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Re our 3-4-77 ltr...

PLANT NAME: Nine Mile Point Unit No. 1
RJL 11/7/77 (1-P)

ENCLOSURE

"Nine Mile Point Unit 1
Start-up Physics-Test Results-Cycle 5
September 1977"

(29-P)

FOR ACTION/INFORMATION

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NIAGARA MOHAWK POWER CORPORATION

NIAGARA MOHAWK

300 ERIE BOULEVARD, WEST
SYRACUSE, N. Y. 13202

November 2, 1977

Director of Nuclear Reactor Regulation
Attn: Mr. George Lear, Chief
Operating Reactors Branch #3
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63

Dear Mr. Lear:

Your letter of March 4, 1977 requested Niagara Mohawk to submit a summary report of the startup physics tests within 90 days following completion of the Cycle 5 startup test program. The enclosed information addresses your request.

Very truly yours,

NIAGARA MOHAWK POWER CORPORATION

Donald P. Dise
Vice President-Engineering

SWW/szd
Enclosure

NINE MILE POINT UNIT 1

Start-up Physics Test Results - Cycle 5

September 1977

Test Abstracts and Results

The test abstracts, results, and comparisons of measured and predicted responses for the startup physics tests are outlined below.

1.0 Control rod drive scram tests (hot)

2.0 Shut down margin tests.

3.0 Instrumentation calibrations

4.0 Cold Critical comparison with actual measurements.

5.0 Power distribution calculation comparison above 50% power with actual measurements.

1.0 CONTROL ROD DRIVE SCRAM TESTS (hot)

1.1 Control Rod Drive Scram Test Abstract

Following a major refueling outage, it is necessary to verify that the control rods fully insert upon receiving a scram signal within the time interval specified in the Technical Specifications.

The general procedure is to withdraw the control rods in the A sequence to the "black and white" pattern; then alternate between scram-insertion and withdrawal until all the previously withdrawn rods have been scrammed and the remaining rods withdrawn. At this point, the rod pattern will be in the B sequence "black and white"; then alternate between scram-insertion and withdrawal until all rods have been scrammed, and the rod pattern is the A sequence "black and white" again. After analyzing the scram times, the control rods are withdrawn to the specified beginning of cycle pattern.

The control rod time testing shall be considered acceptable if Technical Specification 3.1.1C is met.

1.2 Control Rod Drive Scram Test Results

Table 1.1 contains the results of the control rod drive scram tests (hot). Results of the test are within the values specified by Technical Specification 3.1.1C. (see Table 1.2).

Table 1.1

ROD SCRAM TIMES AFTER JULY 1977 OUTAGE

SECONDS

ROD#	5%	20%	50%	90%
02-19	.32	.72	1.54	2.66
02-23	.33	.76	1.73	2.94
02.27	.33	.71	1.60	2.74
02-31	.33	.76	1.66	2.80
02-35	.34	.76	1.63	2.68
06-15	.34	.80	1.80	3.06
06-19	.34	.78	1.69	2.78
06-23	.34	.77	1.69	2.86
06-27	.34	.78	1.70	2.85
06-31	.33	.82	1.82	3.07
06-35	.33	.79	1.77	2.99
06-39	.34	.78	1.74	3.07
10-11	.35	.84	1.87	3.20
10-15	.35	.82	1.84	3.11
10-19	.32	.72	1.65	2.82
10-23	.32	.72	1.65	2.87
10-27	.37	.91	1.98	3.31
10-31	.35	.84	1.84	3.25
10-35	.32	.81	1.86	3.19
10-39	.35	.81	1.75	2.95
10-43	.33	.76	1.68	2.85
10-07	.36	.79	1.67	2.78
14-11	.37	.82	1.85	3.14
14-15	.35	.75	1.68	3.00
14-19	.39	.93	2.07	3.40
14-23	.36	.90	2.00	3.39
14-27	.35	.85	1.88	3.23
14-31	.33	.74	1.66	2.94
14.35	.34	.77	1.75	2.99
14-39	.34	.78	1.71	2.93
14-43	.34	.79	1.78	3.03
14-47	.34	.71	1.59	2.74
18-03	.36	.71	1.54	2.90
18-07	.34	.80	1.73	2.88
18-11	.35	.73	1.61	2.95
18-15	.39	.87	1.91	3.23
18-19	.37	.85	1.84	3.07
18-23	.35	.80	1.78	3.01
18-27	.35	.75	1.71	3.25
18-31	.34	.80	1.74	2.93
18-35	.36	.88	1.95	3.28
18-39	.37	.85	1.88	3.22
18-43	.34	.81	1.77	3.02
18-47	.34	.78	1.72	2.96
18-51	.36	.75	1.68	3.00
22-03	.32	.74	1.62	2.79
22-07	.36	.84	1.86	3.11
22-11	.32	.75	1.68	2.89
22-15	.34	.75	1.76	3.19
22-19	.35	.83	1.94	3.44
22.23	.34	.72	1.65	3.08
22-27	.35	.78	1.69	2.85

Table 1.1 (Continued)

ROD#	5%	20%	50%	90%
22-31	.35	.82	1.80	3.07
22-35	.37	.82	1.78	2.99
22-39	.33	.77	1.68	2.82
22-43	.33	.77	1.72	2.96
22-47	.33	.74	1.55	2.59
22-51	.35	.81	1.80	3.04
26-03	.31	.76	1.69	2.86
26-07	.34	.79	1.72	2.90
26-11	.33	.74	1.67	2.87
26-15	.36	.83	1.81	3.07
26-19	.39	.88	1.88	3.18
26-23	.34	.80	1.84	3.27
26-27	.36	.84	1.89	3.22
26-31	.33	.71	1.69	2.93
26-35	.36	.87	1.80	3.06
26-39	.33	.79	1.73	2.94
26-43	.34	.82	1.88	3.18
26-47	.35	.86	1.81	3.08
26-51	.31	.79	1.82	3.08
30-03	.35	.81	1.75	2.92
30-07	.35	.80	1.76	2.99
30-11	.34	.82	1.85	3.16
30-15	.37	.83	1.82	3.07
30-19	.38	.87	1.82	3.08
30-23	.34	.77	1.68	2.88
30-27	.37	.91	2.08	3.48
30-31	.37	.89	1.93	3.21
30-35	.36	.86	2.00	3.34
30-39	.36	.74	1.68	3.09
30-43	.35	.80	1.76	2.98
30-47	.30	.72	1.65	2.85
30-51	.35	.79	1.73	2.91
34-03	.31	.73	1.58	2.66
34-07	.31	.71	1.54	2.58
34-11	.32	.74	1.65	2.80
34-15	.36	.87	1.98	3.40
34-19	.35	.83	1.90	3.27
34-23	.36	.81	1.78	3.05
34-27	.37	.88	1.99	3.48
34-31	.39	.93	1.91	3.19
34-35	.36	.76	1.68	3.04
34-39	.37	.80	1.70	2.85
34-43	.31	.74	1.69	2.87
34-47	.32	.75	1.62	2.77
34-51	.32	.75	1.61	2.74
38-07	.31	.78	1.72	2.90
38-11	.36	.80	1.74	2.94
38-15	.35	.76	1.73	3.20
38-19	.34	.81	1.78	3.06
38-23	.36	.86	2.03	3.43
38-27	.36	.80	1.75	2.99
38-31	.30	.77	1.76	3.00

Table 1.1 (Continued)

ROD#	5%	20%	50%	90%
38-35	.36	.81	1.75	2.96
38-39	.33	.78	1.69	2.89
38-43	.35	.75	1.63	2.76
38-47	.30	.72	1.54	2.60
42-11	.31	.77	1.72	2.93
42-15	.36	.82	1.77	2.99
42-19	.37	.86	2.07	3.65
42-23	.35	.78	1.69	2.85
42-27	.37	.86	1.90	3.23
42-31	.33	.72	1.58	2.79
42-35	.36	.85	1.83	3.04
42-39	.36	.81	1.74	2.94
42-43	.30	.76	1.68	2.84
46-15	.29	.72	1.60	2.72
46-19	.35	.78	1.67	2.79
46-23	.32	.79	1.75	3.01
46-27	.36	.83	1.81	3.03
46-31	.35	.84	1.87	3.06
46-35	.36	.80	1.70	2.88
46-39	.28	.69	1.51	2.60
50-19	.32	.76	1.64	2.75
50-23	.34	.77	1.61	2.70
50-27	.31	.74	1.63	2.78
50-31	.35	.80	1.75	2.92
50-35	.33	.77	1.63	2.78
Average	-----	----	-----	-----
	.345	.814	1.78	3.08

Table 1.2

Average Scram Insertion Time Comparisons

% Inserted From Fully Withdrawn	Average Scram Insertion Times (SEC) After July 1977 Outage	Tech Spec Limit
5	0.345	0.375
20	0.814	0.90
50	1.78	2.00
90	3.08	5.00

2.0 SHUTDOWN MARGIN TEST

2.1 Shutdown Margin Test Abstract

The purpose of this test is to demonstrate that the reactor can be made subcritical with a shutdown margin of 0.25% k at any time in the subsequent cycle with the strongest operable control rod fully withdrawn.

With the core at its most reactive condition, cold and xenon-free the analytically strongest control rod is fully withdrawn from the core. A second control rod is then withdrawn to a position which results in an amount of reactivity at least equal to the required margin.

The shutdown margin test shall be considered acceptable if the reactor has remained subcritical throughout the test.

2.2 Shutdown Margin Test Results

Figure 2.1 summarizes the results of the Shutdown Margin Test. Control rod 18-27, shown analytically to be the strongest, was fully withdrawn from the core. Control rod 14-31 was then withdrawn to position 08 which analytically resulted in an insertion of approximately .8% delta K. As shown on Figure 2.1 the reactor remained subcritical throughout the test. Results of the test are within the criteria specified in the Technical Specification.

FIGURE 2.1

REACTIVITY MARGIN - CORE LOADING

Procedure:

1. All Rods In

SRM	11	12	13	14
Readings	43	35	29	17

2. Rod CR1 18-27 selected

3. Rod CR1 18-27 position 48

4. Reactor Subcritical

SRM	11	12	13	14
Readings	44	50	30	20

5. Rod CR2 14-31 Selected

6. Rod CR2 to position 08.

7. Reactor Subcritical

SRM	11	12	13	14
Readings	45	58	32	19

3.0 Instrumentation Calibration Test

3.1 Instrumentation Calibration Test Abstract

The purpose of this test is to calibrate the Local Power Range Monitoring (LPRM) System.

The LPRM System is a spatial array of in-core fission chambers used to monitor the in-core neutron flux. In the process computer formulation, each chamber signal is calibrated to produce a meter reading which is proportional to the neutron flux in the water gap at the axial elevation of the chamber.

The calibration procedure consists of data taking, calculations and amplifier adjustments. A set of LPRM readings and Transverse In-Core Probe (TIP) traces are recorded. The process computer is used to determine the correct readings that the LPRM's should have read based on the TIP traces. The individual amplifier input calibration currents required to produce a selected standard meter reading on each LPRM meter are recorded. These input currents are divided by the ratio of the calculated-to-observed LPRM readings (Gain Adjustment Factors-GAF). These new input calibration currents are then applied and the amplifier gains adjusted to produce the selected standard meter readings, thereby calibrating the LPRM's.

3.2 Instrumentation Calibration Test Results

Figure 3.1 contains the LPRM Instrument Calibration Results for an instrumentation calibration performed at a power level of 98% of rated.

FIGURE 3.1

LPRM INSTRUMENTATION CALIBRATION RESULTS

LPRM PROBE	AS FOUND INPUT CURRENT	G.A.F.	REQUIRED INPUT CURRENT 105%
28-41C	512	.87	588
36-33C	880	1.05	838
36-49C	855	1.00	Same
44-41C	851	.99	859
28-41A	720	1.78	395
36-33A	842	1.05	801
36-49A	994	1.01	984
44-41A	943	.99	952
36-41C	1100	1.08	1018
28-49C	1010	1.06	952
44-33C	515	1.11	463
28-33C	970	1.08	898
36-41A	874	1.11	787
28-49A	No Detector Input		
44-33A	807	1.05	768
28-33A	783	.68	1151
36-17C	970	1.04	932
44-25C	815	1.06	768
28-09C	630	.96	656
28-25C	903	1.09	828
36-17A	970	1.09	890
44-25A	473	1.08	438
28-09A	752	1.05	716
28-25A	890	1.10	809
28-17C	949	1.06	895
36-09C	1060	.97	1092
36-25C	656	1.00	Same
44-17C	970	1.01	960
28-17A	927	1.09	850
36-09A	750	1.03	728
36-25A	536	1.11	482
44-17A	823	1.00	Same
12-33D	930	1.03	902
20-41D	894	1.00	Same
12-33B	983	1.00	Same
20-41B	307	1.17	262
12-41D	1120	.35	1160
04-33D	1483	1.05	1412
20-49D	1240	.96	1292
20-33D	1160	1.18	983
12-41B	1060	1.03	1029
04-33B	857	1.05	816

FIGURE 3.1 (Continued)

LPRM INSTRUMENTATION CALIBRATION RESULTS

LPRM PROBE	AS FOUND INPUT CURRENT	G.A.F.	REQUIRED INPUT CURRENT 105%
20-49B	859	1.00	Same
20-33B	887	1.01	878
12-17D	1410	1.09	1293
20-09D	1200	1.08	1111
04-25D	1290	1.03	1252
20-25D	1123	1.13	993
12-17B	1031	1.05	981
20-09B	791	1.02	775
04-25B	1000	1.05	952
20-25B	1018	1.08	942
04-17D	1110	.95	1168
12-09D	1052	.99	1063
12-25D	1020	1.02	1000
20-17D	941	1.04	905
04-17B	1010	1.13	971
12-09B	930	1.04	894
12-25B	980	.95	1031
20-17B	685	.99	691
12-33A	No Detector Input		
20-41A	870	1.03	844
12-33C	676	1.01	669
20-41C	820	1.02	803
12-41A	840	0.00	712
04-33A	944	1.06	890
20-49A	743	1.02	728
20-33A	738	1.09	677
12-41C	1150	1.01	1138
04-33C	1095	0.00	755
20-49C	580	1.03	563
20-33C	830	1.20	691
12-17A	910	1.04	875
20-09A	733	1.18	621
04-25A	No Detector Input		
20-25A	555	1.06	523
12-17C	1000	1.05	952
20-09C	823	1.12	734
04-25C	1030	1.08	953
20-25C	970	1.07	906
04-17A	753	.96	784
12-09A	1061	.99	1071
12-25A	413	1.05	393

FIGURE 3.1 (Continued)

LPRM INSTRUMENTATION CALIBRATION RESULTS

LPRM PROBE	AS FOUND INPUT CURRENT	G.A.F.	REQUIRED INPUT CURRENT 105%
20-17A	694	1.01	687
04-17C	990	.97	1020
12-09C	970	1.02	950
12-25C	725	1.11	653
20-17C	900	1.02	882
28-41B	760	1.01	752
36-33B	870	1.03	844
36-49B	926	1.04	890
44-41B	800	1.01	792
28-41D	557	1.05	530
36-33D	1050	1.06	990
36-49D	1000	1.03	970
44-41D	1108	.98	1130
36-41B	1090	1.07	1019
28-49B	904	1.01	895
44-33B	1010	1.05	962
28-33B	1230	1.80	683
36-41D	1300	1.09	1193
28-49D	1460	1.02	1431
44-33D	1420	1.30	1092
28-33D	1250	1.09	1147
36-17B	1008	1.09	925
44-25B	740	1.03	718
28-09B	741	1.00	Same
28-25B	970	1.07	906
36-17D	1300	1.09	1193
44-25D	710	1.04	683
28-09D	1540	1.22	1262
28-25D	1256	1.11	1131
28-17B	1042	1.10	947
36-09B	800	1.04	769
36-25B	680	1.02	666
44-17B	275	0.00	238
28-17D	1100	1.06	1037
36-09D	1143	1.03	1109
36-25D	995	1.13	880
44-17D	1120	.99	1131

No Detector Input - No signal is received from the LPRM. This could be caused by faulty connections or failed detectors.

4.0 Cold Critical Comparison

4.1 Cold Critical Comparison Test Abstract

The cold critical control rod pattern was analytically derived as shown on Figure 4.1. Control rod withdrawals to target control rod inventory were compared to the analytically derived pattern.

4.2 Cold Critical Comparison Test Results

Figure 4.2 contains the actual cold critical control rod pattern. The difference between the observed and predicted control rod inventories is less than one percent in reactivity.

COLD CRITICAL CONTROL ROD PATTERN

X = POSITION 48

	2	6	10	14	18	22	26	30	34	38	42	46	50
51						X							
47													
43						X		X		X			
39													
35		X		X				X		X			
31													
27		X				X		X				X	
23													
19				X		X				X		X	
15													
11				X		X		X					
7													
3								X					

FIGURE 4.1

	2	6	10	14	18	22	26	30	34	38	42	46	50
51						X		X					
47													
43				X		X		X		X			
39													
35		X		X				X		X		X	
31													
27		X		X		X		X		X		X	
23													
19		X		X		X		16		X		X	
15													
11				X		X		X		X			
7													
3						X		X					

FIGURE 4.2

5.0 Power Distribution Comparison

5.1 Power Distribution Comparison Test Abstract

The power distribution in the core is monitored by the process computer. Off line predictive Models are used to develop a power distribution corresponding to specific plant operating conditions.

5.2 Power Distribution Comparison Test Results

The power distribution comparison test was performed under the core operating conditions shown on Figure 5.1. Comparisons of the actual to predicted core axial power distribution is shown on Figure 5.2. Comparisons of the actual to predicted core average radial power distribution is shown on Figure 5.3.

Date	August 31, 1977
Core Power Level	1830 MWt (98.9%)
Core Flow Rate	66.4 Mlb/hr. (98.4%)
Pressure	1035 PSIA
Subcooling	22.9 Btu/Lb.

CONTROL ROD PATTERN
NOTCHES WITHDRAWN
BLANK = 48 = FULL OUT

	2	6	10	14	18	22	26	30	34	38	42	46	50
51													
47						22		22					
43					38				38				
39				4		14		14		4			
35			34				34				34		
31		22		14		6		6		14		22	
27			34								34		
23		22		14		6		6		14		22	
19			34				34				34		
15				4		14		14		4			
11					38				38				
7						22		22					
3													

Figure 5.1 NINE MILE POINT UNIT 1 OPERATING CONDITIONS FOR BEGINNING OF CYCLE 5 COMPARISONS

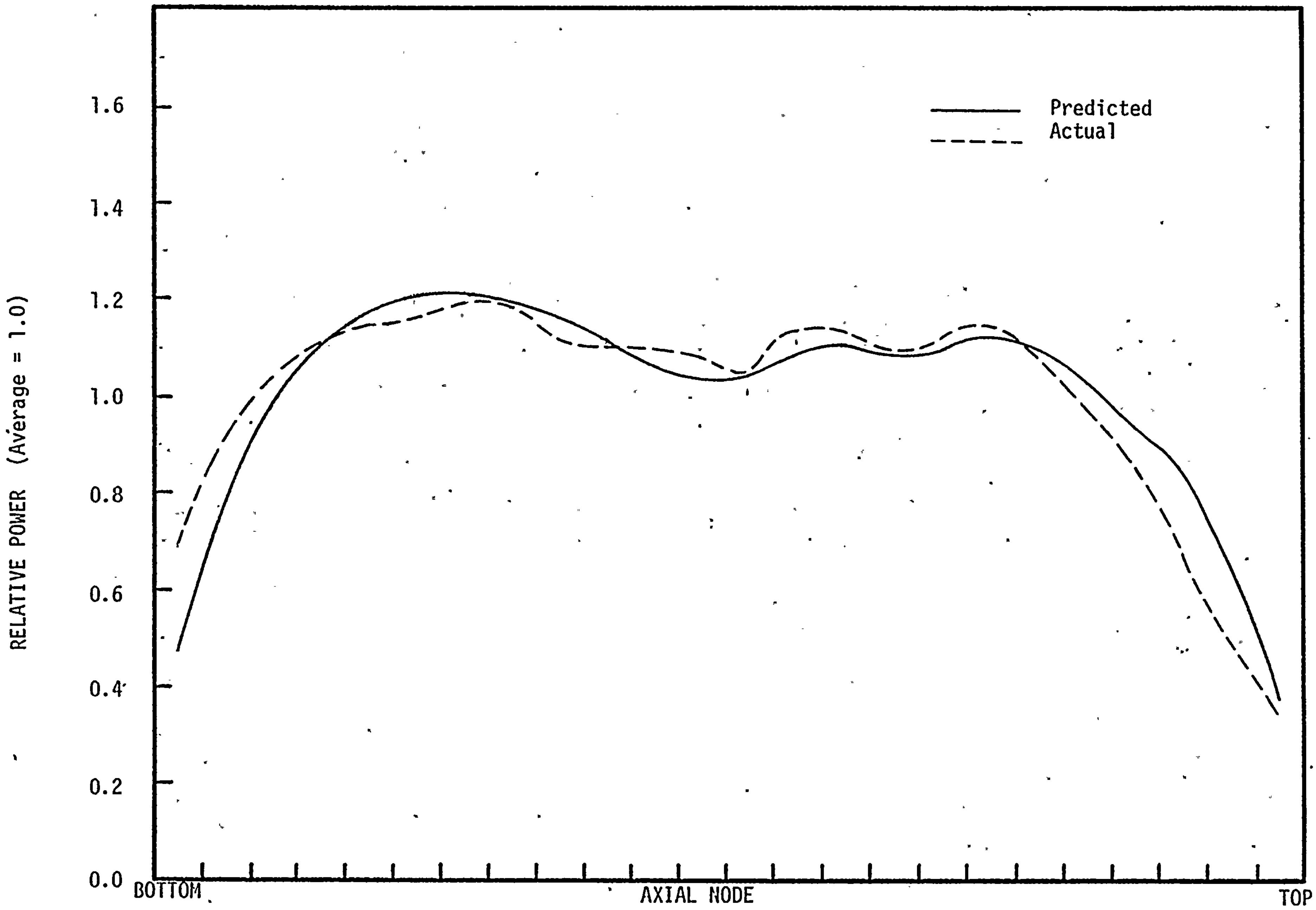

FIGURE 5.2. Core Average Axial Power Distribution Comparisons for Nine Mile Point Unit 1, August 31, 1977

Figure 5.3

CORE AVERAGE RADIAL POWER DISTRIBUTION

	Ring	Actual	Predicted
Center	1	1.012	1.002
	2	0.927	0.922
	3	1.123	1.084
	4	1.082	1.072
	5	1.104	1.127
	6	1.043	1.056
Edge	7	0.824	0.816

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