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Shearon Harris Nuclear Power Plant (HNP), Unit 1
Docket No. 50-400/Renewed License No. NPF-63

Subject: Cycle 20 Startup Test Report

Ladies and Gentlemen:

In accordance with Technical Specification 6.9.1.1, Duke Energy Progress, Inc. (Duke Energy) submits the enclosed Cycle 20 Startup Test Report for the Shearon Harris Nuclear Plant, Unit 1. The report is required following installation of fuel that has a different design or has been manufactured by a different fuel supplier.

This document contains no regulatory commitments.

Please refer any questions regarding this submittal to John Caves at (919) 362-2406.

Sincerely,

H. Duncan Brewer

Enclosure: Cycle 20 Startup Test Report

cc: Mr. J. D. Austin, NRC Sr. Resident Inspector, HNP
Ms. M. Barillas, NRC Project Manager, HNP
Mr. V. M. McCree, NRC Regional Administrator, Region II

HNP-15-065

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT NO. 1
DOCKET NO. 50-400 / RENEWED LICENSE NO. NPF-63

Enclosure

Cycle 20 Startup Test Report
(30 pages including cover)

Harris Nuclear Plant Unit 1, Cycle 20

Startup Test Report

July 30, 2015

DUKE ENERGY PROGRESS, INC.

EXECUTIVE SUMMARY

The Harris Technical Specifications Section 6.9 (Reporting Requirements) provides the following guidance for conditions specifically requiring a startup report and items that should be addressed in the startup report.

STARTUP REPORT

Section 6.9.1.1: A summary report of plant startup and power escalation testing shall be submitted following: (1) receipt of an Operating License, (2) amendment to the license involving a planned increase in power level, (3) installation of fuel that has a different design or has been manufactured by a different fuel supplier, and (4) modifications that may have significantly altered the nuclear, thermal, or hydraulic performance of the unit.

The Startup Report shall address each of the tests identified in the Final Safety Analysis Report and shall include a description of the measured values of the operating conditions or characteristics obtained during the test program and a comparison of these values with design predictions and specifications. Any corrective actions that were required to obtain satisfactory operation shall also be described. Any additional specific details required in license conditions based on other commitments shall be included in this report.

Startup Reports shall be submitted within: (1) 90 days following completion of the Startup Test Program, (2) 90 days following resumption or commencement of commercial power operation, or (3) 9 months following initial criticality, whichever is earliest. If the Startup Report does not cover all three events (i.e., initial criticality, completion of Startup Test Program, and resumption or commencement of commercial operation), supplementary reports shall be submitted at least every 3 months until all three events have been completed.

The scope of this report was generated by reviewing the tests described in FSAR Chapter 14 and determining the impact of a Lead Test Assembly (LTA) program, which installs fuel that has a different design, on these tests. The results of this review are addressed in Table 4.6.3 and covers the startup test program associated with the implementation of LTA program.

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1.0 Introduction

1.1 General

This startup report documents test results for Harris Nuclear Plant Unit 1, Cycle 20 and the introduction of a Lead Test Assembly (LTA) program featuring fuel of a different design. EC 95161 (Reference 5.1) implements the Cycle 20 core design, which contains 8 LTAs of the AREVA GAIA mechanical design. An evaluation was performed in EC 98982 (Reference 5.2) to validate that receipt, storage, and handling of the GAIA LTAs are acceptable with current site equipment and procedures.

The GAIA fuel design is similar to the resident AREVA Advanced HTP (High Thermal Performance) fuel design in form, function, and material. However, the GAIA LTA is differentiated from the AREVA Advanced HTP assembly by several key design features:

- The GAIA structural spacer grids feature a new mixing vane design for improved thermal hydraulic performance. Fuel rod stability is based upon the HTP spacer grid spring line contact with springs located at the four corners of each cell. The grids are fabricated with the M5 alloy, which has been used as cladding material for two previous HNP fuel regions.
- The GAIA assembly contains three Intermediate GAIA Mixers (IGMs) based on a proven mid span mixing grid design to further augment thermal hydraulic performance. The IGMs are also fabricated with the M5 alloy.
- The GAIA assembly features the GRIP™ bottom nozzle assembly for maximum filtering efficiency and serviceability, as well as a reconstitutable top nozzle, which is typical of the nozzles used on Advanced HTP 17x17 fuel. The GRIP™ bottom nozzle is a combination of AREVA FUELGUARD technology, used in the current HTP product, and TRAPPER technology, which provides a low Δp.
- The GAIA guide and instrumentation tubes are fabricated from the Q12™ quaternary alloy. This alloy is a variation on the M5 alloy, differing primarily by the presence of small quantities of tin and iron in Q12™. The tin improves resistance to thermal creep, and iron is key to maintaining excellent corrosion performance.
- Small differences in the fuel pellet, fuel rod, fuel assembly, and guide/instrument tube dimensions.

This report primarily focuses on the results of the following evolutions:

- Component & Initial Operation Tests
- Operational and Power Ascension Tests

These evolutions were modeled after those described in Chapter 14 of the Harris FSAR. The evolutions were modified to eliminate testing that is no longer appropriate. Examples of tests that were judged to be inappropriate include low power flux mapping and boron worth measurements. In the cases of boron worth measurement alternate testing described in ANSI 19.6.1 (Reference 5.3) was performed. Plant power ascension data demonstrates that HNP core monitoring systems can safely and accurately measure core behavior following implementation of the LTA program.

1.2 Cycle Description

The Cycle 20 core consists of 56 fresh AREVA (Advanced HTP) assemblies, along with 93 previously irradiated HTP assemblies. Additionally, Cycle 20 introduces 8 fresh LTAs, all of the AREVA GAIA mechanical design. The specifics for the core reload design are presented in the Engineering Change package for the Cycle 20 reload (Reference 5.1).

The Cycle 20 full core loading pattern (Reference 5.15) is shown in Figure 1.2.1, with the GAIA LTAs displayed by fresh fuel index ZA7. The GAIA LTAs are incorporated into the core loading pattern such that they remain non-limiting with regard to power production and peaking during normal operation and transients. Additionally, the GAIA LTAs were restricted from core locations in which Rod Cluster Control Assemblies (RCCAs) are also located.

2.0 Summary

Safe operation with the LTAs is supported by evaluation of the core loading pattern such that it will operate safely within the bounds defined in Technical Specifications, and that installed safety systems and procedures remain effective at mitigating the consequences of events and accidents described in Chapter 15 of the FSAR. The reload safety evaluation, as documented by the reload Engineering Change package (Reference 5.1), validates safe operation of the Cycle 20 loading pattern and, by extension, the LTAs within the loading pattern.

Monitoring the various core parameters and responses during low power physics testing and power ascension verified there were no unanticipated changes in reactor physics or power distribution with respect to the designed core, that the core can operate within design limits, and that systems available for reactivity control and core monitoring are not impacted.

3.0 Component & Initial Operation Test Summaries

3.1 Fuel Handling Equipment System Test

EC 98982 (Reference 5.2) contains an evaluation validating that receipt, storage, and handling of the GAIA LTAs is acceptable with current site equipment and procedures. The LTA fuel assembly to handling tool/gripper interfaces were verified to be acceptable, dimensionally, and a functional test with the new-fuel tool and a GAIA top nozzle was completed prior to manufacture and shipment.

Movement of the GAIA LTAs to the reactor vessel during the refueling outage was completed without issues.

4.0 Operational and Power Ascension Test Summaries

4.1 Reactor Coolant System Flow Measurement Test

The GAIA LTAs were evaluated in Reference 5.1 with respect to influence on core pressure drop, and were not expected to impact RCS flow significantly. Reactor coolant system flow was measured using EST-709 (Reference 5.5). The HNP accident analyses are based on the most limiting RCS flow values (minimum or maximum). The Cycle 20 measured EST-709 flow is bounded by the various accident analysis values. The corresponding description and numerical values are as follows:

RCS Flow Description	Flow (gpm)
Thermal Design (low)	277,800
Technical Specification Minimum[1]	299,998[2]
Cycle 20 Measured Flow per EST-709	302,827
Mechanical Design Flow Limit	314,231[2]

1 293,540 x 1.022, where 1.022 is the RCS flow rate measurement uncertainty (2.1%) plus a penalty of 0.1% for minor undetected fouling of feedwater venturi.
2 EST-709(Reference 5.5).

4.2 Calibration of Nuclear Instrumentation Test

The Intermediate Range (IR) and Power Range (PR) detectors were adjusted prior to initial Cycle 20 startup per procedure EPT-008 [Reference 5.7]. The adjustments account for changes in instrumentation response due to changes in loading pattern design and core leakage from the previous cycle (19) to the new cycle (20). The methodology and calculations to determine the adjustment factor (also referred to as the "R-factor") and any calculation biases are detailed in calculation HNP-F/NFSA-0252 [Reference 5.8]. The GAIA LTAs are modeled explicitly in the physics code used to model the core power distribution, and therefore, any impact to the calibration is implicit in the supplied adjustment factors.

The Cycle 20 predicted Intermediate Range setpoints for the N35 and N36 detectors are compared to the actual calibrated IR setpoint installed for Cycle 19 by procedure EPT-009 [Reference 5.6]. This data is included in Table 4.2.1.

The Cycle 20 Power Range (PR) R-factor is applied to the N41, N42, N43, and N44 top and bottom HFP normalized detector currents from the last incore/excore calibration performed in Cycle 19 using procedure EST-911 [Reference 5.9]. This data is included in Table 4.2.2.

4.3 Flux Distribution Measurement Test

Testing of the Movable Incore Detector System was effectively accomplished by exercising the system for performance of core flux mapping and power distribution measurement.

Core power distributions for Cycle 20 are measured by processing moveable detector traces with the INPAX-W code, which is a module of the POWERTRAX core monitoring system. The INPAX-W code uses the physics code PRISM to supply calculated reaction rates, assembly power distributions, and local peaking factors. The GAIA LTAs are modeled explicitly in PRISM, allowing for best-estimate calculated reaction rates for signal-to-power conversion in INPAX-W.

Power distribution maps for the power ascension flux maps are included as Figures 4.3.1 through 4.3.3. It should be noted that the GAIA LTAs are in the following core locations, per the core loading pattern shown in Figure 1.2.1:

- F-13, C-10, C-06, F-03, K-03, N-06, N-10, K-13

Two of these locations (F-13 and N-10) are directly measurable by the Movable Incore Detector system.

The initial low power flux map is taken near 30% power to verify core loading is as designed. Map 521 was taken immediately after stabilizing power near 30% (before equilibrium xenon was established) for core verification. The maximum difference between measured and calculated powers was -5.9% (location R08), as shown in Figure 4.3.1.

Map 523 taken near 100% power exhibited a limiting assembly (location D07) enthalpy rise hot channel factor ($F_{\Delta H}$) of 1.536, including uncertainties, or 0.925 fraction of limit. The following flux maps passed acceptance criteria contained in FMP-200 (Reference 5.10).

- Map 521 @ 30% (verifying that the core was loaded as designed)
- Map 522 @ 75%
- Map 523 @ 100%

The Core Operating Limits Report (COLR, PLP-106) [Reference 5.11] requires a minimum of 38 measured traces for all flux maps.

4.4 Core Performance Test

The flux maps following core loading verification are taken to verify compliance with Technical Specification requirements and limits on hot channel factors, quadrant power tilts, and to establish allowed power levels for successive power ascension. The following flux maps were taken near 75% and 100% power, respectively.

- Map 522 @ 75%
- Map 523 @ 100%

All flux maps allowed full power operation with no additional intermediate power level maps other than those required per PLP-626 [Reference 5.12]. Table 4.4.1 includes pertinent statistics for evaluating map quality and monitoring of required core parameters.

The flux maps allowed power ascension and then full power operation based on meeting the applicable acceptance criteria.

4.5 Power Coefficient Measurement Test

The RMAS reactivity computer is set up before LPPT using procedure EPT-026 [Reference 5.13]. Comparing period measurements to the startup rate indicated by the computer performed following initial criticality performs a checkout of the reactivity computer. The six-group constants input into the reactivity computer were provided by AREVA and are listed in Table 4.5.1.

The reactivity computer checkout requires that the average absolute difference between indicated and theoretical reactivity for the positive period measurements is less than 5%. Results of the reactivity computer checkout are included in Table 4.5.1.

The isothermal temperature coefficient (ITC) is measured at All Rods Out (ARO), HZP to verify that Technical Specification requirements limiting the ARO moderator temperature coefficient (MTC) to less than or equal to +5 pcm/^{o}F. Should the MTC exceed the acceptance criteria, rod withdrawal limits for startup and power ascension must be established. The MTC is derived from the measured ITC using the equation below, where the doppler temperature coefficient (DTC) is accounted for as a calculated predicted value.

$$ITC = MTC + DTC$$

Low Power Physics Testing (LPPT) is performed under a single test procedure (EST-923) (Reference 5.14). EST-923 covers:

- Initial criticality
- Reactivity computer period checks
- Test band determination (point of adding heat determination)
- ARO boron endpoint

- Temperature coefficient determination
- Control rod bank worth measurements (rod swap)

Results for Cycle 20 LPPT and the corresponding acceptance criteria are listed in Table 4.5.2. Table 4.5.2 also contains test results from sections 4.6 and 4.7.

4.6 Control Rod Reactivity Worth Test

The worths of the control and shutdown banks are measured using the rod swap technique. The reference bank (for Cycle 20, control bank B) was measured via boron dilution. The remaining banks were measured fully inserted in the presence of the reference bank in a critical configuration.

The review criteria for the rod worths are as follows:

1 The absolute value of the percent difference between measured and predicted integral worth of the reference bank is less than 10%.
2 For all banks other than the reference bank, the absolute value of the percent difference between measured and predicted worths is less than 15% or the absolute value of the reactivity difference between measured and predicted worths is less than 100 pcm, whichever is greater.

The acceptance criterion requires that the sum of the measured worths be between 90% and 110% of the sum of the predicted worths.

Results for Cycle 20 LPPT and the corresponding acceptance criteria are listed in Table 4.5.2. Figures 4.6.1 and 4.6.2 graphically compare the predicted and measured integral and differential rod worths for the reference bank.

4.7 Boron Endpoint Measurement All Rods Out Test

The boron endpoint is measured at the Hot Zero Power (HZP), All Rods Out (ARO) condition. The acceptance criterion for the boron endpoint measurement requires the HZP, ARO endpoint to be within 50 ppm of the predicted value.

Results for Cycle 20 Low Power Physics Testing (LPPT) and the corresponding acceptance criteria are listed in Table 4.5.2.

5.0 References

5.1 EC 95161, Revision 1, “HNP Cycle 20 Core Design and Safety Analysis.”

5.2 EC 98982, Revision 0, “GAIA Lead Assembly Fuel Receipt (H1C20).”

5.3 ANSI 19.6.1 "Reload Startup Physics Test for Pressurized Water Reactors."

5.4 NOT USED

5.5 EST-709 "Reactor Coolant System Flow Determination By Calorimetric."

5.6 EPT-009 “Intermediate Range Detector Setpoint Verification.”

5.7 EPT-008 "Intermediate and Power Range Detector Setpoint Determination."

5.8 HNP-F/NFSA-0252, “HNP Cycle 20 BOC NI Adjustment.”

5.9 EST-911 "Incore/Excore Detector Calibration Using POWERTRAX.”

5.10 FMP-200 "Full Core Flux Map Review Checklist (POWERTRAX Version)."

5.11 PLP-106 "Technical Specification Equipment List Program and Core Operating Limits Report."

5.12 PLP-626, “Power Ascension Testing After a Refueling Outage.”

5.13 EPT-026 "RMAS Setup and Operation."

5.14 EST-923 "Initial Criticality and Low Power Physics Testing."

5.15 HNP-F/NFSA-0243, “HNP Cycle 20 Loading Pattern and Core Models.”

5.16 POWERTRAX (HNP Cycle 20)

Figure 1.2.1
Harris Cycle 20 Full Core Loading Pattern

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
1							Y12 F-14 ---	Y62 D-12 ---	Y13 K-14 ---							1
2					Y65 J-13 ---	Z27 F-05 ---	ZA44 ---- ZA5	ZA38 ---- ZA5	ZA43 ---- ZA5	Z24 K-05 ---	Y72 G-13 ---					2
3				Y25 D-13 ---	ZA52 ---- ZA6	ZA60 ---- ZA7	Z39 B-07 ---	Z62 H-14 ---	Z44 P-07 ---	ZA59 ---- ZA7	ZA51 ---- ZA6	Y32 M-13 ---				3
4			Y26 C-12 ---	Z46 E-13 ---	ZA32 ---- ZA4	Z54 F-13 ---	ZA24 ---- ZA3	Z18 D-09 ---	ZA23 ---- ZA3	Z61 K-13 ---	ZA31 ---- ZA4	Z49 N-11 ---	Y31 N-12 ---			4
5		Y66 C-07 ---	ZA53 ---- ZA6	ZA33 ---- ZA4	Z16 J-04 ---	ZA16 ---- ZA3	Z09 J-10 ---	ZA02 ---- ZA1	Z02 G-10 ---	ZA15 ---- ZA3	Z15 D-07 ---	ZA30 ---- ZA4	ZA50 ---- ZA6	Y71 N-07 ---		5
6		Z25 L-10 ---	ZA61 ---- ZA7	Z58 C-10 ---	ZA17 ---- ZA3	Z13 L-08 ---	ZA08 ---- ZA2	Z34 D-11 ---	ZA07 ---- ZA2	Z12 H-05 ---	ZA14 ---- ZA3	Z57 N-10 ---	ZA58 ---- ZA7	Z26 E-10 ---		6
7	Y15 B-10 ---	ZA45 ---- ZA5	Z45 J-14 ---	ZA25 ---- ZA3	Z03 F-07 ---	ZA09 ---- ZA2	Z52 N-05 ---	Z31 D-05 ---	Z51 E-03 ---	ZA06 ---- ZA2	Z08 K-07 ---	ZA22 ---- ZA3	Z38 G-14 ---	ZA42 ---- ZA5	Y10 P-10 ---	7
8	Y64 D-04 ---	ZA39 ---- ZA5	Z63 B-08 ---	Z19 G-04 ---	ZA03 ---- ZA1	Z35 E-04 ---	Z32 L-04 ---	Z01 H-08 ---	Z30 E-12 ---	Z37 L-12 ---	ZA01 ---- ZA1	Z21 J-12 ---	Z65 P-08 ---	ZA37 ---- ZA5	Y60 M-12 ---	8
9	Y14 B-06 ---	ZA46 ---- ZA5	Z40 J-02 ---	ZA26 ---- ZA3	Z06 F-09 ---	ZA10 ---- ZA2	Z53 L-13 ---	Z33 M-11 ---	Z50 C-11 ---	ZA05 ---- ZA2	Z05 K-09 ---	ZA21 ---- ZA3	Z43 G-02 ---	ZA41 ---- ZA5	Y11 P-06 ---	9
10		Z28 L-06 ---	ZA62 ---- ZA7	Z55 C-06 ---	ZA18 ---- ZA3	Z10 H-11 ---	ZA11 ---- ZA2	Z36 M-05 ---	ZA12 ---- ZA2	Z11 E-08 ---	ZA13 ---- ZA3	Z60 N-06 ---	ZA57 ---- ZA7	Z23 E-06 ---		10
11		Y67 C-09 ---	ZA54 ---- ZA6	ZA34 ---- ZA4	Z17 M-09 ---	ZA19 ---- ZA3	Z04 J-06 ---	ZA04 ---- ZA1	Z07 G-06 ---	ZA20 ---- ZA3	Z14 G-12 ---	ZA29 ---- ZA4	ZA49 ---- ZA6	Y70 N-09 ---		11
12			Y27 C-04 ---	Z47 C-05 ---	ZA35 ---- ZA4	Z59 F-03 ---	ZA27 ---- ZA3	Z20 M-07 ---	ZA28 ---- ZA3	Z56 K-03 ---	ZA36 ---- ZA4	Z48 L-03 ---	Y30 N-04 ---			12
13				Y28 D-03 ---	ZA55 ---- ZA6	ZA63 ---- ZA7	Z42 B-09 ---	Z64 H-02 ---	Z41 P-09 ---	ZA64 ---- ZA7	ZA56 ---- ZA6	Y29 M-03 ---				13
14					Y68 J-03 ---	Z22 F-11 ---	ZA47 ---- ZA5	ZA40 ---- ZA5	ZA48 ---- ZA5	Z29 K-11 ---	Y69 G-03 ---					14
15							Y09 F-02 ---	Y58 M-04 ---	Y16 K-02 ---							15
	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	

Serial Number
Previous Core Location
Fresh Fuel Index

Fresh Fuel Index	Number of Assemblies	Bundle Serial Numbers	Fuel Type	Description	
ZA1	4	ZA01 - ZA04	HTP	4.70 CZE	24 pins at 8 w/o Gd2O3 + 4 pins at 2 w/o Gd2O3
ZA2	8	ZA05 - ZA12	HTP	4.70 CZE	20 pins at 8 w/o Gd2O3 + 8 pins at 2 w/o Gd2O3
ZA3	16	ZA13 - ZA28	HTP	4.70 CZE	20 pins at 8 w/o Gd2O3 + 4 pins at 2 w/o Gd2O3
ZA4	8	ZA29 - ZA36	HTP	4.95 CZE	16 pins at 8 w/o Gd2O3 + 8 pins at 4 w/o Gd2O3
ZA5	12	ZA37 - ZA48	HTP	4.95 CZE	16 pins at 4 w/o Gd2O3
ZA6	8	ZA49 - ZA56	HTP	4.95 CZE	4 pins at 4 w/o Gd2O3
ZA7	8	ZA57 - ZA64	GAIA LTA	4.45 CZE	4 pins at 8 w/o Gd2O3 + 16 pins at 6 w/o Gd2O3

Table 4.2.1
Intermediate Range Detector Setpoint Determination

Cycle	Conditions	N35		N36	
		Trip	Rod Stop[1]	Trip	Rod Stop[1]
19	Installed (EPT-009)	8.420E-05	6.736E-05	6.990E-05	5.592E-05
20	Predicted (initial startup) (EPT-008)	8.471E-05	6.777E-05	7.947E-05	6.358E-05

1 Rod Stop setpoints are 80% of the trip values, per EPT-008.

Table 4.2.2
Power Range Detector Calibration Values

PR Detector		Cycle 19 Currents[1]	Cycle 20 Currents[2]
N41	Top	177.2	148.9
	Bottom	194.5	163.5
N42	Top	190.3	159.9
	Bottom	214.7	180.4
N43	Top	215.4	181.0
	Bottom	234.1	196.7
N44	Top	174.8	146.9
	Bottom	205.2	172.5

1 Power Range data taken from applicable performance of EST-911. (Reference 5.9).
2 Power Range data taken from Cycle 20 performance of EPT-008. (Reference 5.7).

Figure 4.3.1
Flux Map 521 Measured vs. Calculated Powers (30%)

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
							0.253	0.321	0.253						
01							0.252	0.323	0.252						
							0.4	-0.6	0.4						
					0.326	0.604	0.988	0.997	0.989	0.610	0.330				
02					0.327	0.604	0.983	0.988	0.983	0.605	0.329				
					-0.3	0.0	0.5	0.9	0.6	0.8	0.3				
				0.408	1.188	1.190	1.304	1.315	1.298	1.193	1.197	0.420			
03				0.408	1.192	1.190	1.296	1.305	1.296	1.191	1.195	0.411			
				0.0	-0.3	0.0	0.6	0.8	0.2	0.2	0.2	2.1			
			0.408	0.941	1.280	1.294	1.313	1.213	1.319	1.298	1.285	0.957	0.413		
04			0.410	0.947	1.283	1.304	1.320	1.221	1.322	1.304	1.285	0.948	0.408		
			-0.5	-0.6	-0.2	-0.8	-0.5	-0.7	-0.2	-0.5	0.0	0.9	1.2		
		0.327	1.191	1.272	1.158	1.228	1.122	1.164	1.142	1.240	1.176	1.305	1.210	0.334	
05		0.328	1.194	1.284	1.186	1.245	1.146	1.173	1.147	1.245	1.187	1.284	1.193	0.328	
		-0.3	-0.3	-0.9	-2.4	-1.4	-2.1	-0.8	-0.4	-0.4	-0.9	1.6	1.4	1.8	
		0.599	1.182	1.290	1.232	0.973	1.138	1.112	1.150	0.977	1.251	1.322	1.212	0.616	
06		0.604	1.190	1.303	1.244	0.978	1.144	1.118	1.149	0.978	1.245	1.304	1.191	0.605	
		-0.8	-0.7	-1.0	-1.0	-0.5	-0.5	-0.5	0.1	-0.1	0.5	1.4	1.7	1.8	
	0.247	0.974	1.284	1.310	1.136	1.145	1.220	1.114	1.226	1.149	1.156	1.350	1.323	1.004	0.259
07	0.252	0.982	1.294	1.321	1.146	1.148	1.216	1.113	1.216	1.144	1.146	1.321	1.296	0.984	0.252
	-2.0	-0.8	-0.8	-0.8	-0.9	-0.3	0.3	0.1	0.8	0.4	0.9	2.1	2.0	2.0	2.7
	0.305	0.982	1.293	1.207	1.161	1.108	1.108	1.093	1.116	1.112	1.183	1.242	1.338	1.038	0.337
08	0.323	0.987	1.304	1.220	1.172	1.117	1.113	1.095	1.113	1.118	1.173	1.221	1.306	0.988	0.323
	-5.9	-0.5	-0.9	-1.1	-0.9	-0.8	-0.5	-0.2	0.3	-0.5	0.8	1.7	2.4	4.8	4.2
	0.247	0.974	1.284	1.305	1.122	1.131	1.203	1.110	1.230	1.143	1.153	1.342	1.320	1.008	0.257
09	0.252	0.982	1.295	1.320	1.145	1.144	1.216	1.113	1.216	1.149	1.147	1.322	1.296	0.984	0.252
	-2.0	-0.8	-0.9	-1.1	-2.0	-1.1	-1.1	-0.3	1.1	-0.5	0.5	1.5	1.8	2.4	1.9
		0.600	1.187	1.289	1.228	0.968	1.126	1.109	1.147	0.979	1.253	1.321	1.208	0.606	
10		0.604	1.189	1.303	1.245	0.978	1.149	1.118	1.144	0.979	1.245	1.304	1.191	0.605	
		-0.7	-0.2	-1.1	-1.4	-1.0	-2.0	-0.8	0.3	0.0	0.6	1.3	1.4	0.2	
		0.325	1.180	1.269	1.168	1.236	1.140	1.168	1.144	1.240	1.186	1.300	1.211	0.332	
11		0.327	1.191	1.283	1.186	1.245	1.147	1.173	1.146	1.245	1.187	1.285	1.195	0.329	
		-0.6	-0.9	-1.1	-1.5	-0.7	-0.6	-0.4	-0.2	-0.4	-0.1	1.2	1.3	0.9	
			0.404	0.937	1.274	1.299	1.336	1.221	1.323	1.308	1.292	0.963	0.426		
12			0.408	0.947	1.285	1.304	1.322	1.221	1.321	1.304	1.284	0.948	0.411		
			-1.0	-1.1	-0.9	-0.4	1.0	0.0	0.2	0.3	0.6	1.6	3.5		
				0.407	1.184	1.187	1.295	1.298	1.298	1.204	1.200	0.413			
13				0.411	1.194	1.191	1.296	1.305	1.296	1.190	1.193	0.408			
				-1.0	-0.8	-0.3	-0.1	-0.5	0.2	1.2	0.6	1.2			
					0.326	0.602	0.980	0.990	0.984	0.608	0.330				
14					0.328	0.605	0.983	0.988	0.984	0.604	0.328				
					-0.6	-0.5	-0.3	0.2	0.0	0.7	0.6				
							0.246	0.322	0.252						
15							0.252	0.323	0.252						
							-2.4	-0.3	0.0						

Measured Power
Calculated Power
Percent Difference

Figure 4.3.2
Flux Map 522 Measured vs. Calculated Powers (75%)

Measured Power
Calculated Power
Percent Difference

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
01							0.276 0.276 0.0	0.362 0.361 0.3	0.277 0.276 0.4						
02					0.331 0.332 -0.3	0.612 0.613 -0.2	1.008 1.008 0.0	1.080 1.081 -0.1	1.011 1.009 0.2	0.621 0.614 1.1	0.335 0.333 0.6				
03				0.408 0.407 0.2	1.147 1.147 0.0	1.156 1.157 -0.1	1.276 1.276 0.0	1.303 1.301 0.2	1.277 1.276 0.1	1.161 1.158 0.3	1.153 1.150 0.3	0.420 0.410 2.4			
04			0.409 0.409 0.0	0.919 0.921 -0.2	1.237 1.233 0.3	1.259 1.265 -0.5	1.282 1.290 -0.6	1.194 1.205 -0.9	1.288 1.292 -0.3	1.263 1.266 -0.2	1.234 1.236 -0.2	0.930 0.923 0.8	0.412 0.408 1.0		
05		0.331 0.332 -0.3	1.147 1.148 -0.1	1.225 1.234 -0.7	1.140 1.168 -2.5	1.230 1.246 -1.3	1.129 1.151 -1.9	1.163 1.171 -0.7	1.146 1.153 -0.6	1.236 1.247 -0.9	1.149 1.169 -1.7	1.252 1.235 1.4	1.163 1.148 1.3	0.341 0.332 2.6	
06		0.608 0.613 -0.8	1.150 1.156 -0.5	1.256 1.265 -0.7	1.240 1.245 -0.4	1.071 1.080 -0.8	1.171 1.174 -0.3	1.136 1.136 0.0	1.178 1.179 -0.1	1.066 1.081 -1.4	1.243 1.247 -0.3	1.279 1.267 0.9	1.174 1.158 1.4	0.625 0.613 1.9	
07	0.273 0.276 -1.1	0.996 1.007 -1.1	1.260 1.274 -1.1	1.281 1.290 -0.7	1.146 1.152 -0.5	1.179 1.178 0.1	1.251 1.239 1.0	1.139 1.134 0.4	1.247 1.239 0.6	1.173 1.175 -0.2	1.155 1.152 0.3	1.313 1.291 1.7	1.293 1.277 1.2	1.031 1.009 2.1	0.282 0.276 2.1
08	0.359 0.360 -0.3	1.064 1.079 -1.4	1.279 1.299 -1.6	1.191 1.203 -1.0	1.165 1.170 -0.4	1.132 1.136 -0.4	1.134 1.134 0.0	1.117 1.115 0.2	1.136 1.134 0.2	1.126 1.137 -1.0	1.174 1.171 0.3	1.213 1.205 0.7	1.304 1.301 0.2	1.106 1.081 2.3	0.370 0.361 2.4
09	0.274 0.276 -0.7	0.997 1.007 -1.0	1.262 1.275 -1.0	1.276 1.289 -1.0	1.129 1.151 -1.9	1.165 1.174 -0.8	1.233 1.239 -0.5	1.135 1.134 0.1	1.249 1.239 0.8	1.175 1.179 -0.3	1.155 1.153 0.2	1.302 1.292 0.8	1.287 1.277 0.8	1.025 1.009 1.6	0.283 0.277 2.1
10		0.609 0.612 -0.5	1.156 1.156 0.0	1.253 1.265 -1.0	1.229 1.246 -1.4	1.067 1.080 -1.2	1.169 1.179 -0.9	1.135 1.137 -0.2	1.179 1.175 0.3	1.079 1.081 -0.2	1.250 1.247 0.2	1.278 1.267 0.9	1.172 1.159 1.1	0.622 0.614 1.3	
11		0.329 0.331 -0.6	1.138 1.146 -0.7	1.221 1.233 -1.0	1.147 1.168 -1.8	1.238 1.246 -0.6	1.151 1.153 -0.2	1.172 1.171 0.1	1.154 1.152 0.2	1.249 1.247 0.2	1.163 1.169 -0.5	1.248 1.236 1.0	1.167 1.151 1.4	0.338 0.333 1.5	
12			0.404 0.407 -0.7	0.913 0.922 -1.0	1.226 1.235 -0.7	1.264 1.266 -0.2	1.307 1.292 1.1	1.208 1.205 0.2	1.298 1.291 0.5	1.276 1.267 0.7	1.245 1.235 0.8	0.939 0.923 1.7	0.430 0.410 4.7		
13				0.407 0.410 -0.7	1.143 1.150 -0.6	1.157 1.158 -0.1	1.278 1.276 0.2	1.293 1.301 -0.6	1.284 1.277 0.5	1.178 1.158 1.7	1.161 1.149 1.0	0.414 0.408 1.4			
14					0.331 0.333 -0.6	0.613 0.614 -0.2	1.011 1.009 0.2	1.080 1.081 -0.1	1.019 1.009 1.0	0.622 0.614 1.3	0.336 0.332 1.2				
15							0.282 0.276 2.1	0.363 0.361 0.6	0.279 0.276 1.1						

Figure 4.3.3
Flux Map 523 Measured vs. Calculated Powers (100%)

Legend (each cell): Measured Power / Calculated Power / Percent Difference

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
01							0.293 0.292 0.3	0.390 0.385 1.3	0.294 0.292 0.7						
02					0.334 0.334 0.0	0.617 0.617 0.0	1.018 1.017 0.1	1.138 1.135 0.3	1.021 1.017 0.4	0.623 0.618 0.8	0.338 0.336 0.6				
03				0.408 0.407 0.2	1.115 1.116 -0.1	1.133 1.134 -0.1	1.260 1.259 0.1	1.296 1.293 0.2	1.261 1.260 0.1	1.138 1.136 0.2	1.123 1.121 0.2	0.423 0.410 3.1			
04			0.407 0.409 -0.5	0.902 0.906 -0.4	1.205 1.203 0.2	1.236 1.242 -0.5	1.265 1.272 -0.6	1.187 1.194 -0.6	1.271 1.274 -0.2	1.242 1.244 -0.2	1.203 1.207 -0.3	0.915 0.908 0.8	0.413 0.408 1.2		
05		0.332 0.335 -0.9	1.111 1.117 -0.5	1.190 1.204 -1.2	1.127 1.159 -2.8	1.235 1.250 -1.2	1.139 1.157 -1.6	1.164 1.171 -0.6	1.152 1.159 -0.6	1.238 1.252 -1.1	1.136 1.161 -2.2	1.219 1.205 1.1	1.132 1.119 1.1	0.345 0.335 2.9	
06		0.609 0.616 -1.1	1.122 1.133 -1.0	1.229 1.241 -1.0	1.244 1.249 -0.4	1.152 1.159 -0.6	1.195 1.196 -0.1	1.149 1.149 0.0	1.199 1.201 -0.2	1.140 1.160 -1.8	1.244 1.252 -0.6	1.254 1.244 0.8	1.150 1.136 1.2	0.630 0.618 1.9	
07	0.290 0.291 -0.3	1.002 1.014 -1.2	1.237 1.256 -1.5	1.259 1.271 -1.0	1.150 1.157 -0.6	1.201 1.200 0.1	1.266 1.253 1.0	1.155 1.147 0.7	1.268 1.254 1.1	1.196 1.197 -0.1	1.160 1.158 0.2	1.292 1.273 1.5	1.275 1.261 1.1	1.045 1.018 2.6	0.299 0.292 2.3
08	0.388 0.384 1.0	1.119 1.132 -1.2	1.269 1.290 -1.7	1.179 1.192 -1.1	1.163 1.169 -0.5	1.145 1.148 -0.3	1.150 1.147 0.3	1.134 1.129 0.4	1.154 1.148 0.5	1.142 1.150 -0.7	1.173 1.172 0.1	1.199 1.195 0.3	1.289 1.294 -0.4	1.154 1.135 1.6	0.392 0.386 1.5
09	0.290 0.291 -0.3	1.006 1.015 -0.9	1.246 1.257 -0.9	1.255 1.270 -1.2	1.131 1.156 -2.2	1.187 1.196 -0.8	1.251 1.253 -0.2	1.153 1.147 0.5	1.270 1.254 1.3	1.199 1.201 -0.2	1.159 1.159 0.0	1.278 1.274 0.3	1.264 1.260 0.3	1.027 1.018 0.9	0.296 0.292 1.4
10		0.614 0.616 -0.3	1.137 1.132 0.4	1.231 1.241 -0.8	1.234 1.250 -1.3	1.150 1.159 -0.8	1.198 1.200 -0.2	1.153 1.149 0.3	1.205 1.197 0.7	1.162 1.160 0.2	1.253 1.252 0.1	1.248 1.244 0.3	1.143 1.136 0.6	0.623 0.618 0.8	
11		0.333 0.334 -0.3	1.109 1.116 -0.6	1.192 1.203 -0.9	1.140 1.159 -1.7	1.244 1.250 -0.5	1.160 1.158 0.2	1.176 1.171 0.4	1.164 1.158 0.5	1.259 1.252 0.6	1.155 1.161 -0.5	1.213 1.206 0.6	1.132 1.120 1.1	0.339 0.336 0.9	
12			0.405 0.407 -0.5	0.899 0.906 -0.8	1.196 1.205 -0.8	1.241 1.243 -0.2	1.286 1.273 1.0	1.198 1.195 0.3	1.281 1.272 0.7	1.254 1.244 0.8	1.213 1.205 0.7	0.921 0.908 1.4	0.429 0.410 4.4		
13				0.407 0.409 -0.5	1.112 1.119 -0.6	1.134 1.135 -0.1	1.260 1.259 0.1	1.284 1.293 -0.7	1.268 1.260 0.6	1.153 1.135 1.6	1.128 1.118 0.9	0.413 0.408 1.2			
14					0.334 0.335 -0.3	0.617 0.617 0.0	1.021 1.017 0.4	1.138 1.135 0.3	1.031 1.017 1.4	0.626 0.617 1.4	0.339 0.335 1.2				
15							0.300 0.292 2.7	0.389 0.385 1.0	0.296 0.292 1.4						

Table 4.4.1

Flux Map Summary[1]

Map #	Burnup (EFPD)	Date	Time	Power (%)	CBD (steps)	Boron (ppm)
521	0.13	5/15/2015	23:30:00	28.2	134	1958
522	0.67	5/17/2015	03:30:00	72.7	177	1664
523	2.77	5/19/2015	09:30:00	99.8	218	1464

Map #	RMS Difference[2]	Max $F_{\Delta H}$	Fraction to Limit, $F_{\Delta H}$	Max F_Q	Fraction to Limit, F_Q	Axial Offset (%)
521	1.15%	1.651	0.795	2.563	0.532	-8.7
522	0.95%	1.582	0.870	2.315	0.699	-1.6
523	0.95%	1.536	0.925	2.146	0.889	-1.6

Map #	Thimbles Used	Thimbles Required	Quadrant Power Tilt Ratio			
			NW	NE	SW	SE
521	48	38	0.994	1.007	0.992	1.007
522	47	38	0.995	1.004	0.994	1.007
523	45	38	0.994	1.004	0.995	1.007

1 Flux map summary data taken from respective INPAX-W runs [Reference 5.16]
2 RMS Difference = Measured Power - Calculated Power

Table 4.5.1
Reactivity Computer Checkout

Input Parameters to the Reactivity Computer[1]			
Group	$ß_1$	$I * ß_1$	λ_ι
1	0.000215	0.000208	0.0128
2	0.001341	0.001301	0.0317
3	0.001218	0.001181	0.1207
4	0.002629	0.002550	0.3209
5	0.000966	0.000937	1.4022
6	0.000235	0.000228	3.8778
$\Sigma ß_i$	0.006603	0.006405	-----

Prompt Neutron Lifetime = 14.26
Importance Factor (I) = 0.97
Delayed Neutron Fraction ($\Sigma ß_{eff}$) = 0.006405

Positive Insertion Period Check[2]					
Collection #	Δtime (sec)	Period (sec)	Calculated Reactivity (pcm)	Measured Reactivity (pcm)	% Deviation
1	48.1	69.4	76.283	75.793	-0.64
2	48.9	70.6	75.327	75.334	0.01
3	49.8	71.8	74.391	74.384	-0.01
4	51.9	74.8	72.151	72.684	0.74
Average	49.7	71.6	74.538	74.549	0.02

1 Reactivity computer inputs from Cycle 20 Powertrax [Reference 5.16].
2 Measured data from Cycle 20 (RFO19) performance of EST-923 [Reference 5.14].

Table 4.5.2
Low Power Physics Testing Results Summary

Boron Endpoint (ppm)						
Configuration	Measured[1]	Predicted[1]	Difference		Acceptance	
HZP, ARO	2144	2139	5.0		± 50	
Control Rod Worths (pcm)						
Bank	Measured[1]	Predicted[1]	Difference		Acceptance	
			Pcm	% Dev[2]	pcm	% Dev[2]
CBB	1288.673	1244.000	-44.673	3.59		± 10
SBA	1067.412	1022.000	45.412	4.44		± 15
SBB	983.048	1019.000	-35.952	-3.53		± 15
SBC	305.787	315.000	-9.213	-2.92	± 100	
CBA	277.476	309.000	-31.524	-10.2	± 100	
CBC	775.020	812.000	-36.980	-4.55		± 15
CBD	1005.793	1024.000	-18.207	-1.78		± 15
Sum of Worths	5703.208	5745.000	$^{M}/_{P}$ = 0.9927		0.9 ≤ $^{M}/_{P}$ ≤ 1.1	
HZP Temperature Coefficient (pcm/°F) RCS @ 2132 ppm						
	Measured[1]	Predicted[1]	Difference		Acceptance	
ITC	-3.571	-4.051	0.480		Difference ± 2	
MTC	-2.051	-2.531	0.480		Measured ≤ +5	

1 Measured and predicted data obtained from Cycle 20 performance of EST-923 [Reference 5.14].
2 % Deviation = [(Measured – Predicted) / Predicted] * 100

Figure 4.6.1
Integral Worth of the Reference Bank

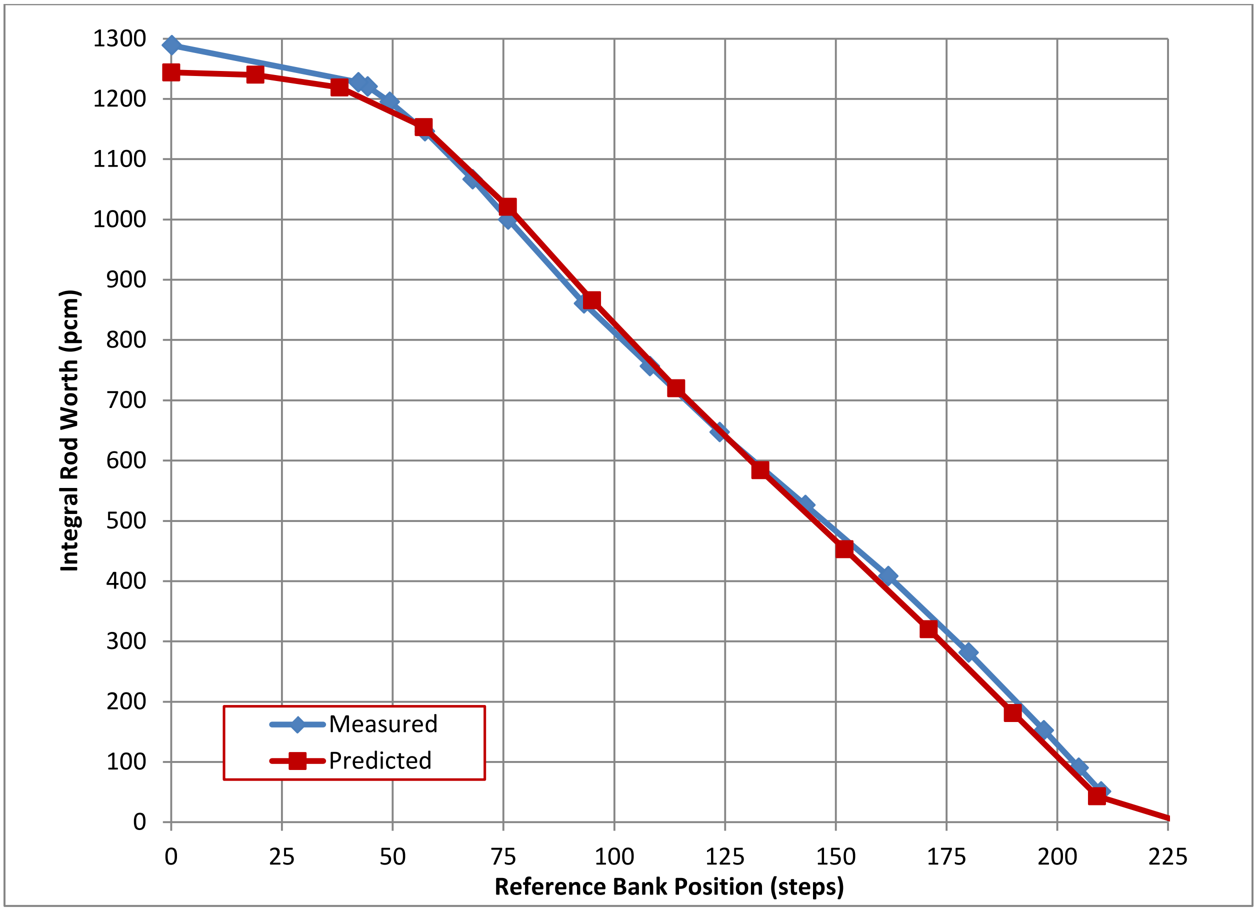

Figure 4.6.2

Differential Worth of the Reference Bank

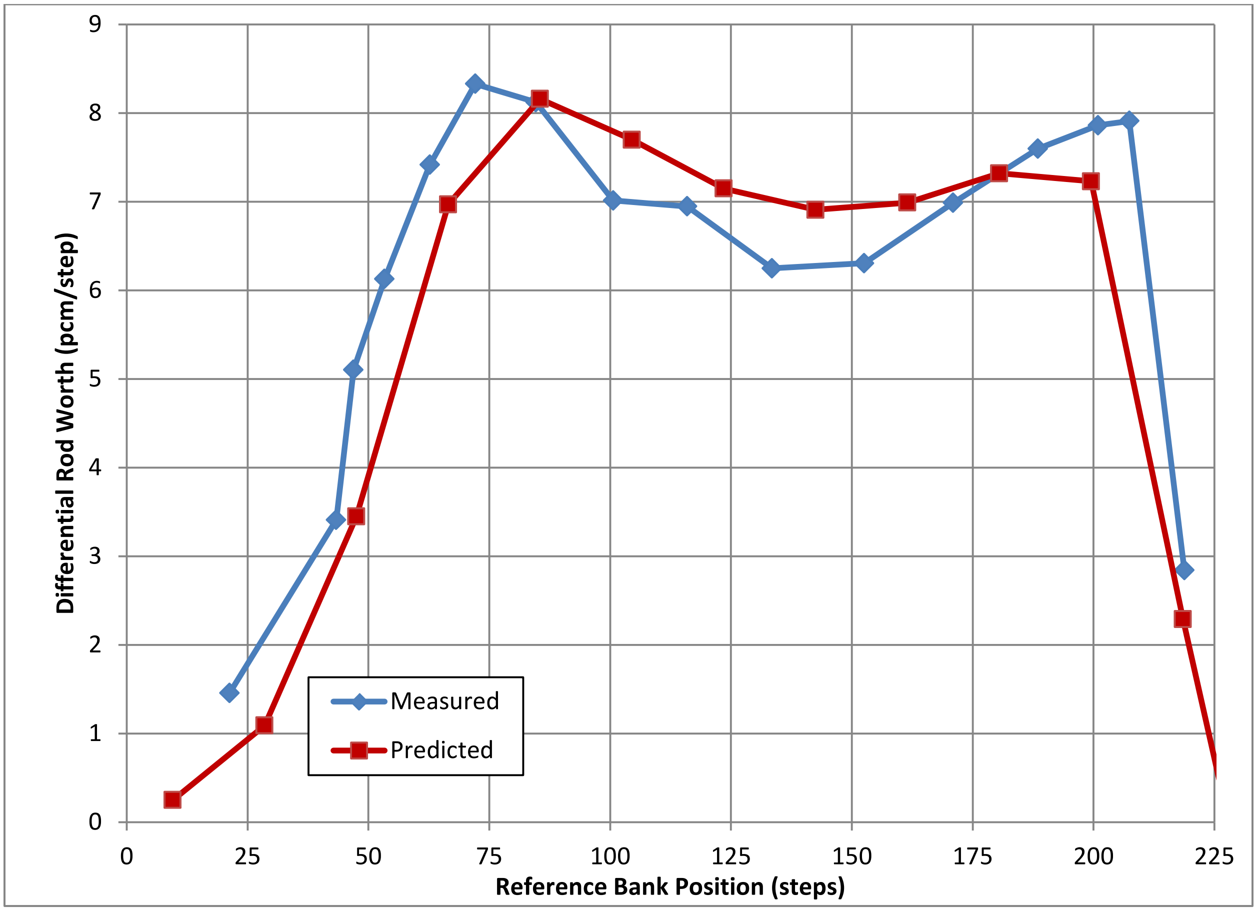

Table 4.6.3 - FSAR Chapter 14 Tests

Heat Tracing and Freeze Protection	Not impacted by LTA program.
Main, Auxiliary and Start-up Transformer	Not impacted by LTA program.
6.9 kv Switchgear	Not impacted by LTA program.
480 VAC Distribution	Not impacted by LTA program.
120 V ESF Uninterruptible AC System	Not impacted by LTA program.
Class 1E DC System	Not impacted by LTA program.
Normal Emergency AC/DC Lighting System	Not impacted by LTA program.
Communications System	Not impacted by LTA program.
Annunciator System	Not impacted by LTA program, system performance is monitored during routine operation, maintenance, and surveillance tests.
Reactor Protection System Engineered Safety Features Actuation Logic	Not impacted by LTA program.
Reactor Protection System Engineered Safety Features Actuation Response Time Test	No impact on system from LTA program, system performance is monitored during routine operation.
Piping Vibration	No impact on system from LTA program, system performance is monitored during routine operation.
Metal Impact Monitoring	No impact on system from LTA program, system performance is monitored during routine operation.
Radiation Monitoring System	No impact on system from LTA program, system performance is monitored during routine operation.
Excore Nuclear Instrumentation (NIS)	No impact on system from LTA program, system performance is monitored during routine operation.
Emergency Diesel	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Fire Protection System	No impact on system from LTA program, system performance is monitored during routine operation.
Normal Service Water	No impact on system from LTA program, system performance is monitored during routine operation.
Emergency Service Water	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Compressed and Instrument Air Systems	No impact on system from LTA program, system performance is monitored during routine operation.

Reactor Coolant System Hydrostatic Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
RTD/TC Cross Calibration Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Pressurizer Relief Tank (PRT) Test	No impact on system from LTA program, system performance is monitored during routine operation.
Safety Injection System Performance Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
High –Head Safety Injection System Check Valve Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Safety Injection (SI) Accumulator Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Residual Heat Removal System Cold Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Residual Heat Removal System Hot Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Containment Spray System Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Chemical and Volume Control Cold Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Chemical and Volume Control Hot Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Auxiliary Feedwater System Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Fuel Handling Equipment System Test	LTA dimensions evaluated for compatibility prior to manufacture & shipment. See discussion in Section 3.1.
Fuel Pool Cooling and Cleanup System Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Component Cooling Water	No impact on system from LTA program, system performance is monitored during routine operation.
Gaseous Waste Processing System Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Solid Waste Processing Test	No impact on system from LTA program, system performance is monitored during routine operation.
Liquid Waste Processing System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Containment Isolation Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Containment Integrated Leak Rate Test and Structural Integrity Test	Not impacted by LTA program.
Reactor Coolant System Hot Functional Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance tests.
Piping Thermal Expansion	No impact on system from LTA program, system performance is

and Dynamic Effects Test	monitored during routine operation.
Pressurizer Pressure and Level Control Test	No impact on system from LTA program, system performance is monitored during routine operation.
Main Steam System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Feedwater System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Condensate System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Turbine Generator Test	No impact on system from LTA program, system performance is monitored during routine operation.
Circulating Water System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Condenser Vacuum and Condensate Makeup System	No impact on system from LTA program, system performance is monitored during routine operation.
Waste Processing Computer Test	No impact on system from LTA program, system performance is monitored during routine operation.
Containment Ventilation and Cooling, Primary Shield and Reactor Supports Cooling System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Plant HVAC Test	No impact on system from LTA program, system performance is monitored during routine operation.
Engineered Safety Features Integrated Test	No impact on system from LTA program, system performance is monitored during routine operation.
Process Computer Test	No impact on system from LTA program, system performance is monitored during routine operation.
Boron Recycle Test	No impact on system from LTA program, system performance is monitored during routine operation.
Refueling Water Storage Tank Test	No impact on system from LTA program, system performance is monitored during routine operation.
Primary Makeup Water System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Rod Control System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Passive Safety Injection System Check Valve Test	No impact on system from LTA program, system performance is monitored during routine operation.
Containment Recirculation Sump Test	No impact on system from LTA program, system performance is monitored during routine operation.
Containment Vacuum Relief Test	No impact on system from LTA program, system performance is monitored during routine operation.
Combustible Gas Control System In Containment	No impact on system from LTA program, system performance is monitored during routine operation.

Test	
Gross Failed Fuel Detection System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Essential Services Chilled Water System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Stud Tensioner Hoist Load Test	No impact on system from LTA program, system performance is monitored during routine operation.
Polar Crane Test Summary	No impact on system from LTA program, system performance is monitored during routine operation.
Feedwater Heater Drain, Level and Bypass Control Systems Test	No impact on system from LTA program, system performance is monitored during routine operation.
Seismic Instrumentation Test	No impact on system from LTA program.
Extraction Steam System Test	No impact on system from LTA program.
Primary Sampling System Test	No impact on system from LTA program.
Secondary Sampling System Test	No impact on system from LTA program.
Loss of Instrument Air Test	No impact on system from LTA program.
Containment Building Hot Penetration Test	No impact on system from LTA program.
Simulated Loss of On-Site Power Test	No impact on system from LTA program.
AC Distribution System Optimum Operating Voltage Test	No impact on system from LTA program, system performance is monitored during routine operation.
Auxiliary Feedwater Turbine Pump Two-Hour Run Test	No impact on system from LTA program.
Moveable Incore Detector Test	Minimal impact on system from LTA program, due to different materials and dimensions of the GAIA instrument tube. System performance is discussed in Section 4.4.
Rod Control and Position Indication System Test	No impact from LTA program, since the LTAs were not loaded in rodded core locations.
Rod Drive Mechanism Timing Test	No impact from LTA program, since the LTAs were not loaded in rodded core locations.
Rod Drop Time Measurement Test	No impact from LTA program, since the LTAs were not loaded in rodded core locations.
Reactor Coolant System Flow Measurement Test	Minimal impact on system from LTA program, due to different pressure drop associated with GAIA assemblies. system performance discussed in section 4.1.
Reactor Coolant System Flow Coastdown Test	System operation was reviewed and determined to be acceptable by analytical methods.

Calibration of Nuclear Instrumentation Test	Minimal impact on system from LTA program, system performance discussed in section 4.2.
Rod Control System Test	No impact on system from LTA program, system performance is monitored during routine operation.
Flux Distribution Measurement Test	Minimal impact on system from LTA program, system performance discussed in section 4.3.
Core Performance Test	Minimal impact on system from LTA program, system performance discussed in section 4.4.
Power Coefficient Measurement Test	Minimal impact on system from LTA program, system performance discussed in section 4.5.
Control Rod Reactivity Worth Test	Minimal impact on system from LTA program, system performance discussed in section 4.6.
Boron Reactivity Worth Test	Minimal impact on system from LTA program, system performance discussed in section 4.7.
Automatic Rod Control Test	No impact on system from LTA program.
Steam Generator Moisture Carryover Test	No impact on system from LTA program.
Load Swing Test	No impact on system from LTA program.
Large Load Reduction From 75 Percent Power Test	No impact on system from LTA program.
Turbine Trip From 100 Percent Power Test	No impact on system from LTA program.
Remote Shutdown Test	No impact on system from LTA program.
Loss of Offsite Power Test	No impact on system from LTA program.
Pressurizer Heaters and Spray Valves Capability Test	No impact on system from LTA program.
Gross Failed Fuel Detection System Test	No impact on system from LTA program.
Pressurizer Continuous Spray Flow Verification Test	Not impacted by LTA program, system performance is monitored during routine operation.
Reactor Coolant System Leakrate Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance.
Natural Circulation Test Summary	No impact on system from LTA program, system performance is monitored during routine operation and surveillance.
Main Steam and Feedwater Systems Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance.
Shield Survey Test	No impact on system from LTA program, system performance is monitored during routine operation and surveillance.
Loss of Feedwater Heater(s) Test	No impact on system from LTA program.

Main Steam Isolation Valve Test	No impact on system from LTA program.
Steam Generator Test for Condensation Water Hammer	No impact on system from LTA program.
Steam Turbine-Driven and Motor-Driven Auxiliary FW Pumps Endurance Test	No impact on system from LTA program.
Resistance Temperature Detector (RTD) Bypass Flow VerificationTest	Test is no longer applicable with current RTD configuration
Secondary Sampling System Test	No impact on system from LTA program.