PSE&G

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Nuclear Business Unit

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United States Nuclear Regulatory Commission
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Gentlemen:

SALEM UNIT 1 CYCLE 14 STARTUP REPORT
SALEM GENERATING STATION - UNIT 1
F0ACILITY OPERATING LICENSE DPR-70
DOCKET NO. 50-272

Public Service Electric & Gas (PSE&G) Company hereby submits a summary report of plant startup and power ascension testing for Salem Unit 1 Cycle 14 in accordance with the requirements of Technical Specification 6.9.1.1. The report is required since fuel of a new design was installed for Cycle 14. A description of the fuel design changes and the summary of testing are included in Attachment 1.

Should you have any questions regarding this submittal, please contact C. Manges at (856) 339-3234.

Sincerely,

G. Salamon
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Attachment

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ATTACHMENT
SALEM UNIT 1 CYCLE 14 STARTUP REPORT

Salem Unit 1 began its fourteenth cycle of operation on October 25, 1999 and will complete this cycle of operation on April 7, 2001. The burnup at the end of Cycle 14 is predicted to be approximately 19300 MWD/MTU. The Cycle 14 reload included one region of fresh Westinghouse RFA (Robust Fuel Assembly) fuel. This feed region, designated Region 16, consists of seventy-two assemblies enriched to 4.405 w/o U^{235}. This feed region also uses 528 fresh wet annular burnable absorber (WABA) rods and 6528 1.25X (~1.9625 mg/in B^{10}) integral fuel burnable absorber (IFBA) rods. Cycle 14 is the first Salem Unit 1 reload to use intermediate flow mixer (IFM) grids, the 1.25X IFBA loading, annular fuel pellets at the top and bottom 6 inches of the Region 16 fuel, and a protective bottom grid (a debris mitigation feature). Additionally, the Cycle 14 reload will be the first reload for Salem to use WABA as the discrete burnable absorber.

The Cycle 14 reload core introduced a new fuel design, as well as a new burnable absorber design, to the Salem Unit 1 reactor. The reload core design was verified during the reactor startup physics testing program.

The program included the following tests:

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

Salem Unit 1 Cycle 14 is the first cycle at Salem Unit 1 to use the Dynamic Rod Worth Measurement methodology. Critical boron, bank worth, and temperature coefficient measurement results are provided in Tables 1, 2, and 3 respectively. Comparisons to appropriate review and/or acceptance criteria are provided. Since the review criteria are typically more restrictive than acceptance criteria for measured to predicted comparisons, only comparisons to the review criteria are provided.

TABLE 1

Salem Unit 1 Cycle 14 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**
1845	1851	1801 - 1901	Pass

TABLE 2

Salem Unit 1 Cycle 14 Dynamic Rod Worth Measurement (DRWM) Results				
Rod Bank	**Measured Worth (pcm)**	**Design Value (pcm)**	**Review Criteria**	**Pass/Fail**
D	736.4	735.2	± 15 %	Pass
C	536.6	545.4	± 100 pcm	Pass
B	539.0	538.4	± 100 pcm	Pass
A	845.7	782.9	± 15 %	Pass
SD	425.8	430.1	± 100 pcm	Pass
SC	280.5	279.9	± 100 pcm	Pass
SB	852.4	843.8	± 15 %	Pass
SA	1045.2	1009.8	± 15 %	Pass
Total	5261.6	5165.5	± 8 %	Pass

TABLE 3

Salem Unit 1 Cycle 14 BOL HZP ARO Isothermal Temperature Coefficient (ITC) Measurement and Inferred Most Limiting Moderator Temperature Coefficient (MTC)	
Parameter	**Value**
ITC Measured Value (pcm/ °F)	-3.30
ITC Design Value (pcm/ °F)	-2.55
Design Review Criteria Range (± 2 pcm/ °F)	-1.30 to -5.30
Pass/Fail	Pass
MTC Inferred Value * (pcm/ °F)	-1.60
MTC Acceptance Value (pcm/ °F)	< 0
Pass/Fail	Pass

* Measured MTC value is corrected to the most limiting burnup for MTC (~150 MWD/MTU)

Due to the satisfactory completion of startup physics testing for Salem Unit 1 Cycle 14, 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 that met the Technical Specification limits for the flux map power level; however, the 23.7% flux map did not meet the full power limit for F_{xy}. Not meeting the full power limit for F_{xy} requires that F_{xy} be measured within 24 hours of a power increase of greater than 20% from the last time F_{xy} was measured. The second flux map, first at 44.5% power, met the Technical Specification limit for that power level and the full power limit; therefore, the hold for F_{xy} measurement was lifted. An additional flux map was performed at 44.5% power to ensure that the results previously obtained at 44.5% power were valid since the first map at this power was taken in a transient condition. All peaking factors were again verified at 44.5% power and power ascension to full power was initiated. The first near full power, 96.9% flux map was taken on November 2, 1999. This flux map showed acceptable comparisons to peaking factor limits, with at least 3% margin to the $F_{\Delta H}$ and F_{xy} Technical Specification limits and 18% margin to the F_Q Technical Specification limit.

TABLE 4

Salem Unit 1 Cycle 14 Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$) as a Function of INCORE Map Power Level Near BOL			
Test Conditions (Power)	**Measured Values**	**Required Value 1.65[1.0+0.3(1-P)]**	**Pass/Fail**
23.7 %	1.707	<2.028	Pass
44.5 %	1.664	<1.925	Pass
44.5 %	1.657	<1.925	Pass
96.9 %	1.585	<1.665	Pass
100.0%	1.588	<1.65	Pass

TABLE 5

Salem Unit 1 Cycle 14 Maximum Heat Flux Hot Channel Factor ($F_Q(z)$) as a Function of INCORE Map Power Level Near BOL			
Test Conditions (Power)	**Measured Values**	**Required Value***	**Pass/Fail**
23.7 %	2.3393	<4.7400	Pass
44.5 %	2.1669	<4.7040	Pass
44.5 %	2.1654	<4.7760	Pass
96.9 %	2.0293	<2.4767	Pass
100.0%	2.0944	<2.400	Pass

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

TABLE 6

Salem Unit 1 Cycle 14 Maximum Computed Radial Peaking Factor (F^C_{xy}) as a Function of INCORE Map Power Level and Rodded Condition for Surveilled Core Axial Heights			
Test Conditions (Power)	**Measured Values**	**Required Value**	**Pass/Fail**
23.7 %	Rodded = 1.9026	Rodded < 2.6176	Pass
	Unrodded = 1.8059	Unrodded < 2.175	
44.5 %	Rodded = N/A	Rodded = N/A	Pass
	Unrodded = 1.7549	Unrodded < 2.065	
44.5 %	Rodded = 1.8383	Rodded < 2.4846	Pass
	Unrodded = 1.7469	Unrodded < 2.065	
96.9 %	Rodded = N/A	Rodded = N/A	Pass
	Unrodded = 1.7195	Unrodded < 1.786	
100.0%	Rodded = N/A	Rodded = N/A	Pass
	Unrodded = 1.749	Unrodded < 1.77	