to illustrate that point.

A spreadsheet from the SUPERCALC 3 (Release 2) microcomputer program was used to evaluate the raw data obtained from the chart record by the inspector. The spreadsheet converted observations of reactivity and rod bank position to reactivity increments, rod increments, and differential and integral reactivity worths. The licensee's values of differential were added to the spreadsheet. Then the program was used to graph the results of the differential worth measurements. The spreadsheet (attachment 2) and graph (attachment 3) are enclosures to this report.

(3) FNP-1-STP-121 (Revision 16), Power Range Axial Offset Calibration was performed on June 2, 1985. Using a least squares fit spreadsheet with the SUPERCALC 3 program, the inspector performed an independent analysis of the licensee's correlation of chamber currents to flux axial offset. A graph from that analysis is provided as attachment 4 to this report. A table comparing the licensees results with those obtained from the spreadsheet is provided in attachment 5. The agreement between results is acceptable for each chamber.

(4) FNP-85-0904, Unit 1, Cycle 2 Startup Report. That report was an accurate summary of the test results, and confirmed that all acceptance criteria had been satisified.

(5) WCAP-10795 (Proprietary), The Nuclear Design and Core Management of the Joseph M. Farley Unit 1 Power Plant, Cycle 7, March 1985. This document was the source of the numerical acceptance or performance criteria used to establish acceptable startup test results.

b. Unit 2, Cycle 4

Most of the startup program had been witnessed as reported in inspection report 364/85-14. This inspection was limited to confirming that the remaining startup program was completed and an acceptable startup report issued. The documents reviewed included:

(1) FNP-2-ETP-3605, Power Ascension Procedure,

(2) FNP-2-STP-121, Incore-Excore Detector Calibration,

(3) FNP-2-STP-115.1, RCS Flow Measurement, and

(4) FNP-85-0516, Unit 2, Cycle 4 Startup Report.

(5) WCAP-10674 (Proprietary), The Nuclear Design and Core Management of the Joseph M. Farley Unit 2 Power Plant, Cycle 4, November 1985 (Revision 1 incorporated August 1985). This document was the source of the numerical acceptance or performance criteria used to establish acceptable startup test results.

All procedures were found to be complete and the startup report was an accurate representation of the results obtained.

No violations or deviations were identified in the inspection of the post-refueling startup programs.

6. Surveillance Tests (61702,61707,61708)

The following completed surveillance tests were reviewed for technical adequacy, compliance with procedure requirements, and compliance with Technical Specification requirements for frequency of performance during the current operating cycle.

a. Unit 1

(1) FNP-1-STP-29.1, Shutdown Margin Calculation (T-average at 547),

(2) FNP-1-STP-29.2, Shutdown Margin Calculation (T-average at 547),

(3) FNP-1-STP-110, Determination of Limiting Hot Channel Factors, and

(4) FNP-1-STP-115.1, RCS Flow Measurement (Heat Balance Method).

b. Unit 2

(1) FNP-2-STP-29.1, Shutdown Margin Calculation (T-average at 547),

(2) FNP-2-STP-29.2, Shutdown Margin Calculation (T-average _ 547),

(3) FNP-2-STP-110, Determination of Limiting Hot Channel Factors,

(4) FNP-2-STP-111, Overall Core Reactivity Balance,

(5) FNP-2-STP-114.1, Moderator Temperature Coefficient for Boron Concentration Less Than 300 ppmB, and

(6) FNP-2-STP-115.1, RCS Flow Measurement (Heat Balance Method).

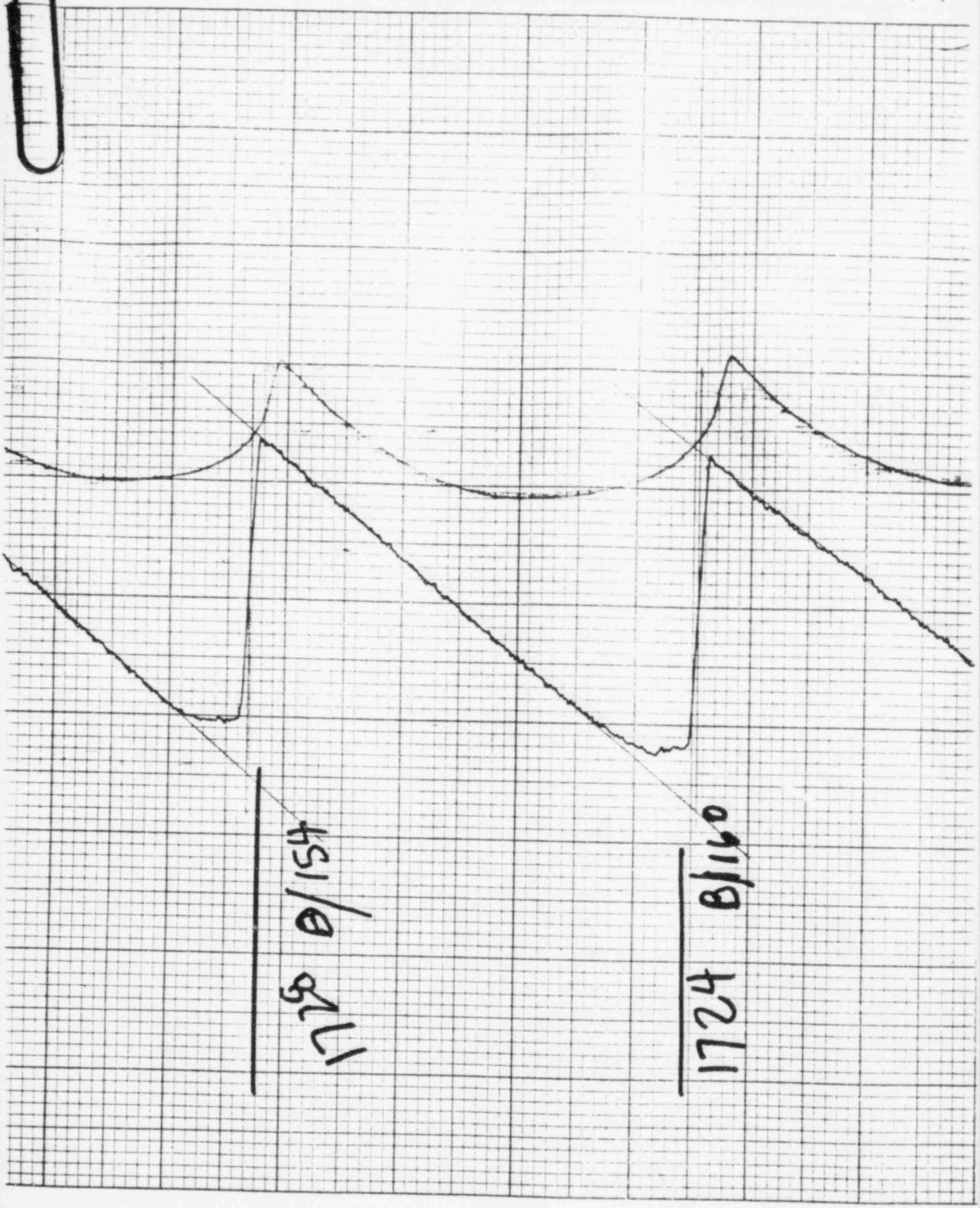
No violations or deviations were identified during the inspection of these surveillance tests.

7. Followup on Inspector Identified Item (92701)

(Open) Inspector Followup Item 348/364/84-12-02: Evaluate use of chi-squared test for source range nuclear instruments (SRNI). The licensee has instituted the use of the test to confirm operability of the SRNIs prior to starting a refueling outage. Currently the licensee is considering more frequent use of the test to assure operability of the SRNIs during those periods when reactor safety is particularly dependent on them : during refueling, during startup of a new core, and during periods when the vessel water level had been lowered for maintenance and inspection.

Attachments:
1. Reactivity Computer Trace
2. Table of Rod Worth
3. Graph of Rod Worth
4. N41 Least Squares Test
5. Nuclear Instrument Correlation

ATTACHMENT 1 REACTIVITY COMPUTER TRACE



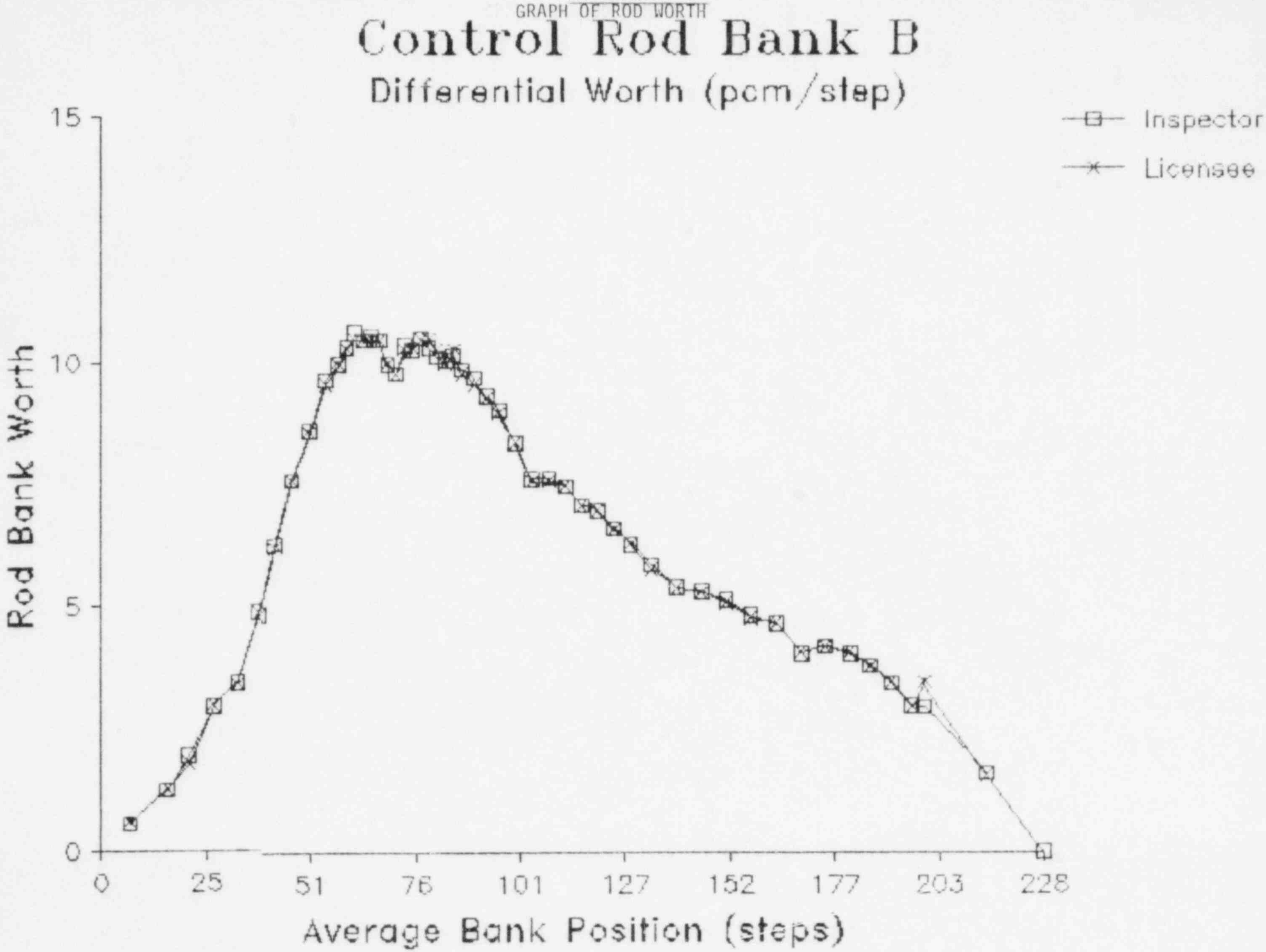
ATTACHMENT 2

Table of Rod Worth

FARLEY UNIT 1: Beginning of Cycle 7 Inspection Report 50-348/364/85-39

| Rod Steps Start | Finish | Reactivity(pcm) Start | Finish | Net Change Rho(pcm) | Steps | Differential (pcm/step) | Plot at Step | Licensee Different |
|---|---|---|---|---|---|---|---|---|
| Control Rod Bank B | | | | | | 0 | 228 | |
| 228.0 | 200.0 | 48.0 | 2.0 | 46.0 | 28.0 | 1.64 | 214 | 1.60 |
| 200.0 | 198.0 | 2.0 | -4.0 | 6.0 | 2.0 | 3.00 | 199 | 3.50 |
| 198.0 | 194.0 | 10.3 | -1.8 | 12.1 | 4.0 | 3.03 | 196 | 3.00 |
| 194.0 | 188.0 | 10.9 | -10.0 | 20.9 | 6.0 | 3.48 | 191 | 3.50 |
| 188.0 | 184.0 | 4.5 | -10.8 | 15.3 | 4.0 | 3.83 | 186 | 3.80 |
| 184.0 | 178.0 | 4.4 | -20.0 | 24.4 | 6.0 | 4.07 | 181 | 4.10 |
| 178.0 | 172.0 | 9.4 | -15.9 | 25.3 | 6.0 | 4.22 | 175 | 4.20 |
| 172.0 | 166.5 | 11.2 | -11.2 | 22.4 | 5.5 | 4.07 | 169 | 4.10 |
| 166.5 | 160.0 | 13.2 | -17.2 | 30.4 | 6.5 | 4.68 | 163 | 4.70 |
| 160.0 | 154.0 | 14.2 | -14.9 | 29.1 | 6.0 | 4.85 | 157 | 4.80 |
| 154.0 | 148.0 | 12.9 | -18.0 | 30.9 | 6.0 | 5.15 | 151 | 5.10 |
| 148.0 | 142.0 | 13.0 | -19.0 | 32.0 | 6.0 | 5.33 | 145 | 5.30 |
| 142.0 | 136.0 | 13.2 | -19.3 | 32.5 | 6.0 | 5.42 | 139 | 5.40 |
| 136.0 | 130.0 | 12.9 | -22.4 | 35.3 | 6.0 | 5.88 | 133 | 5.80 |
| 130.0 | 126.0 | 17.0 | -8.2 | 25.2 | 4.0 | 6.30 | 128 | 6.30 |
| 126.0 | 122.0 | 12.9 | -13.6 | 26.5 | 4.0 | 6.63 | 124 | 6.60 |
| 122.0 | 118.0 | 16.5 | -11.5 | 28.0 | 4.0 | 7.00 | 120 | 7.00 |
| 118.0 | 114.0 | 12.6 | -15.8 | 28.4 | 4.0 | 7.10 | 116 | 7.10 |
| 114.0 | 110.0 | 12.3 | -17.7 | 30.0 | 4.0 | 7.50 | 112 | 7.50 |
| 110.0 | 106.0 | 10.5 | -20.2 | 30.7 | 4.0 | 7.68 | 108 | 7.60 |
| 106.0 | 102.0 | 17.8 | -12.8 | 30.6 | 4.0 | 7.65 | 104 | 7.60 |
| 102.0 | 98.0 | 11.9 | -21.7 | 33.6 | 4.0 | 8.40 | 100 | 8.40 |
| 98.0 | 94.0 | 17.3 | -19.0 | 36.3 | 4.0 | 9.08 | 96 | 9.00 |
| 94.0 | 92.0 | 11.7 | -7.0 | 18.7 | 2.0 | 9.35 | 93 | 9.30 |
| 92.0 | 88.0 | 20.0 | -18.9 | 38.9 | 4.0 | 9.73 | 90 | 9.60 |
| 88.0 | 86.0 | 11.9 | -7.9 | 19.8 | 2.0 | 9.90 | 87 | 9.80 |
| 86.0 | 84.0 | 11.6 | -8.8 | 20.4 | 2.0 | 10.20 | 85 | 10.30 |
| 84.0 | 82.0 | 10.0 | -10.2 | 20.2 | 2.0 | 10.10 | 83 | 10.00 |
| 82.0 | 80.0 | 10.5 | -9.8 | 20.3 | 2.0 | 10.15 | 81 | 10.30 |
| 80.0 | 78.0 | 14.5 | -6.2 | 20.7 | 2.0 | 10.35 | 79 | 10.50 |
| 78.0 | 76.0 | 12.2 | -8.9 | 21.1 | 2.0 | 10.55 | 77 | 10.50 |
| 76.0 | 74.0 | 12.5 | -8.1 | 20.6 | 2.0 | 10.30 | 75 | 10.30 |
| 74.0 | 72.0 | 11.4 | -9.4 | 20.8 | 2.0 | 10.40 | 73 | 10.30 |
| 72.0 | 70.0 | 14.3 | -5.3 | 19.6 | 2.0 | 9.80 | 71 | 9.80 |
| 70.0 | 68.0 | 13.0 | -7.0 | 20.0 | 2.0 | 10.00 | 69 | 10.00 |
| 68.0 | 66.0 | 7.1 | -13.9 | 21.0 | 2.0 | 10.50 | 67 | 10.50 |
| 66.0 | 64.0 | 11.0 | -10.2 | 21.2 | 2.0 | 10.60 | 65 | 10.50 |
| 64.0 | 62.0 | 7.5 | -13.5 | 21.0 | 2.0 | 10.50 | 63 | 10.50 |
| 62.0 | 60.0 | 6.1 | -15.2 | 21.3 | 2.0 | 10.65 | 61 | 10.50 |
| 60.0 | 58.0 | 9.2 | -11.5 | 20.7 | 2.0 | 10.35 | 59 | 10.30 |
| 58.0 | 56.0 | 9.9 | -10.1 | 20.0 | 2.0 | 10.00 | 57 | 10.00 |
| 56.0 | 52.0 | 19.0 | -19.7 | 38.7 | 4.0 | 9.68 | 54 | 9.60 |
| 52.0 | 48.0 | 14.6 | -20.0 | 34.6 | 4.0 | 8.65 | 50 | 8.60 |
| 48.0 | 44.0 | 13.5 | -17.0 | 30.5 | 4.0 | 7.63 | 46 | 7.60 |
| 44.0 | 40.0 | 13.3 | -12.0 | 25.3 | 4.0 | 6.33 | 42 | 6.25 |
| 40.0 | 36.0 | 8.8 | -10.8 | 19.6 | 4.0 | 4.90 | 38 | 4.88 |
| 36.0 | 30.0 | 15.0 | -5.7 | 20.7 | 6.0 | 3.45 | 33 | 3.42 |
| 30.0 | 24.0 | 10.8 | -7.1 | 17.9 | 6.0 | 2.98 | 27 | 3.00 |
| 24.0 | 18.0 | 8.0 | -3.9 | 11.9 | 6.0 | 1.98 | 21 | 1.83 |
| 18.0 | 14.0 | 4.5 | -.5 | 5.0 | 4.0 | 1.25 | 16 | 1.25 |
| 14.0 | 0 | 3.7 | -4.0 | 7.7 | 14.0 | .55 | 7 | .57 |

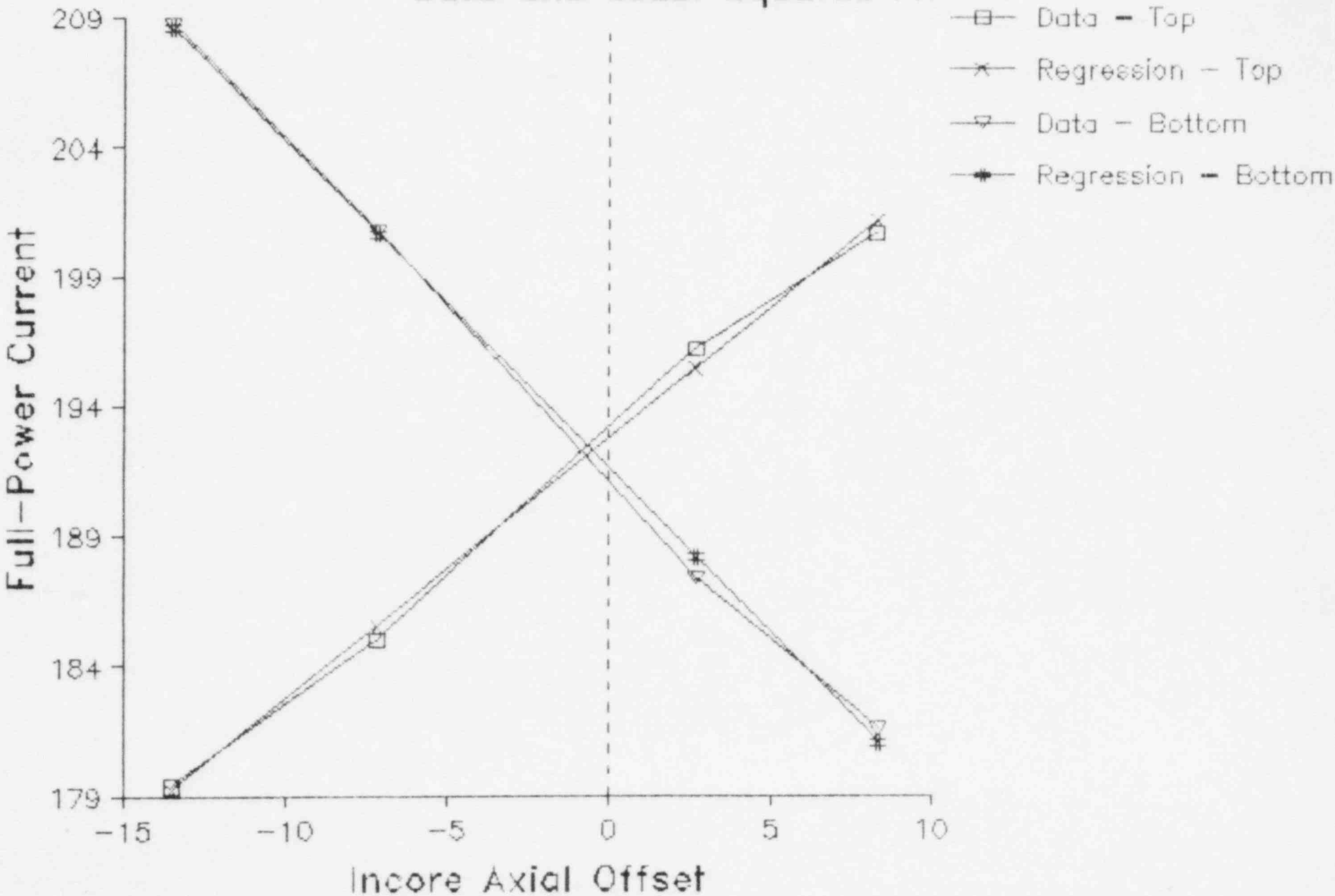
ATTACHMENT 3
GRAPH OF ROD WORTH



ATTACHMENT 4

# FARLEY 1, N41

Data and Least Squares Fit



ATTACHMENT 5

NUCLEAR INSTRUMENT CORRELATION

FARLEY UNIT 1: Inspection Report 348/85-39

Results of Incore-Excore Nuclear Instrument Correlation
Beginning of Cycle 7

FULL POWER
CHAMBER CURRENT = IZ(current at zero offset) + B*[AXIAL OFFSET]

| CHAMBER | IZ LICENSEE | IZ SUPERCALC 3 | IZ uncertainty SUPERCALC 3 | B LICENSEE | B SUPERCALC 3 | B uncertainty SUPERCALC 3 |
|---|---|---|---|---|---|---|
| N41 TOP | 192.811 | 192.690 | 33.000 | .989 | .997 | .184 |
| N41 BOT. | 191.442 | 191.580 | 32.810 | -1.247 | -1.259 | .175 |
| N42 TOP | 188.370 | 188.243 | 36.410 | 1.068 | 1.077 | .204 |
| N42 BOT. | 186.255 | 186.404 | 21.475 | -1.323 | -1.335 | .118 |
| N43 TOP | 188.329 | 188.209 | 29.300 | .995 | 1.003 | .164 |
| N43 BOT. | 200.670 | 200.819 | 39.880 | -1.346 | -1.359 | .203 |
| N44 TOP | 181.742 | 181.620 | 8.715 | 1.036 | 1.046 | .051 |
| N44 BOT. | 187.008 | 187.154 | 42.039 | -1.283 | -1.294 | .229 |

The full-power chamber currents reported here are only about 2/3 that reported at similar facilities. However, the licensee reports no difficulity with system performance as a consequence.