

TABLE 15.3-1

## SALEM UNIT 1 SMALL BREAK LOCA ANALYSIS TIME SEQUENCE OF EVENTS

Break Spectrum (High  $T_{avg}$ )

	<u>4-inch</u>	<u>3-inch</u>	<u>2-inch</u>	<u>1.5-inch</u>
Break Occurs (sec)	0.0	0.0	0.0	0.0
Reactor Trip Signal (sec)	22.88	41.72	188.84	104.02
Safety Injection Signal (sec)	22.88	41.72	188.84	112.76
Safety Injection Begins (sec)	54.1	73.5	220.5	144.5
Loop Seal Venting (sec)	320	588	1308	2604
Top of Core Uncovered (sec)	540	922	1918	N/A <sup>1</sup>
Accumulator Injection Begins (sec)	810	1830	N/A	N/A <sup>1</sup>
Peak Clad Temperature Occurs (sec)	883	1532	3275	N/A
Top Of Core Covered (sec)	1300	2650	6630	N/A <sup>1</sup>

## Results for the 2-inch break size

	High $T_{avg}$	Low $T_{avg}$
Break Occurs (sec)	0.0	0.0
Reactor Trip Signal (sec)	188.84	55.21
Safety Injection Signal (sec)	188.84	55.21
Safety Injection Begins (sec)	220.5	91.0
Loop Seal Venting (sec)	1308	1448
Top Of Core Uncovered (sec)	1918	2152
Accumulator Injection Begins (sec)	N/A	N/A
Peak Clad Temperature Occurs (sec)	3275	3333
Top Of Core Covered (sec)	6630	6560

<sup>1</sup> Momentary core uncovering occurred during prelude to loop seal clearing. Extended core uncovering was not experienced. The momentary temperature excursion maintains clad temperatures well below 700°F.

TABLE 15.3-1a

SALEM UNIT 2 SMALL BREAK LOCA ANALYSIS TIME SEQUENCE OF EVENTS  
Break Spectrum

	<u>4-inch</u>	<u>3-inch</u>	<u>2-inch</u>
Break Occurs (sec)	0.0	0.0	0.0
Reactor Trip Signal (sec)	14.9	26	63
Safety Injection Signal (sec)	14.9	26	63
Safety Injection Begins (sec)	46.9	58	95
Loop Seal Clearing (sec)	311	535	1353
Top of Core Uncovered (sec)	644	723	1727
Accumulator Injection Begins (sec)	881	2025	N/A
Peak Clad Temperature Occurs (sec)	971	812	2004
Top Of Core Covered (sec)	1293	2272	3638

TABLE 15.3-2

## SALEM UNIT 1 INPUT PARAMETERS USED IN THE ECCS ANALYSES

Parameter	High $T_{avg}$	Low $T_{avg}$
Reactor core rated-thermal power <sup>1,7</sup> , (Mwt)	3411	3411
Peak linear power <sup>1,2</sup> (kw/ft)	12.812	12.812
Total peaking factor ( $F_Q^T$ at peak <sup>2</sup> )	2.40	2.40
Power shape	See Figure 15.3-2	
$F_{CH}$	1.65	1.65
Fuel <sup>3</sup>	17 x 17	17 x 17
Accumulator water volume, nominal (ft <sup>3</sup> /accumulator)	850	850
Accumulator tank volume, nominal (ft <sup>3</sup> /accumulator) <sup>4</sup>	1350	1350
Pumped safety injection flow	See Figure 15.3-3	
Steam generator tube plugging level (%) <sup>5</sup>	25	25
Thermal Design Flow/loop, (gpm)	82,500	82,500
Vessel average temperature, (°F)	580	566
Reactor coolant pressure, (psia)	2300	2300
Min. aux. feedwater flowrate/loop, (lb/sec) <sup>6</sup>	44.13	44.13

NOTES

- 1 Two percent is added to this power to account for calorimetric error. Reactor coolant pump heat is not modeled in the SBLOCA analyses.
- 2 This represents a power shape corresponding to a peaking factor envelope ( $K_{(z)}$ ) based on  $F_Q^T = 2.40$ .
- 3 The Performance + fuel features analyzed included ZIRLO™ cladding. Zirc-4 cladding was analyzed and ZIRLO™ cladding was determined to be limiting. Results are not included in this report because the differences in PCT's between fuel cladding materials was insignificant. The analysis bounds operation with PERFORMANCE + VANTAGE-5H, and STANDARD (275 psig backfill) fuels.
- 4 Accumulator gas pressure is consistent with Technical Specification minimum minus uncertainties.
- 5 Uniform.
- 6 Flowrates per steam generator.
- 7 Small Break LOCA Analysis was performed at 3411 Mwt with 2 percent calorimetric uncertainty. A subsequent evaluation has allowed an uprate to 3459 Mwt due to calorimetric uncertainty reduction. This increase in power does not change the ultimate analyzed core power and therefore, the uprated conditions were not explicitly analyzed. As such, no changes are required to Table 15.3-2.

TABLE 15.3-2a

## SALEM UNIT 2 INPUT PARAMETERS USED IN THE ECCS ANALYSES

Parameter	
Reactor core rated-thermal power <sup>1</sup> , (Mwt)	3459
Peak linear power <sup>1,2</sup> (kw/ft)	13.896
Total peaking factor ( $F_Q^T$ at peak <sup>2</sup> )	2.50
Power shape	See Figure 15.3-2a
$F_{DH}$	1.65
Fuel <sup>3</sup>	17 x 17
Accumulator water volume, nominal (ft <sup>3</sup> /accumulator)	850
Accumulator tank volume, nominal (ft <sup>3</sup> /accumulator) <sup>4</sup>	1350
Pumped safety injection flow	See Figure 15.3-3a
Steam generator tube plugging level (%) <sup>5</sup>	10
Thermal Design Flow/loop, (gpm)	82,500
Vessel average temperature, (°F)	566-577.9
Reactor coolant pressure, (psia)	2300
Min. aux. feedwater flowrate/loop, (lb/sec) <sup>6</sup>	44.0

## NOTES

- 0.6 percent is added to this power to account for calorimetric error. Reactor coolant pump heat is not modeled in the SBLOCA analyses.
- This represents a power shape corresponding to a peaking factor envelope ( $K_{(z)}$ ) based on  $F_Q^T = 2.502$ .
- The Performance + fuel features analyzed included ZIRLO™ cladding. The analysis bounds operation with PERFORMANCE + VANTAGE-5H, STANDARD and RFA (275 psig backfill) fuels.
- Accumulator gas pressure is consistent with Technical Specification minimum minus uncertainties.
- Uniform.
- Flowrates per steam generator.

TABLE 15.3-3

## SALEM UNIT 1 SMALL BREAK LOCA ANALYSIS FUEL CLADDING RESULTS

Break Spectrum, (High  $T_{avg}$ )

	<u>4-inch</u>	<u>3-inch</u>	<u>2-inch</u>	<u>1.5-inch</u>
Peak Clad Temperature (°F)	1343	1508	1580	N/A <sup>1</sup>
Peak Clad Temperature Location (ft)	11.25	11.50	11.50	N/A
Peak Clad Temperature Time (sec)	883	1532	3275	N/A
Local Zr/H <sub>2</sub> O Reaction, Max (%)	0.1323	0.7343	1.5456	0.0333
Local Zr/H <sub>2</sub> O Reaction Location (ft)	11.25	11.50	11.75	11.00
Total Zr/H <sub>2</sub> O Reaction (%)	< 1.0	< 1.0	< 1.0	< 1.0
Hot Rod Burst Time (sec)	No Burst	No Burst	No Burst	No Burst
Hot Rod Burst Location (ft)	N/A	N/A	N/A	N/A

## Results for the 2-inch break size

	High $T_{avg}$	Low $T_{avg}$
Peak Clad Temperature (°F)	1580	1558
Peak Clad Temperature Location (ft)	11.50	11.75
Peak Clad Temperature Time (sec)	3275	3333
Local Zr/H <sub>2</sub> O Reaction, Max (%)	1.5456	1.3064
Local Zr/H <sub>2</sub> O Reaction Location (ft)	11.75	11.75
Total Zr/H <sub>2</sub> O Reaction (%)	< 1.0	< 1.0
Hot Rod Burst Time (sec)	No Burst	No Burst
Hot Rod Burst Location (ft)	N/A	N/A

<sup>1</sup> Momentary core uncover occurred during prelude to loop seal clearing. Extended core uncover was not experienced. The momentary temperature excursion maintains clad temperatures well below 700°F.

TABLE 15.3-3a

## SALEM UNIT 2 SMALL BREAK LOCA ANALYSIS FUEL CLADDING RESULTS

## Break Spectrum

	<u>4-inch</u>	<u>3-inch</u>	3-inch w/ Annular <u>Pellets</u>	<u>2-inch</u>
Peak Clad Temperature (°F)	964	987	987	910
Peak Clad Temperature Location (ft)	10.75	10.25	10.25	10.75
Peak Clad Temperature Time (sec)	971	812	812	2004
Local Zr/H <sub>2</sub> O Reaction, Max (%)	0.01	0.01	0.01	0.00
Local Zr/H <sub>2</sub> O Reaction Location (ft)	10.75	10.75	10.75	11.00
Total Zr/H <sub>2</sub> O Reaction (%)	< 1.0	< 1.0	< 1.0	< 1.0
Hot Rod Burst Time (sec)	No Burst	No Burst	No Burst	No Burst
Hot Rod Burst Location (ft)	N/A	N/A	N/A	N/A

TABLE 15.3-4

## TIME SEQUENCE OF EVENTS FOR COMPLETE LOSS OF FLOW EVENTS

<u>Accident</u>	<u>Event</u>	<u>Time (sec)</u>
Undervoltage Event	All reactor coolant pumps begin to coast	0.0
	Undervoltage reactor trip	0.0
	Rods begin to drop	1.5
	Minimum DNBR occurs	3.4
Underfrequency Event	Frequency decay begins and RCS flow is reduced	0.0
	Underfrequency reactor trip	1.2
	Rods begin to drop	1.8
	Minimum DNBR occurs	3.9