



**Duke Energy**

Oconee Nuclear Station  
7800 Rochester Highway  
Seneca, SC 29672

(864) 885-3107 OFFICE  
(864) 885-3564 FAX

W. R. McCollum, Jr.  
Vice President

February 28, 2001

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-001

Subject: Oconee Nuclear Station - Units 1, 2, and 3  
Docket Nos. 50-269, 50-270, 50-287  
Oconee Unit 1 Cycle 20 Startup Testing Report  
Evaluation Submittal

Pursuant to the requirements in Section 16.13.9, "Startup Report," from the Selected Licensee Commitments Manual, Duke Energy Corporation hereby submits to the Commission the Oconee Nuclear Station Unit 1 (ONS-1), Cycle 20 Startup Testing Report. The premise of the report is to provide the Staff with the satisfactory results from the ONS-1 cycle 20 startup tests which utilized the stations' initial loading of Framatome Mark B-11 reload fuel. It is also planned to utilize this new fuel assembly design for future ONS-2 and ONS-3 reloads.

If you have any questions or require additional information, please contact Stephen C. Newman, Oconee Regulatory Compliance Group, at (864) 885-4388.

Very truly yours,

W. R. McCollum, Jr.  
Site Vice President  
Oconee Nuclear Site

Attachment

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U. S. Nuclear Regulatory Commission  
February 28, 2001

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cc: L. A. Reyes, Regional Administrator  
Region II

M. C. Shannon, Senior Resident Inspector  
Ocone Nuclear Site

D. E. LaBarge, Senior Project Manager  
NRR

**DUKE POWER COMPANY**  
**OCONEE NUCLEAR STATION**  
**OCONEE 1 CYCLE 20**  
**STARTUP TESTING REPORT**

Part 1: Fuel Design

Part 2: Zero Power Physics Test

Part 3: Power Escalation Test

Prepared by: Angela M. Burkhart

**OCONEE 1 CYCLE 20  
Startup Testing Report  
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**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Part 1: Fuel and Core Design**

**1.0 Summary**

The Unit 1 Cycle 20 (O1C20) core consists of 177 fuel assemblies, each of which is a 15 by 15 array containing 208 fuel rods, 16 guide tubes and one incore instrument guide tube. The fuel consists of dished-end, cylindrical pellets of uranium dioxide. The reinserted fuel is clad in cold worked Zircaloy-4 and the fresh fuel is clad in M5. The O1C20 fuel assemblies have an average nominal fuel loading of 487 kg uranium in the Mk B10 assemblies and 459 kg uranium in the B11 assemblies.

The O1C20 core loading for this cycle consists of the following:

- 60 fresh fuel assemblies with 3.21 wt% U-235 each with 16 radial zoned reduced enrichment fuel pins at 2.91 wt% U-235 (designated Batch 22).
- 44 reinserted assemblies with 3.68 wt% U-235 each containing 16 radial zoned reduced enrichment fuel pins at 3.38 wt% U-235 (designated Batch 21A)
- 16 reinserted assemblies with 4.02 wt% U-235 each containing 16 radial zoned reduced enrichment fuel pins at 3.72 wt% U-235 (designated Batch 21B)
- 45 reinserted assemblies with 3.61 wt% U-235 each containing 16 radial zoned reduced enrichment fuel pins at 3.31 wt% U-235 (designated Batch 20B)
- 12 reinserted assemblies with 3.68 wt% U-235 (designated Batch 19C)

Figure 1 shows the batch loading pattern. Figure 2 shows the assembly radial zoning pattern.

All assemblies have six inch blanket regions (top and bottom) enriched to 2.00 wt% U-235. The core periphery is composed of Batches 19C and 20B assemblies. Batch 22 assemblies are distributed throughout the core interior with Batches 20B, 21A and 21B. The reinsert fuel is comprised of Mk B10 fuel.

Cycle 20 will operate in a rods-out, feed and bleed mode. Core reactivity control is supplied mainly by soluble boron and is supplemented by 61 full length Ag-In-Cd control rods and 44 burnable poison rod assemblies (BPRAs). In addition to the full length control rods, eight Inconel (gray) axial shaping rods (APSRs) are provided for additional control of the axial power distribution.

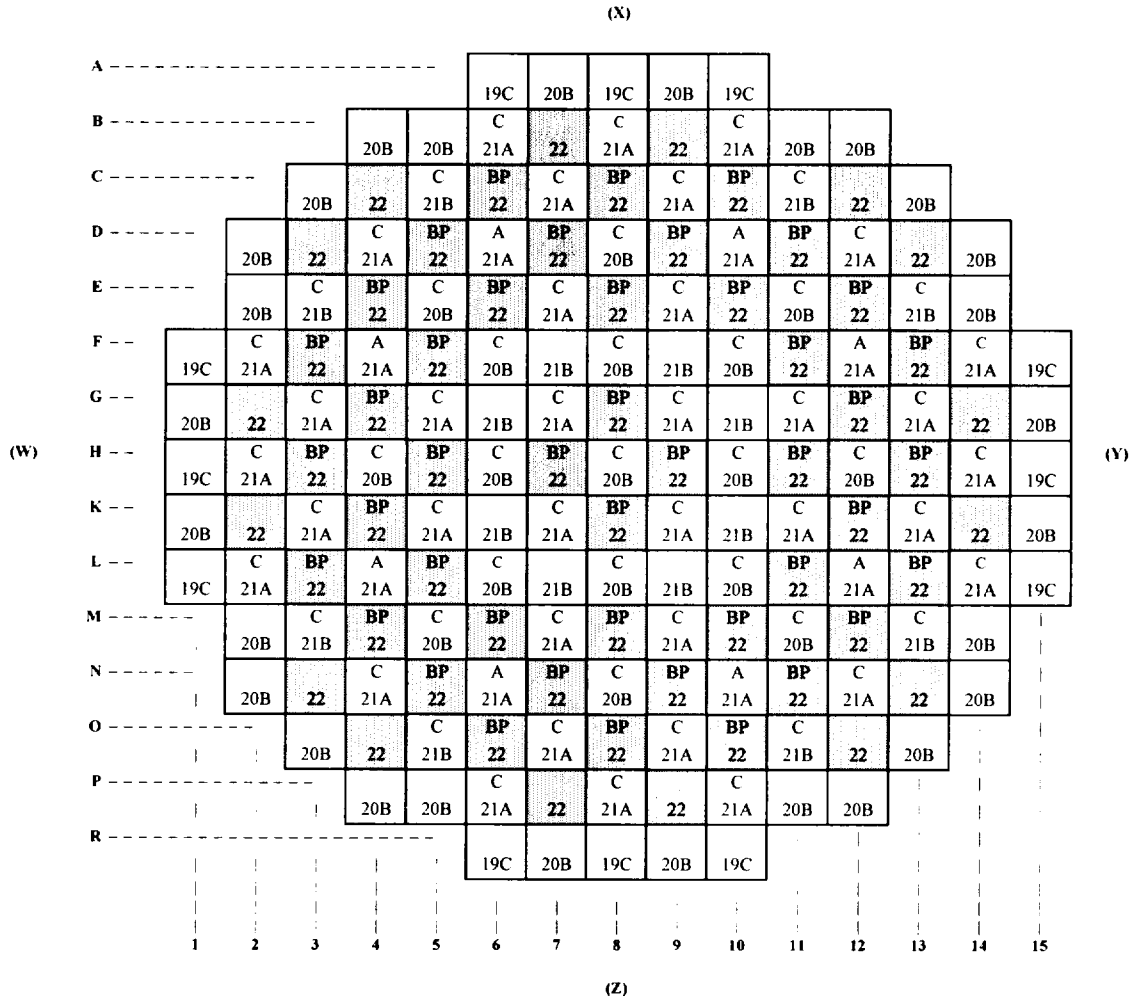
**Oconee 1 Cycle 20**  
**STARTUP TESTING REPORT**  
**Part 1: Fuel and Core Design**

Oconee 1 Cycle 20 is the first full reload batch with Mk B11 fuel. The Mk B11 design offers improvements in departure from nucleate boiling (DNB) margins and fuel cycle economy while retaining many proven features of the earlier fuel assembly designs. These features include: keyable spacer grids, floating grid restraint system, flow optimized control rod guide tube assembly, quick disconnect upper end fitting, anti-straddle lower end fitting, Zircaloy intermediate grids, cruciform hold down spring, and debris resistant fuel rods (extended lower end plug on fuel rods). The Mk B11 fuel utilizes a smaller diameter fuel pin for improved fuel utilization, mixing vanes for some of the intermediate grids to improve thermal performance and also incorporates some design enhancements which are not Mk B11 specific traits. Specifically, these enhancements include chamfered edges on the upper end fitting to assist with fuel handling, and a six leaf hold down spring design to reduce spring holddown force due to recent generic incomplete rod insertion concerns.

The Mk B11 design is planned for use in all three Oconee Units.

# Oconee 1 Cycle 20 STARTUP TESTING REPORT Part 1: Fuel and Core Design

## Figure 1: O1C20 Core Design

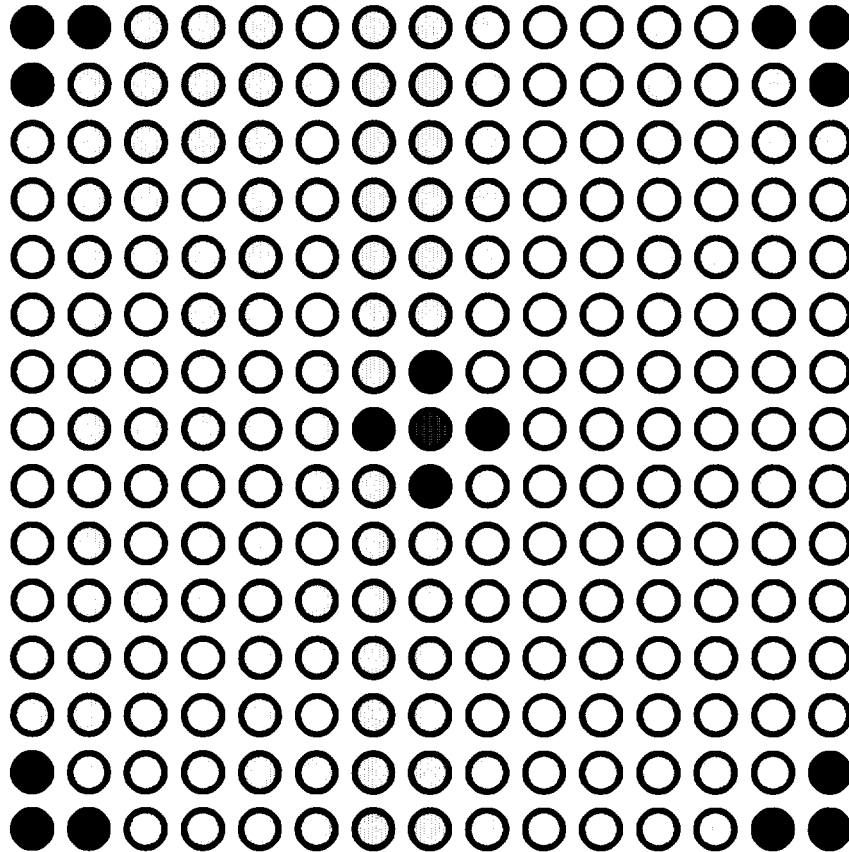


Control Type (A = Part Length Control Rod, BP = Burnable Poison, C = Control Rod)  
 Fuel Batch

Notes: Batch 19C FAs are Mk-B10F, Batches 20B, 21A, and 21B FAs are Mk-B10L, Batch 22 FAs are Mk-B11  
 BPRAs are Mk-B5  
 Fresh fuel assemblies are shaded All others are from O1C19

Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Part 1: Fuel and Core Design

Figure 2: Pin Map Showing Layout for Radial Zoned Fuel Assemblies



- One (1) Centered Instrument Tube
- Sixteen (16) Empty Guide Tubes
- 192 Fuel Pins at nominal enrichment
- 16 Fuel Pins at reduced enrichment

No fuel assemblies or burnable poison rods from the spent fuel pool are being used in O1C20.



**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Part 2: Zero Power Physics Test**

2.0 Introduction and Summary

The Oconee 1 Cycle 20 Zero Power Physics Test (ZPPT) was conducted from January 12 through 13, 2001 per station procedure PT/0/A/0711/01. This testing was conducted to verify the nuclear parameters upon which the Oconee 1 Cycle 20 core design, safety analysis and Technical Specifications are based.

Zero Power Physics Testing measurements were made with reactor power, Reactor Coolant System (RCS) pressure and RCS temperature as required by procedure. The following nuclear parameters were measured:

- (a) All-Rods-Out Critical Boron Concentration (Enclosure 1.0)
- (b) Differential Boron Worth (Enclosure 1.0)
- (c) Integral Rod Worth for Control Rod Groups 5, 6, and 7 (Enclosure 2.0)
- (d) Temperature and Moderator Coefficients of Reactivity (Enclosure 3.0)

The Framatome Reactivity Measurement and Analysis System (RMAS) was used to record RCS temperature, intermediate range power levels and control rod positions. Reactivity was calculated by the RMAS computer.

On January 13, 2001 at 2052, ZPPT was declared complete. All acceptance criteria were met.

2.1 Approach to Criticality

The initial RCS heatup following the refueling outage began on January 7, 2001 at 2200. Full RCS temperature and pressure necessary for unit startup were achieved on January 9, 2001 at 0100. Rod withdrawal for the Control Rod Drive Trip Time Test (CRDTTT) began at 2325 on January 10, 2001. The CRDTTT was performed at hot shutdown conditions (i.e.,  $> 1\% \Delta k/k$  shutdown) per station procedure PT/0/A/0300/001. Each control rod group was individually withdrawn. The CRDTTT was satisfactorily completed at 1800 on January 11, 2001.

1/M (inverse subcritical multiplication) vs. withdrawn rod worth plots were maintained throughout the approach to criticality. Rod withdraw began on January 11, 2001 at 2248. Criticality was achieved at 0132 on January 12, 2001 with rod Groups 1-6 at 100% wd

**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Part 2: Zero Power Physics Test**

(withdrawn), Group 7 at 73% wd, Group 8 at 35% wd, an RCS average temperature of 537.7 °F, and an RCS boron concentration of 1746 ppmB.

2.2 Pre-Physics Measurements

After establishing stable conditions with the reactor critical, reactor power was slowly increased to verify and record NI overlap. The point of adding sensible heat was also determined. From the sensible heat determination, the upper testing limit on the wide range NIs (as indicated on the Control Room Chart) was established for ZPPT.

An on-line OAC reactivity meter checkout was then performed utilizing reactivity changes of about  $\pm 750 \mu\rho$  and measuring the associated doubling times. The measured doubling times were compared to calculated values and found to agree within the procedure acceptance criteria.

2.3 Physics Testing

A. All Rods Out (ARO) Boron Concentration Measurement

The RCS equilibrium boron concentration was measured with Groups 1-6 at 100% wd, Group 7 at 80% wd, and APSR Group 8 at 35% wd. The control rods were moved to their all-rods-out position (Groups 1-7 at 100% wd, Group 8 at 35% wd) and the associated reactivity change was converted to a boron equivalent in ppmB. The All Rods Out Boron Concentration was then calculated and verified to be within procedure acceptance criteria.

B. Reactivity Coefficient Measurements

The temperature coefficient measurement was made while maintaining equilibrium boron concentration in the RCS, with control rod Group 7 withdrawn to 80% wd and with APSR Group 8 at 35% wd. This test measured the reactivity change associated with a ramp increase in RCS temperature of approximately 5.37 °F and a subsequent decrease of 10.97 °F. The data from the two temperature ramps was averaged using the  $\Delta T$  magnitudes as weighting factors. The change in reactivity was divided by the change in RCS temperature to calculate the temperature coefficient. The measured temperature coefficient was corrected for the difference in RCS average test temperature and reference temperature (532 °F). The moderator temperature coefficient was calculated by subtracting the predicted isothermal Doppler coefficient from the measured temperature coefficient.

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**Part 2: Zero Power Physics Test**

C. Control Rod Integral Worths and Differential Boron Worth Measurement

The worths of control rod Groups 5, 6, and 7 were measured by steadily deborating the RCS and compensating for the resulting positive reactivity addition by inserting control rods from 100% wd on Group 7 to 0% wd on Group 5 (with no rod overlap). The reactivity changes resulting from the discrete control rod insertions were summed for each group to obtain the group integral rod worth. Each of the three measured groups passed their individual acceptance criteria

The differential boron worth was calculated by dividing the total rod worth of Groups 5, 6, and 7 inserted between the initial and final boron samples by the corresponding change in RCS boron concentration. The initial value for the boron concentration was recorded at ARO critical equilibrium conditions. The final value of boron concentration was recorded as reactivity approached steady-state. The measured differential boron worth met procedure acceptance criteria.

**Oconee 1 Cycle 20  
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Part 3: Power Escalation Test**

3.0 Introduction and Summary

The Oconee 1 Cycle 20 Power Escalation Test was performed between January 13, 2001 and January 23, 2001 per station procedure PT/0/A/0811/01. Testing was performed at 18% Full Power (FP), 73% FP and 100% FP to verify nuclear parameters upon which the Oconee 1 Cycle 20 core design, safety analysis and Technical Specifications are based. The following tests and verifications were performed:

- (a) Initial Core Symmetry Check at 18% FP;
- (b) NSSS Heat Balance at 18% FP, 73% FP, and 100% FP (Enclosure 4.0);
- (c) Incore Detector Checkout at 18% FP, 40% FP, and 100%FP;
- (d) Power Imbalance Detector Correlation Slope Measurement at 73% FP;
- (e) Core Power Distribution at 18% FP, 40% FP, and 100% FP (Enclosures 5.0 through 5.3 and 6.0);
- (f) All-Rods-Out Critical Boron Concentration at 100% FP (Enclosure 1.0).

The unit reached 18% FP at 0344 on January 13, 2001. Low power testing (LPT) was completed at 1846 on 1/17/01. The unit reached 73% FP at 0200 on 1/19/01. Testing at this intermediate plateau (Intermediate Power Testing, IMPT) was completed at 0830 on 1/19/01. The unit reached the Full Power Testing plateau on 1/19/01 at 1815. Full Power Testing (FPT), consisting of Incore Detector Checkout, Core Power Distribution, NSSS Heat Balance and All-Rods-Out Critical Boron, was performed at this plateau. A secondary precision calorimetric was also completed as the last evolution at this plateau. FPT was concluded at 1735 on 1/20/01. Power Escalation Testing was declared complete on 1/23/01 at 1025.

3.1 NSSS Heat Balance/RCS Flow Verification

Off-line secondary heat balances were performed at 18% FP, 73% FP and 100% FP. An off-line primary heat balance was performed at 100% FP after constants were adjusted with precision calorimetrics data. These tests verified the accuracy of the on-line plant computer program which performs primary and secondary-side heat balances. The plant on-line computer accuracy was verified by performing an off-line calculation using the same inputs

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**STARTUP TESTING REPORT**  
**Part 3: Power Escalation Test**

that feed the on-line computer. The on-line and off-line results were compared for the same period, and verified to agree within 2% FP. This same method was used to verify that RCS flow was greater than the required flow per the Core Operating Limits Report (COLR). Normalization of the plant computer RCS flow constants (used to calculate flow from the primary delta-P instrumentation) was performed during FPT and the on-line power calculations were then verified to agree within 2% FP.

### 3.2 Core Power Distribution

Core Power Distribution tests were conducted at 18% FP, 40% FP and at 100% FP. These tests verified that reactor power imbalance, quadrant power tilt and radial/total power peaks did not exceed their respective specified limits.

Specific checks were made as follows:

Incore imbalance was compared to the error adjusted imbalance LOCA limit curve and was verified to be within specified limits (based on Core Operating Limits Report).

The maximum positive quadrant power tilt was verified to be less than the error adjusted LOCA limit (based on Core Operating Limits Report).

Prior to performing the radial and total peaking factor comparisons, PT/0/A/0302/06 (Review and Control of Incore Instrumentation Signals) was performed to identify and evaluate erroneous Self Powered Neutron Detector signals. This test was performed as a prerequisite to core power distribution tests at 18% FP, 40% FP and 100% FP.

The radial and total peaking factors were measured and compared to the predicted values at 40% FP and 100% FP. All acceptance criteria were satisfied.

### 3.3 Power Imbalance Detector Correlation

The Power Imbalance Detector Correlation was performed at 73% FP. The purpose of this test was to measure the excore to incore power imbalance correlation slopes for NI Channels 5, 6, 7, and 8, and to verify these slopes met acceptance criteria.

The excore/incore imbalance correlation slope for each NI Channel (5-8) was determined by a least squares fit of excore to incore imbalance indications. A total of 35 incore imbalance

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STARTUP TESTING REPORT  
Part 3: Power Escalation Test**

points which ranged between  $-9.94\%$  and  $+4.67\%$  FP were used. All the slopes were verified to meet acceptance criteria.

The correlation slopes for NI Channels 5, 6, 7, and 8 were calculated to be 1.15, 1.15, 1.17, and 1.16 respectively.

3.4 All Rods Out Critical Boron Measurement at Power

The All Rods Out Critical Boron at Power measurement was made at 100% FP, and the difference between measured and predicted reactivity (in terms of ppmB) was verified to be acceptable.

**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Enclosure 1.0**

ALL-RODS-OUT CRITICAL BORON CONCENTRATION  
AND DIFFERENTIAL BORON WORTH RESULTS

	<b>Zero Power ARO Critical Boron Concentration</b>	<b>At-Power ARO Critical Boron Concentration</b>	<b>Differential Boron Worth</b>
<b>CONDITIONS</b>	Initial Critical 0 EFPD  Gp 7 @ 80% wd Gp 8 @ 35% wd 1750 ppmB	100% FP 2.88 EFPD  Gp 7 @ 92% wd Gp 8 @ 35% wd 1267 ppmB	<b>Initial State:</b> Gp 7 @ 80% wd Gp 8 @ 35% wd 1752 ppmB  <b>Final State:</b> Gp 4 @ 100% wd Gp 5 @ 20.2% wd Gp 8 @ 35% wd 1447 ppmB
<b>MEASURED VALUE</b>	1759.9 ppmB	1258 ppmB	-0.008713 <sup>Δk</sup> / <sub>k</sub> ppmB
<b>PREDICTED VALUE</b>	1760 ppmB	1242 ppmB	-0.00802 <sup>Δk</sup> / <sub>k</sub> ppmB
<b>DEVIATION</b>	0.1 ppmB	+16 ppmB	-7.95%*
<b>ACCEPTANCE CRITERIA</b>	Predicted ± 50 ppmB	Predicted ± 50 ppmB	Meas > -0.0133% <sup>Δk</sup> / <sub>k</sub> ppmB and ±15% dev. from pred.

\*  $\frac{(\text{Predicted} - \text{Measured})}{\text{Measured}} * 100$

**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Enclosure 2.0**

INTEGRAL GROUP ROD WORTH MEASUREMENTS

<b>PARAMETER</b>	<b>MEASURED VALUE (% k/k)</b>	<b>PREDICTED VALUE (% k/k)</b>	<b>DEVIATION<sup>*</sup> (%)</b>	<b>ACCEPTANCE CRITERION</b>
<b>Gp 7 Integral Worth</b>	-0.84365	-0.808	-4.2	± 15% Deviation
<b>Gp 6 Integral Worth</b>	-0.86067	-0.8460	-1.7	± 15% Deviation
<b>Gp 5 Integral Worth</b>	-1.20655	-1.094	-9.3	± 15% Deviation
<b>Gp 5-7 Integral Worth</b>	-2.91087	-2.748	-5.6	± 10% Deviation

<sup>\*</sup> % Dev. =  $\frac{\text{Predicted} - \text{Measured}}{\text{Measured}} * 100$



**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Enclosure 3.0**

REACTIVITY COEFFICIENTS

PARAMETER	CONDITIONS	MEASURED VALUE	PREDICTED VALUE	DEVIATION (Meas-Pred)	ACCEPTANCE CRITERIA
<b>Hot Zero Power Temperature Coefficient (ARO)</b>	T <sub>ave</sub> = 532 F Gp 7 @ 79.8% wd Gp 8 @ 35% wd 1750 ppmB	+0.1359E-4 $\frac{\Delta k}{k \text{ } ^\circ\text{F}}$	+0.1361E-4 $\frac{\Delta k}{k \text{ } ^\circ\text{F}}$	-0.0002 E-4 $\frac{\Delta k}{k \text{ } ^\circ\text{F}}$	Measured - Predicted = $\pm 0.2\text{E-}4 \frac{\Delta k}{k \text{ } ^\circ\text{F}}$
<b>Hot Zero Power Moderator Temperature Coefficient (ARO)</b>	T <sub>ave</sub> = 532 F Gp 7 @ 79.8% wd Gp 8 @ 35% wd 1750 ppmB	+0.3044E-4 $\frac{\Delta k}{k \text{ } ^\circ\text{F}}$	+0.3046E-4 $\frac{\Delta k}{k \text{ } ^\circ\text{F}}$	-0.0002 E-4 $\frac{\Delta k}{k \text{ } ^\circ\text{F}}$	Measured - Predicted = $\pm 0.2\text{E-}4 \frac{\Delta k}{k \text{ } ^\circ\text{F}}$  and Measured $\leq +0.5\text{E-}4 \frac{\Delta k}{k \text{ } ^\circ\text{F}}$

**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Enclosure 4.0**

NSSS HEAT BALANCE/RCS FLOW VERIFICATION

<b>Test Plateau</b>	<b>Plant Computer Online Primary Power Level (%FP)</b>	<b>Plant Computer Online Sec. Power Level (%FP)</b>	<b>Offline<sup>1</sup> Calculated Primary Power Level</b>	<b>Offline<sup>1</sup> Calculated Secondary Power Level</b>	<b>RCS Flow<sup>1,2</sup> (%DF)</b>
<b>LPT</b>	18.19	18.43	-	18.39	113.42
<b>IMPT</b>	71.89	73.08	-	73.05	112.4
<b>FPT</b>	99.35	100.0	-	99.96	111.93
<b>FPT<sup>3</sup></b>	99.33	100.00	99.68	99.97	112.13

<sup>1</sup>Calculated by the offline heat balance program

<sup>2</sup>Required to be > Core Operating Limit Report RCS flow of 108.5 % DF

<sup>3</sup>Offline heat balance program constants adjusted with precision calorimetrics data at full power (does not alter secondary power offline heat balance)

**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Enclosure 5.0**

**RADIAL PEAKING FACTORS AT IMPT**

	8	9	10	11	12	13	14	15
H	1.13	1.42	1.24	1.38	1.04	1.29	0.97	0.32
	1.08	1.38	1.24	1.40	1.04	1.28	1.05	0.35
	4.8%	3.3%	0.1%	-2.0%	0.2%	0.9%	-7.7%	-7.5%
K		1.41	1.49	1.38	1.35	1.29	1.08	0.32
		1.39	1.46	1.33	1.30	1.32	1.10	0.32
		0.9%	1.7%	3.6%	3.9%	-2.0%	-1.4%	0.4%
L			1.19	1.36	1.29	1.26	0.75	0.20
			1.14	1.30	1.32	1.25	0.75	0.20
			4.3%	4.7%	-2.1%	0.6%	0.0%	2.9%
M				1.13	1.27	1.08	0.42	
				1.13	1.36	1.06	0.42	
				0.2%	-7.0%	2.5%	-0.7%	
N					0.98	0.85	0.25	
					1.01	0.86	0.27	
					-2.9%	-0.4%	-7.9%	
O						0.32		
						0.35		
						-7.5%		

Predicted
Measured
%dev

$$\% \text{ Dev.} = \frac{\text{Predicted} - \text{Measured}}{\text{Measured}} * 100$$

**Core Conditions**

Power	40.32 %FP	
Group 5	100% wd	
Group 6	100%wd	
Group 7	56% wd	
Group 8	36% wd	
Imbalance	-4.59	
Burnup	1.06 EFPD	
RCS Boron	1460 ppmB	
Incore Tilt	WX	XY
	3.22	1.41
	YZ	ZW
	-2.78	-1.85

Max 1/8 Core % Deviation is 4.8 % at H8	Acceptance criteria: + 15% of Predicted
Min 1/8 Core % Deviation is -7.9% at N14	Acceptance criteria: - 15% of Predicted
Max Peak Deviation is -1.7%	Acceptance Criteria: <+5%
Root Mean Square of Deviations is 4.8%	Acceptance Criteria: <+7.5%

**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Enclosure 5.1**

**TOTAL PEAKING FACTORS AT IMPT**

	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
<b>H</b>	1.47	1.88	1.64	1.93	1.64	1.86	1.35	0.44
	1.34	1.77	1.59	1.93	1.53	1.82	1.42	0.46
	9.8%	5.8%	3.2%	-0.4%	7.3%	2.2%	-4.7%	-4.1%
<b>K</b>		1.85	1.98	1.89	1.93	1.82	1.52	0.44
		1.83	1.92	1.77	1.82	1.81	1.53	0.40
		1.2%	3.5%	6.9%	5.9%	0.7%	-0.7%	9.3%
<b>L</b>			1.58	1.87	1.86	1.78	1.04	0.28
			1.47	1.76	1.90	1.76	1.00	0.25
			7.4%	6.5%	-1.7%	0.7%	3.3%	11.3%
<b>M</b>				1.57	1.85	1.56	0.59	
				1.52	1.98	1.50	0.58	
				3.2%	-6.7%	4.3%	2.5%	
<b>N</b>					1.62	1.30	0.37	
					1.60	1.26	0.34	
					1.3%	3.4%	6.2%	
<b>O</b>						0.49		
						0.48		
						1.5%		

Predicted  
Measured  
%dev

$$\%Dev = \frac{\text{Predicted} - \text{Measured}}{\text{Measured}} * 100$$

**Core Conditions**

Power	40.32 %FP	
Group 5	100% wd	
Group 6	100%wd	
Group 7	56% wd	
Group 8	36% wd	
Imbalance	-4.59	
Burnup	1.06 EFPD	
RCS Boron	1460 ppmB	
Incore Tilt	WX	XY
	3.22	1.41
	YZ	ZW
	-2.78	-1.85

Max 1/8 Core % Deviation is 11.3 % at L15	Acceptance criteria: + 15% of Predicted
Min 1/8 Core % Deviation is -6.7 % at M12	Acceptance criteria: - 15% of Predicted
Maximum Peak Deviation is -0.39%	Acceptance Criteria: <+7.5%

**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Enclosure 5.2**

**RADIAL PEAKING FACTORS AT FPT**

	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
<b>H</b>	1.02	1.29	1.18	1.37	1.16	1.30	1.05	0.35
	1.06	1.32	1.17	1.35	1.16	1.31	0.97	0.33
	-3.5%	-2.1%	0.3%	1.1%	-0.5%	-0.5%	7.7%	6.4%
<b>K</b>		1.31	1.37	1.29	1.31	1.32	1.09	0.33
		1.31	1.40	1.34	1.36	1.29	1.09	0.33
		0.0%	-1.9%	-3.7%	-3.1%	2.4%	0.3%	0.3%
<b>L</b>			1.09	1.27	1.30	1.24	0.76	0.20
			1.14	1.33	1.28	1.25	0.75	0.21
			-3.8%	-4.0%	1.6%	-1.1%	0.3%	-2.0%
<b>M</b>				1.13	1.38	1.09	0.45	
				1.13	1.30	1.11	0.44	
				0.2%	6.0%	-2.1%	2.6%	
<b>N</b>					1.14	0.94	0.29	
					1.14	0.93	0.27	
					0.4%	1.5%	7.3%	
<b>O</b>						0.37		
						0.36		
						2.1%		

measured  
predicted  
% dev

% Dev=  $\frac{\text{Predicted} - \text{Measured}}{\text{Measured}} * 100$

**Core Conditions**

Power	100 %FP	
Group 5	100% wd	
Group 6	100%wd	
Group 7	91% wd	
Group 8	35% wd	
Imbalance	-1.09	
Burnup	2.88 EFPD	
RCS Boron	1265 ppmB	
Incore Tilt	WX	XY
	2.48	1.50
	YZ	ZW
	-2.11	-1.88

Max 1/8 Core % Deviation is 7.7 % at H14	Acceptance criteria: + 10% of Predicted
Min 1/8 Core % Deviation is -4.0% at L11	Acceptance criteria: - 15% of Predicted
Max peak Deviation is -1.56%	Acceptance Criteria: <+5%
Root Mean Square of Deviations is 3.11%	Acceptance Criteria: <+7.5%

**Oconee 1 Cycle 20  
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**TOTAL PEAKING FACTORS AT FPT**

	8	9	10	11	12	13	14	15
<b>H</b>	1.20	1.57	1.40	1.68	1.37	1.60	1.29	0.43
	1.30	1.63	1.44	1.68	1.44	1.64	1.22	0.41
	-7.9%	-3.9%	-2.6	0.2%	-5.5%	-2.7%	6.0%	4.3%
<b>K</b>		1.61	1.67	1.54	1.58	1.59	1.35	0.38
		1.61	1.72	1.65	1.68	1.61	1.37	0.41
		0.4%	-3.2%	-6.3%	-6.0%	-1.4%	-1.8%	-7.6%
<b>L</b>			1.26	1.52	1.61	1.53	0.90	0.24
			1.39	1.63	1.59	1.56	0.94	0.26
			-9.0%	-6.7%	1.1%	-2.0%	-4.0%	-8.4%
<b>M</b>				1.32	1.69	1.31	0.53	
				1.37	1.61	1.38	0.54	
				-3.7%	5.1%	-5.0%	-1.8%	
<b>N</b>					1.39	1.15	0.35	
					1.43	1.18	0.34	
					-2.4%	-2.2%	1.4%	
<b>O</b>						0.44		
						0.45		
						-2.5%		

measured  
predicted  
% dev

$$\%Dev = \frac{\text{Predicted} - \text{Measured}}{\text{Measured}} * 100$$

**Core Conditions**

Power	100 %FP	
Group 5	100% wd	
Group 6	99%wd	
Group 7	91% wd	
Group 8	35% wd	
Imbalance	-1.09	
Burnup	2.88 EFPD	
RCS Boron	1265 ppmB	
Incore Tilt	WX	XY
	2.48	1.50
	YZ	ZW
	-2.11	-1.88
Max 1/8 Core % Deviation is 6.0 % at H14	Acceptance criteria: + 15% of Predicted	
Min 1/8 Core % Deviation is -9.0 % at L10	Acceptance criteria: - 15% of Predicted	
Max Peak Deviation is -1.91	Acceptance Criteria: <+7.5%	

**Oconee 1 Cycle 20  
STARTUP TESTING REPORT  
Enclosure 6.0**

CORE POWER DISTRIBUTION DATA SUMMARY AT

LPT, IMPT AND FPT PLATEAUS

Power Level (% FP)	18		40		100	
Burnup (EFPD)	0.11		1.06		2.88	
Group 6/7/8 Positions (% wd)	83/8/36		100/56/36		99/91/35	
RCS Boron Concentration (ppmB)	1540		1460		1265	
Incore Imbalance (% FP)	-3.18		-4.59		-1.3	
Incore Tilt WX   XY	3.71	1.63	3.22	1.4	2.4	1.47
	YZ   ZW	-3.19	-2.16	-2.78	-1.85	-2.02