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AUG 2 9 2001

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LRN-01-0270

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

POWER UPRATE TEST SUMMARY
SALEM GENERATING STATION - UNIT 2
FACILITY OPERATING LICENSE DPR-75
DOCKET NO. 50-311

PSEG Nuclear LLC hereby submits a summary report of plant startup and power escalation testing for Salem Unit 2 in accordance with the requirements of Technical Specification 6.9.1.1. The report is required since Amendment 224 to the Salem Unit 2 Technical Specifications increased the licensed power level. The summary of testing is included in Attachment 1.

Attachment 1 also contains a summary of the core design, startup physics testing and beginning-of-cycle power ascension flux mapping results for Salem Unit 2 Cycle 12.

Should you have any questions regarding this submittal, please contact Paul Duke at (856) 339-1466.

Sincerely,

G. Salamon
Manager - Nuclear Safety & Licensing

Attachment

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ATTACHMENT 1
SALEM UNIT 2 CYCLE 12 STARTUP PHYSICS AND 1.4% POWER UPRATE TEST REPORT

Salem Unit 2 began its twelfth cycle of operation on November 15, 2000 when the unit was synchronized to the grid and will complete this cycle of operation on April 4th, 2002. On June 5th, 2001 (approximately 7700 MWD/MTU cycle burnup) the licensed rated thermal power level for Salem Unit 2 was increased from 3411 MWt to 3459 MWt (a 1.4% increase). The burnup at the end of Cycle 12 is predicted to be approximately 19300 MWD/MTU.

The feed fuel region, designated as Region 14, consists of 28 assemblies enriched to 4.402 w/o U^{235} and 52 assemblies enriched to 4.601 w/o U^{235}. This feed region also uses 416 fresh wet annular burnable absorber (WABA) rods and 8992 1.25X (~1.9625 mg/in B10) integral fuel burnable absorber (IFBA) rods. Region 14 is the second Salem Unit 2 reload to use the Westinghouse Robust Fuel Assembly (RFA) fuel design which includes intermediate flow mixer (IFM) grids, a 1.25X IFBA loading, annular fuel pellets at the top and bottom six inches of the fuel rod and a protective bottom grid (a debris mitigation feature).

The reload core design was verified during the reactor startup physics testing and initial power ascension program. The startup physics/initial power ascension program included the following tests:

1. Rod Bank measurements using the Dynamic Rod Worth Measurement (DRWM) technique.
2. Critical boron concentration measurement.
3. Temperature coefficient measurement.
4. Power distribution measurements using the INCORE flux mapping system.

The 1.4% power uprate program was verified via INCORE flux mapping results to assure compliance with Technical Specification power distribution limits.

Salem Unit 2 Cycle 12 was the second cycle at Salem Unit 2 to utilize the DRWM bank measurement technique. Critical boron, bank worth and temperature coefficient measurement results are provided in Tables 1, 2 and 3 respectively. Since the review criteria are typically more limiting than the acceptance criteria for measured to predicted comparisons, only comparisons to the review criteria are provided.

TABLE 1

Salem Unit 2 Cycle 12 Beginning of Life (BOL), Hot Zero Power (HZP), All-Rods-Out (ARO), Critical Boron Measurement			
Measured Value (ppm)	**Design Value (ppm)**	**Review Criteria Range (+/- 50 ppm)**	**Pass/Fail**
1772	1770	1720 to 1830	Pass

TABLE 2

Salem Unit 2 Cycle 12 Dynamic Rod Worth Measurement (DRWM) Results				
Rod Bank	**Measured Worth (pcm)**	**Design Value (pcm)**	**Review Criteria**	**Pass/Fail**
D	736.1	721.6	± 15%	Pass
C	1088.4	1040.7	± 15%	Pass
B	739.4	731.2	± 15%	Pass
A	534.6	518.6	± 15%	Pass
SD	384.6	378.4	± 15%	Pass
SC	393.0	382.2	± 15%	Pass
SB	792.8	776.8	± 15%	Pass
SA	209.4	207.8	± 15%	Pass
Total	4878.3	4757.3	± 8%	Pass

TABLE 3

Salem Unit 2 Cycle 12 BOL HZP ARO Isothermal Temperature Coefficient (ITC) Measurement and Inferred Most Limiting Moderator Temperature Coefficient (MTC)	
Parameter	
ITC Measured Value (pcm/°F)	-3.24
ITC Design Value (pcm/°F)	-3.59
Review Criteria Range (±2 pcm/°F)	-1.59 to -5.59
Pass/Fail	Pass
MTC Inferred Value* (pcm/°F)	-1.15
MTC Acceptance Value (pcm/°F)	< 0
Pass/Fail	Pass

* Measured MTC value is corrected to the most limiting burnup for MTC (~3000 MWD/MTU)

Due to the satisfactory completion of startup physics testing for Salem Unit 2 Cycle 12, power ascension was initiated. INCORE flux map peaking factor measurement results ($F_{\Delta H}$, F_Q, F_{xy}) with appropriate uncertainties applied as a function of core power level are provided in Tables 4, 5 and 6. Each part power flux map provided peaking factor results which met the Technical Specification limits for the flux map power level. The hot-full-power (HFP) flux map was taken on November 21, 2000. This flux map showed acceptable margin to peaking factor limits, with 4.4% margin to the $F_{\Delta H}$ limit, 3.9% margin to the F_{xy} limit and 17.9% margin to the F_Q Technical Specification limit.

TABLE 4

Salem Unit 2 Cycle 12 Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}$) as a Function of INCORE Map Power Level Near BOL			
Test Conditions (Core Power Level)	**Measured Value**	**Required Value 1.65[1.0+0.3(1-P)]**	**Pass/Fail**
28.9%	1.607	< 2.002	Pass
62.3%	1.593	< 1.837	Pass
99.9%	1.578	< 1.650	Pass

TABLE 5

Salem Unit 2 Cycle 12 Maximum Heat Flux Hot Channel Factor ($F_Q(z)$) as a Function of INCORE Map Power Level Near BOL			
Test Conditions (Core Power Level)	**Measured Value**	**Required Value***	**Pass/Fail**
28.9%	2.170	< 4.692	Pass
62.3%	1.996	< 3.775	Pass
99.9%	1.973	< 2.402	Pass

*Corresponds to limit at axial height with highest F_Q value.

TABLE 6

Salem Unit 2 Cycle 12 Maximum Computed Radial Peaking Factor (F_{xy}) as a Function of INCORE Map Power Level and Rodded Condition for Surveilled Core Axial Heights			
Test Conditions (Core Power Level)	**Measured Value**	**Required Value**	**Pass/Fail**
28.9%	Rodded = N/A	Rodded = N/A	Pass
	Unrodded = 1.759	Unrodded = < 2.148	
62.3%	Rodded = N/A	Rodded = N/A	Pass
	Unrodded = 1.748	Unrodded = < 1.970	
99.9%	Rodded = N/A	Rodded = N/A	Pass
	Unrodded = 1.702	Unrodded = < 1.771	

From the beginning of Salem Unit 2's twelfth cycle of operation through June 4th, 2001, the core was operated at a maximum licensed rated thermal power level of 3411 MWt. On June 5th, 2001 (approximately 7700 MWD/MTU cycle burnup) the licensed rated thermal power level for Salem Unit 2 was increased from 3411 MWt to 3459 MWt (a 1.4% increase). INCORE flux map results were obtained at equilibrium conditions prior to and soon after the power uprate program was implemented. The INCORE flux map results were reviewed to assure the measured change in certain core physics parameters, between pre and post power uprate conditions, was consistent with prediction. In addition, the INCORE flux map results obtained at the uprated power level were compared to Technical Specification limits to assure compliance. Table 7 below shows a comparison between the predicted and measured change in certain core physics parameters due to the 1.4% power uprate at Salem Unit 2. The pre-uprate results are at a cycle burnup of 7125 MWD/MTU, while the post-uprate results are at a cycle burnup of 8171 MWD/MTU. All parameters include appropriate uncertainties.

TABLE 7

Comparison of the Change in Measured and Predicted Core Physics Results Between Pre and Post Power Uprate Conditions for Salem Unit 2 Cycle 12

Parameter	Design Value Pre-Uprate	Design Value Post-Uprate	Change in Design Value Pre to Post Uprate*	Measured Value Pre-Uprate	Measured Value Post-Uprate	Change in Measured Value Pre to Post Uprate**
$F_{\Delta H}$	1.539	1.538	-0.06%	1.604	1.611	+0.44%
F_Q	1.896	1.886	-0.53%	2.013	1.999	-0.70%
F_{xy}	1.672	1.667	-0.30%	1.767	1.766	-0.06%
Axial Offset (AO)	-2.93%	-3.15%	-0.22%***	-1.660	-1.797	-0.14%***

* Change in Design Value Pre to Post Uprate =
[(Design Value Post-Uprate – Design Value Pre-Uprate) / Design Value Pre-Uprate]*100

** Change in Measured Value Pre to Post Uprate =
[(Measured Value Post-Uprate – Measured Value Pre-Uprate) / Measured Value Pre-Uprate]*100

*** For Axial Offset, the Change in Design Value Pre to Post Uprate =
[Design Value Post-Uprate – Design Value Pre-Uprate] additionally, the Change in Measured Value Pre to Post Uprate = [Measured Value Post-Uprate – Measured Value Pre-Uprate]

As shown in Table 7 above, the measured change in core physics parameters, between pre and post power uprate conditions, is consistent with prediction.

The INCORE flux map results obtained at the uprated power level (3459 MWt) were also compared to Technical Specification limits to assure compliance. Tables 8, 9 and 10 compare measured peaking factor results against Technical Specification limits. All Technical Specification limits were met at the uprated power level.

TABLE 8

Salem Unit 2 Cycle 12 Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}$) at 8171 MWD/MTU, HFP (3459 MWt), ARO, Equilibrium Poison Conditions			
Test Conditions (Core Power Level)	**Measured Value**	**Required Value 1.65[1.0+0.3(1-P)]**	**Pass/Fail**
100%	1.611	< 1.650	Pass

TABLE 9

Salem Unit 2 Cycle 12 Maximum Heat Flux Hot Channel Factor ($F_Q(z)$) at 8171 MWD/MTU, HFP (3459 MWt), ARO, Equilibrium Poison Conditions			
Test Conditions (Core Power Level)	**Measured Value**	**Required Value***	**Pass/Fail**
100%	1.999	< 2.40	Pass

*Corresponds to limit at axial height with highest F_Q value.

TABLE 10

Salem Unit 2 Cycle 12 Maximum Computed Radial Peaking Factor (F_{xy}) at 8171 MWD/MTU, HFP (3459 MWt), ARO, Equilibrium Poison Conditions			
Test Conditions (Core Power Level)	**Measured Value**	**Required Value**	**Pass/Fail**
100%	Rodded = N/A	Rodded = N/A	Pass
	Unrodded = 1.766	Unrodded = < 1.770	