FPL

Florida Power & Light Company, 6501 S. Ocean Drive, Jensen Beach, FL 34957

November 13, 2009

L-2009-208
10 CFR 50.4

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389
Extended Power Uprate
Data for NRC Confirmatory EPU analyses

This letter provides additional data requested by the NRC via emails dated May 28, 2008, and December 7, 2008, that is needed to build PSL-specific LOCA models for the NRC's confirmatory EPU analyses. This data is provided in Attachments 1 and 2. Attachment 2 contains proprietary information to be withheld from public disclosure per 10 CFR 2.390. Attachment 3 contains a signed affidavit for the basis for the proprietary nature of Attachment 2. Attachment 4 contains a non-proprietary version of Attachment 2.

Please contact Ken Frehafer at 772-467-7748 or Kathy Rydman at 772-467-7680 if there are any questions regarding this information.

Sincerely,

ES Katzman

Eric S. Katzman
Licensing Manager
St. Lucie Plant

ESK/KWF

Attachments

A001
NRR

ST. LUCIE UNIT 2 EPU Input Data Request to NRC for LOCA Model

Item No.	Parameter –Description	Units	Value	Comments
1.	**Plant Operating Conditions**			
1a.	For rated power conditions (Current):			
	1. Primary and Secondary Flow rates:			
	1.1. Core flow	gpm	403,500	Unc: ± 14,500 gpm and min flow is 335,000.
	1.2. Main coolant pumps	gpm	97,500 (2A1) 96,000 (2A2) 95,000 (2B1) 94,000 (2B2)	RCP Pump Test Data
	1.3. Steam flow	lbm/hr	See Item 1a 7.1	--------
	1.4. Feedwater flow	lbm/hr	See Item 1a 7.1	--------
	1.5. SG recirculation ratio/boiler section flow	Power- %CircRatio	Power %Circ Ratio 20 18.41 50 7.91 70 5.42 90 3.96 100 3.46	--------
	2. Primary and Secondary Pressures:			
	2.1. Pressurizer	psia	2250	Nominal Operating Pressure is 2250 psia. Pressure range is 2225 to 2275, with Unc: ± 45

Item No.	Parameter –Description	Units	Value	Comments
				Normal, ± 90 Accident.
	2.2. Core inlet	psia	2286	Based on 2250 psia core outlet and 35.5 psi core pressure drop (UFSAR Table 4.4-4).
	2.3. Core outlet	psia	2250	Assumed to be the same as the pressurizer.
	2.4. Reactor coolant pump discharge	psia	2287	Assume a 1 psi pressure drop from RCP discharge to core inlet.
	2.5. Steam generator dome	psia	886.81	SG outlet pressure from benchmark heat balance plus dP to upstream of flow restrictor
	2.6. Turbine control valve inlet	psia	See Item 1a 7.3	--------
	2.7 Detailed primary loop pressure drop distribution	psi	Table 13 below	Assumes 10% SG tube plugging.
	3. Primary and Secondary Temperatures:			
	3.1. Hot leg	°F	595	Assumed to be the same as the core outlet temperature since the Rx vessel does not have upper head injection.
	3.2. Cold leg	°F	549 Unc: ± 3°F	Tcold temperature at full power.
	3.3. Core outlet	°F	595	--------
	3.4. Upper Head	°F	595	Assumed to be the same as the core outlet temperature since the Rx

Item No.	Parameter –Description	Units	Value	Comments
				vessel does not have upper head injection.
	4. Water levels in the pressurizer and steam generators,			
	4.1. Pressurizer	% Tap Span	See Figure 1	--------
	4.2. Steam Generators	in	411.3	Level above tubesheet
	5. Leakage flows (Bypass):	% of vessel flow	3.7	This is the total core bypass maximum value for minimum core flow rate.
	5.1. Outlet nozzle clearances	percent	1.12	Assume bypass breakdown documented in Unit 1 UFSAR due to unit similarities.
	5.2. Downcomer to upper head	percent	0.16	Assume bypass breakdown documented in Unit 1 UFSAR due to unit similarities.
	5.3. CEA shrouds	percent	N/A	Equivalent to a fraction of the leakage through guide tubes (item 1a.5.5.1). This has not been quantified.
	5.4. Upper head to upper plenum (guide structure holes)	percent	N/A	This has not been quantified.
	5.5. Core bypass (guide tubes, barrel-baffle)			
	5.5.1. Guide tubes	percent	1.76	Assume bypass breakdown documented in Unit 1 UFSAR due to unit similarities.

Item No.	Parameter –Description	Units	Value	Comments
	5.5.2. Barrel-baffle	percent	0.47	Assume bypass breakdown documented in Unit 1 UFSAR due to unit similarities.
	6. Steam generator recirculation ratio	Power-%CircRatio	See Item 1a 1.5	--------
	7. Heat balance information such as:			
	7.1. Feed and steam flows	lbm/hr	11,905,010 11,806,740	Benchmark Heat Balance
	7.2. Feedwater temperature	°F	435	Benchmark Heat Balance
	7.3. Turbine inlet pressure.	psia	852.7	Benchmark Heat Balance, Turbine Inlet Valve
1.	**Plant Operating Conditions**			
1b.	For EPU conditions.			
	1. Primary and Secondary Flow rates:			
	1.1. Core flow	gpm	403,500	Minimum flow is 375,000 gpm.
	1.2. Reactor coolant pumps	gpm	97,500 (2A1) 96,000 (2A2) 95,000 (2B1) 94,000 (2B2)	RCP Pump Test Data
	1.3. Steam flow	lbm/s	See Item 1b 7.1	--------
	1.4. Feedwater flow	lbm/hr	See Item 1b 7.1	--------
	1.5. SG recirculation ratio/boiler section flow	Power- %CircRatio	Power %Circ Ratio 25 13.86 50 7.06 75 4.40	--------

Item No.	Parameter –Description	Units	Value	Comments
			100 3.02	
	2. Primary and Secondary Pressures (absolute pressures):			
	2.1. Pressurizer	psia	2250	Range: 2225 to 2275 psia. Unc.: ± 45 psi normal, ± 90 psi harsh.
	2.2. Core inlet	psia	2286	Assumed to remain similar to current conditions.
	2.3. Core outlet	psia	2250	Assumed to remain similar to current conditions.
	2.4. Reactor coolant pump discharge	psia	2287	Assumed to remain similar to current conditions.
	2.5. Steam generator dome	psia	895.8	**PRELIMINARY** SG outlet pressure from heat balance plus dP to upstream of flow restrictor extrapolated using EPU flow
	2.6. Turbine control valve inlet	psia	See Item 1b.7.3	--------
	2.7 Detailed primary loop pressure drop distribution	psi	Table 13 below	Assumes 10% SG tube plugging.
	3. Primary and Secondary Temperatures:			
	3.1 Hot leg	°F	606.0	Assumes 10% SG tube plugging.
	3.2 Cold leg	°F	551 Unc: ± 3F	Corresponds to 100% Power. Tcold at zero power is 532F.
	3.3 Core outlet	°F	607.9	Assumes 10% SG tube plugging.
	3.4 Upper Head	°F	606.0	Assumed to be the same

Item No.	Parameter –Description	Units	Value	Comments
				as vessel outlet.
	4 Water levels in the pressurizer and steam generators			
	4.1 Pressurizer	% Tap Span	See Figure 1 below	--------
	4.2 Steam Generators	in	411.3	Level above tubesheet
	5 Leakage flows:	% of vessel flow	3.7	--------
	5.1 Outlet nozzle clearances	percent	1.12	Assumed to be similar to current operating value.
	5.2 DC to upper head	percent	0.16	Assumed to be similar to current operating value.
	5.3 CEA shrouds	percent	N/A	This has not been quantified.
	5.4 Upper head to upper plenum (guide structure holes)	percent	N/A	This has not been quantified.
	5.5 Core bypass (guide tubes, barrel-baffle)			
	5.5.1 Guide tubes	percent	1.76	Assumed to be similar to current operating value.
	5.5.2 Barrel-baffle	percent	0.47	Assumed to be similar to current operating value.
	6 Steam generator recirculation ratio	Power-%CircRatio	See Item 1b.1.5	--------
	7 Heat balance information such as:			
	7.1 Feedwater and steam flows	lbm/hr	See Table 14	--------
	7.2 Feedwater temperature	°F	See Table 14	--------
	7.3 Turbine inlet pressure.	psia	See Table 14	--------
2.	**Analysis Topical Reports**			
	1. Topical Report on the licensing analysis of record for LOCA at rated power and EPU	See Comment	See Comment	See References provided below applicable to rated power:

Item No.	Parameter –Description	Units	Value	Comments
	conditions.			• CENPD-132, through Suppl. 4-P-A, "Calculative Method for the CE Nuclear Power Large Break LOCA Evaluation Model", March 2001. • CENPD-137, through Suppl. 2-P-A, "Calculative Method for the ABB CE Small Break LOCA Evaluation Model", "April 1998. No new Topical Reports for EPU analyses. Analysis results are in the UFSAR.
3.	**Safety System Logic, Setpoints and Delay Times**			
	Critical Safety Parameters List (also called "Groundrules document") for the last reload for:			
	1. ESFAS	See Table 5	See Table 5	See Table 5
	2. RPS	See Table 5	See Table 5	See Table 5
	3. SGIS/MSIS	See Table 5	See Table 5	See Table 5
	4. PORV	See Table 5	See Table 5	See Table 5
	5. SRV.	See Table 5	See Table 5	See Table 5
4.	**Primary and Secondary Pressure Drops**			

Item No.	Parameter –Description	Units	Value	Comments
	1. Primary side pressure drop distribution with corresponding flow rate, including leakage flows (from design data or vendor analyses).	See Table 13	See Table 13	--------
	2. Secondary side pressure drop distribution with corresponding flow rate, including leakage flows (from design data or vendor analyses).	Later	Later	Later
5.	**Core and Fuel Design**			
	1. Number of assemblies	N/A	217	--------
	2. Dimensions	N/A	Array: 16 x 16, Pitch: 8.180 in, Length: 158.5 in	The pitch is the sum of 7.972 and 0.208 = 8.180 in.
	3. Spacer grid locations and K-factors	N/A	See Table 4 for grid locations and K-factors.	--------
	4. Vessel pressure drops	psi	a) 5.0 b) 10.4 c) 13.4 d) 6.7	Current values: a) Inlet nozzle & 90 degree turn, b) Downcomer, lower plenum, support structure, c) Fuel assembly, d) Fuel assembly outlet to outlet nozzle.
	5. Bypass and leakage flows	% of total flow	See item 1a.5.5 above	Similar to Item 1a.5.5 above.
	6. Number and location of fuel rods.	N/A	236 per assy 51,212 total. See Figs. 3 and 4 below for location.	Some fuel rods contain burnable absorber material.

Item No.	Parameter –Description	Units	Value	Comments
	7. Number and location of guide tubes.	N/A	5 guide tubes per assy. See Fig. 3 below for location.	--------
6.	**Equipment Drawings and Design Reports**			
	To confirm the calculation of flow path lengths and elevations, flow areas, volumes, metal mass and surface areas (including pipe schedules), and form loss (due to bends, contractions, expansions, orifices, etc.) for the following equipment:			
	1. Reactor vessel and internals (identification of all core bypass flow paths and flow rates, including upper plenum or head to downcomer, if available).	---	See Table 3	---
	2. Primary loop piping (hot leg, cold leg, pump suction)	---	See Table 3	---
	3. Reactor coolant pumps	---	See Table 3	---
	4. Steam generators and internals (U-tube lengths, separators, inlet and outlet plenum, etc.), (TH Design Report)	---	See Table 3	---
	5. Pressurizer, surge line, spray lines, safety and relief valves and connecting lines, etc.	---	See Table 3	---
	6. Main steam lines out to the turbine stop valves, including safety and relief valves and	---	See Table 3	---

Item No.	Parameter –Description	Units	Value	Comments
	connecting lines, main steam isolation valves, flow restrictors, etc.			
	7. Main feedwater lines from the isolation valves to the steam generator inlet.	---	See Table 3	---
	8. Auxiliary feedwater lines and feedwater pump type, configuration and capacity.	---	See Table 3	---
	9. Safety injection equipment including SITs, high and low pressure injection systems and connecting piping.	---	See Table 3	---
	10. Charging and letdown system (CVCS).	---	See Table 3	---
	11. Residual heat removal system.	---	See Comments	See Item 6.9 for LPSI System. LPSI and RHR are the same system.
7.	**Reactor Vessel Internals**			
	Weight and surface area of reactor vessel internal structures:			
	8. Core support barrel	Lbs / sq. ft.	136,600 / 1126 Inside 1110 outside	Includes upper, center, and lower portions of the core support barrel; upper and lower flange; inner and outer nozzle areas.
	9. Core shroud	Lbs / sq. ft.	34,000 / 594 Inside 867 outside	Includes vertical and horizontal surfaces of the core shroud.
	10. Lower core support plate	Lbs / sq. ft.	8,000 / 260	Includes top and bottom surfaces; surface areas

Item No.	Parameter –Description	Units	Value	Comments
				inside the holes of the plate.
	11. Fuel alignment plate (Upper Core Plate)	Lbs / sq. ft.	9,900 / 331	Includes top and bottom surfaces; surface areas inside the holes of the plate.
	12. Upper guide structure	Lbs / sq. ft.	120,000 / 7,120	Includes CEA shrouds with extensions; total UGS plate, flange, beam, & cylinder areas; total fuel alignment plate area (Neglects guide tubes).
	13. Core support assembly	Lbs / sq. ft.	45,500 / 1193	Includes vertical webs; flanges; cylinder; columns; core support plate; bottom plate.
	14. Flow skirt	Lbs / sq. ft.	3,600 / 223	Includes top and bottom surfaces; surface areas inside the holes of the plate.
	15. Control element assembly (CEA) shrouds	Lbs / sq. ft.	48,000 / 1826 Inside 2100 outside	Does not include shroud extensions.
	16. Shroud extensions	Lbs / sq. ft.	10,400 / 866 Inside 1035 outside	-----
	17. Grid assemblies	Lbs / sq. ft.	18.5 / 5.0 per Grid	Each assembly has 9 grids for 217 assemblies.
8.	**Steam Generator Internals**			
	1. Weight of steam generator tube sheet and surface area of tube sheet exposed to primary side fluid.			
	1.1. Weight of Tube Sheet	lbm	93,230	Weight with integral

Item No.	Parameter –Description	Units	Value	Comments
				forged lower cylindrical ring and cladding
	1.2. Surface area of Tube Sheet (Primary Side)	ft^2	72.29	**PRELIMINARY** Estimated from tubesheet OD minus 2X tube OD
	2. Weight and surface area of steam generator wrapper.			
	2.1. Weight of SG wrapper	lbm	34,730	Includes wrapper roof
	2.2. Surface area of SG wrapper	ft^2	~1360	Wetted surface area on downcomer side
9.	**Steam Generator Fluid Volumes**			
	1. Inlet plenum	ft^3	338.4	Includes Manway
	2. Outlet plenum	ft^3	332.0	Includes Manway
	3. Active and inactive (within tube sheet) tubes	ft^3	1230.0 41.3	
	4. Number of steam generator tubes	-	8999	
	5. Length of shortest and longest	in	Single straight leg (not including tubesheet) 262.598 min 273.425 max Tube bend radius (to tube centerline) 4.134 min 73.134 max	
10.	**Steam Generator Parameters**			
	1. Inventory and recirculation ratio	lbm	Power Secondary Mass	Inventory at EPU conditions. Recirculation

Item No.	Parameter –Description	Units	Value	Comments
	versus load (essential at rated power conditions)		0 215680 25 184560 50 164650 75 150600 100 139430	ratios provided in Item 1b. 1.5
	2. SG flow areas, K-factors and flows	Later	Later	Later
11.	**MS Line Flow Restrictor**			
	1. Restrictor flow area	ft^2	1.91 per SG	1.91 ft^2 is the SG outlet nozzle area. The main line flow venturi area is 2.27 ft^2 per SG.
12.	**Steam Generator and Reactor Vessel Heights**			
	1. Volume versus height relationship for the steam generators with downcomer and boiler regions provided separately	See Table 6	See Table 6	--------
	2. Volume versus height for the reactor vessel with internals installed	See Table 6	See Table 6	--------
13.	**Reactor Coolant Pump Rated Conditions**			
	1. Head	ft	296.75	The value is the average of the four pump-specific values (303, 296, 293 & 295 ft)

Item No.	Parameter –Description	Units	Value	Comments
	2. Flow	gpm	87,750	The value is the average of the four pump-specific values (85,000 - 87,500 - 91,000 & 87,500 gpm)
	3. Torque	lbf-ft	33,950	The value is the average of the four pump-specific values (33,860 – 34,000 – 34,720 & 33,230 ft-lbf)
	4. Speed	rpm	900	Synchronous speed
	5. Density	lbm/ ft^3	47.5	The value is the average of the four pump-specific values (47.3, 47.4, 46.9 and 48.4 lbm/ ft^3)
	6. Homologous pump curves (four quadrant)	N/A	See Table 7	--------
	7. Pump inertia and friction (coefficients of polynomial in pump speed)	lbm-ft^2 ft-lbf	102,000 2735	Uncertainty value of $\pm$ 1% may be applied to pump inertia in the analysis to gain operating margin. - Constant for friction and windage torque.
	8. Coolant primary system fluid volume within pump	ft^3	112	--------
	9. RCP metal mass, excluding motor	lbs	75,000	Dry weight.
	10. Reverse rotation device operational for RCPs	N/A	Yes	RCP design torque for anti-reverse rotation device equal to 62,000 ft-lbf.
	11. Pump power to primary fluid	MWt	14.2 (nominal), 20 (max)	--------
	12. Coastdown characteristics	N/A	Figure 2	--------

Item No.	Parameter –Description	Units	Value	Comments
	13. Pump trip setpoints	N/A	Overcurrent	Overload Trip
	14. Pump time delays and logic	N/A	N/A	No safety related RCP trips.
14.	**Core Cooling System**			
	1. HPSI and LPSI delivery curves	gpm	See Tables 8, 9, 10, 11	The flows in the listed tables are for either loop, such that the listed flow is going through each loop listed. The broken loop in Tables 8 and 11 occurs in Loop A1.
	2. SIT total volume	ft^3	1855	Four tanks, each with this capacity.
	3. SIT initial pressure and liquid volume	• psia • ft^3	• (500 to 650 $\pm$ 15) • (1420 to 1556 $\pm$ 32)	TS ranges for SIT pressure and liquid volume.
	4. CST minimum capacity	gal	276,200	--------
	5. Charging pump flow versus pressure	gpm	40 (nominal) to 49 (maximum) 35 minimum, after uncertainties	Reciprocal pump. Flow is per charging pump. Nominal value does not include 4 gpm for RCP bleed-off.
15.a	**Control Systems**			
	Rated power operation of the primary and secondary control systems for:			
	1. SG water level instrumentation and control (three-element)	N/A	See Comment	Pre-EPU description of the SG water level control system is provided in UFSAR Figure 7.7-5. Additional information is contained

Item No.	Parameter –Description	Units	Value	Comments
				in System Description 0711408 "Steam Generators and Feedwater Control System"
	2. SG pressure (including bypass and ADV)	N/A	See Comment	Pre-EPU description of the Steam Bypass Control System is contained in UFSAR Sections 7.2.2.5.3, 7.4.1.4, 7.7.1.1.5, and 10.4.4. Reference Figure 19 (SBCS Simplified Block Diagram). See Essential Valve Characteristics Table 20 for operation of Atmospheric Dump Valves
	3. Pressurizer heaters and sprays	N/A	See Comment	Pre-EPU description of the Pressurizer Pressure Control System is provided in Figure 16
	4. Pressurizer level	N/A	See Comment	Pre-EPU description of the Pressurizer Level Control System is contained in Figures 1 and 17
	5. Auxiliary feedwater	N/A	See Comment	See Table 5 for Auxiliary Feedwater Actuation System setpoints. The Auxiliary Feedwater Actuation System logic is described in UFSAR Section 7.3.1.1.8 and

Item No.	Parameter –Description	Units	Value	Comments
				UFSAR Figures 7.3-12 (drawing 2998-12613) & 7.3.14 (drawing 2998-15003)
	6. CVCS (charging and letdown)	N/A	See Comment	Pre-EPU description of the CVCS System is contained in UFSAR Section 9.3.4
15.b	**Control Systems**			
	EPU condition operation of the primary and secondary control systems for:			
	1. SG water level instrumentation and control (three-element)	N/A	See Comment	Feedwater Control System will be rescaled to reflect new FW pumps, new FW control valves and an expanded nominal flow rate. The post-trip transition logic for main to low power FW control valves will also be revised to improve SG level response.
	2. SG pressure (including bypass and ADV)	N/A	See Comment	EPU does not change ADV control logic or setpoints. Steam Bypass valve capacity will be increased by EPU to restore design capacity in %RTP. The SBCS is functionally implemented in the plant Distributed Control System (DCS). SBCS

Item No.	Parameter –Description	Units	Value	Comments
				will be rescaled to match new valve Cv curves. Quick Open setpoint for sudden loss of load will be decreased from 30% to ≈15%. Transition from Quick Open logic to Modulation control will be modified (through the use of controller output signal tracking) to smooth the steam header pressure response.
	3. Pressurizer heaters and sprays	N/A	See Comment	EPU does not change the Pressurizer Pressure control logic or setpoints.
	4. Pressurizer level	N/A	See Comment	The Pressurizer Level Control Program will be rescaled to reflect the increased Tavg range from 0 to 100% RTP. Program endpoints in terms of volume will remain as is.
	5. Auxiliary feedwater	N/A	See Comment	EPU does not change the AFAS actuation logic or setpoints.
	6. CVCS (charging and letdown)	N/A	See Comment	EPU does not change CVCS control logic or setpoints
16.	**Reactor Vessel Upper Head**			
	1. Upper head fluid temperature	°F	See item 1.b.3.4 above.	Assume to be the same as the core outlet

Item No.	Parameter –Description	Units	Value	Comments
	at normal operating conditions.			temperature since the Rx vessel does not have upper head injection.
17.	**Essential Valve Characteristics**			
	Number of valves, full open flow area, forward/ reverse flow coefficients (CV's), open/close rate, minimum flow at rated conditions, logic for opening and closing the valves for:			
	1. Pressurizer PORVs	--------	See Tables 12 & 20	--------
	2. Pressurizer safety valves	--------	See Tables 12 & 20	--------
	3. Main steam safety valves	--------	See Tables 12 & 20	--------
	4. Atmospheric dump valves	--------	See Tables 12 & 20	--------
	5. TCVs (turbine control valves)	--------	See Tables 12 & 20	--------
	6. Turbine bypass valves	--------	See Tables 12 & 20	--------
	7. TSVs, (turbine stop valves)	--------	See Tables 12 & 20	--------
	8. MFIVs	--------	See Tables 12 & 20	--------
	9. MSIVs	--------	See Tables 12 & 20	--------
18. to 20.	**Reactor Core Parameters**			
	1. Control rod insertion versus time after scram	See Attachment 2	See Attachment 2	
	2. CEA worth versus insertion (with and without highest worth rod stuck out of core)	See Attachment 2	See Attachment 2	
	3. Reactivity versus fuel temperature and reactivity versus	See Attachment	See Attachment 2	

Item No.	Parameter –Description	Units	Value	Comments
	moderator density	2		
	4. Moderator temperature coefficient	See Attachment 2	See Attachment 2	
	5. Typical top peaked axial power profile	See Attachment 2	See Attachment 2	
	6. Minimum and maximum average fuel clad gap conductivity at rated power conditions	See Attachment 2	See Attachment 2	
	7. Minimum local gap conductance as a function of LHGR	See Attachment 2	See Attachment 2	
	8. Gap conductance	See Attachment 2	See Attachment 2	
	9. Linear heat rate	See Attachment 2	See Attachment 2	
	10. Fuel average and centerline temperature as a function of burnup for the hot rod in the hot bundle.	See Attachment 2	See Attachment 2	
	11. Specifications for modeling a small break LOCA, in particular what models/assumptions are used regarding loop seal clearing and hot channel conservatisms. The AREVA SBLOCA methodology topical report was provided and this is very useful. The FSAR or a report on the analysis of record is needed to move from the generic	See Attachment 2	See Attachment 2	

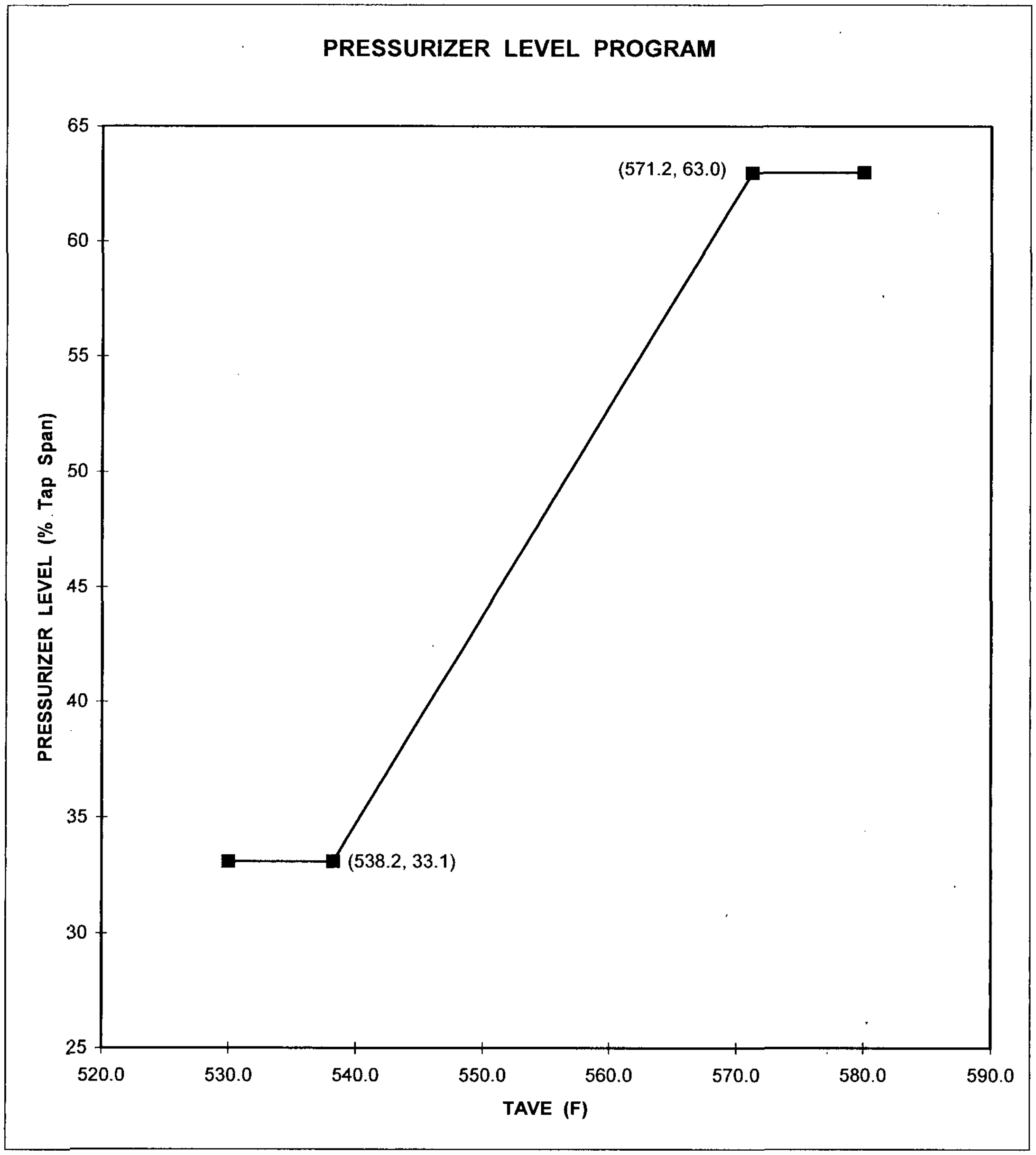
Item No.	Parameter –Description	Units	Value	Comments
	methodology to the plant specific application. Plots of key variables for the EPU LBLOCA and SBLOCA analyses, including containment pressure response.			
21.	**Operator Actions During LOCA**			
	1. Reactor coolant pump trips (conditions to trip pumps – automatic or manual)	None	Pumps automatically trip on LOOP	Accident analysis assumes LOOP concurrent with LOCA, and pumps are not loaded into EDGs or manually operated. Same assumption for EPU analysis.
	2. HPSI throttling criteria	None	See Comments Section.	If HPSI pumps are operating, and **ALL** of the following conditions are satisfied: • RCS subcooling is greater than or equal to minimum subcooling • Pressurizer level is at least 30% and NOT lowering, • At least **ONE** S/G is available for RCS heat removal with level being restored to or maintained between 60 and 70% NR,

Item No.	Parameter –Description	Units	Value	Comments
				• Rx Vessel level indicates sensors 4 through 8 are covered, or NO abnormal differences (greater than 20°F) between THOT and Rep CET temperature, Then, THROTTLE SI flow. Same assumption for EPU analysis.
	3. MS line break auxiliary feedwater control	N/A	See comment	Due to the design of the AFW system that automatically isolates the AFW from the broken loop, no auxiliary feedwater was assumed to be delivered during the post-trip MSLB event. No flow delivered for pre-trip MSLB either.
22.	**Core Operating Limits Report**	See Comment	See Comment	Most recent COLR provided to NRC via FPL letter L-2007-183, dated 11-19-2007. EPU COLR to be provided later after it is issued.
23.	**RCS Material Property Data**			
	For the various materials in the reactor coolant system (stainless steel, inconel, etc.):			
	1. Density	lb/ft^3	See Table 15	--------
	2. Specific heat	BTU/ lbm-°F	See Table 15	--------

Item No.	Parameter –Description	Units	Value	Comments
	3. Thermal conductivity	BTU/hr-ft-°F	See Table 15	--------
	2. Emissivity versus temperature	--------	See Table 15	--------
24.	**Power Level / Uncertainty (New Requests)**			
	1. Current Power Level	MWth	2700	--------
	2. Current Power Uncertainty (LBLOCA/SBLOCA)	%	2	Applicable for both LBLOCA and SBLOCA
	3. EPU Power Level	Mwth	3020	--------
	4. EPU Power Uncertainty (LBLOCA/SBLOCA)	%	0.3 @ full power.	Applicable for both LBLOCA and SBLOCA

Figure 1
ST. LUCIE UNIT 2
PRESSURIZER LEVEL PROGRAM

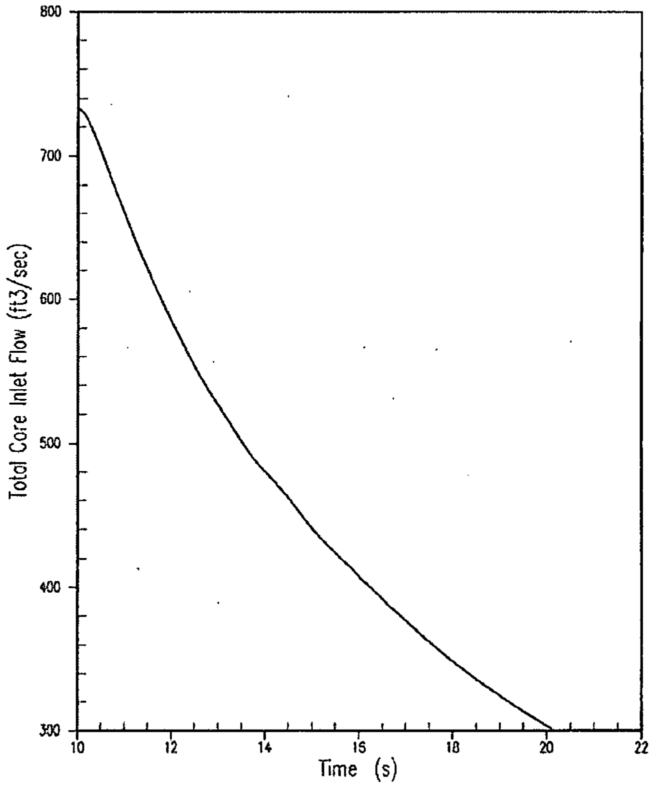
Note: The Values Refer to the Actual Plant Settings



Pressurizer Volume at 63.0% Span is 914 Cu. Ft.

Pressurizer Volume at 33.1% Span is 463 Cu. Ft.

Figure 2 – RCP Coastdown

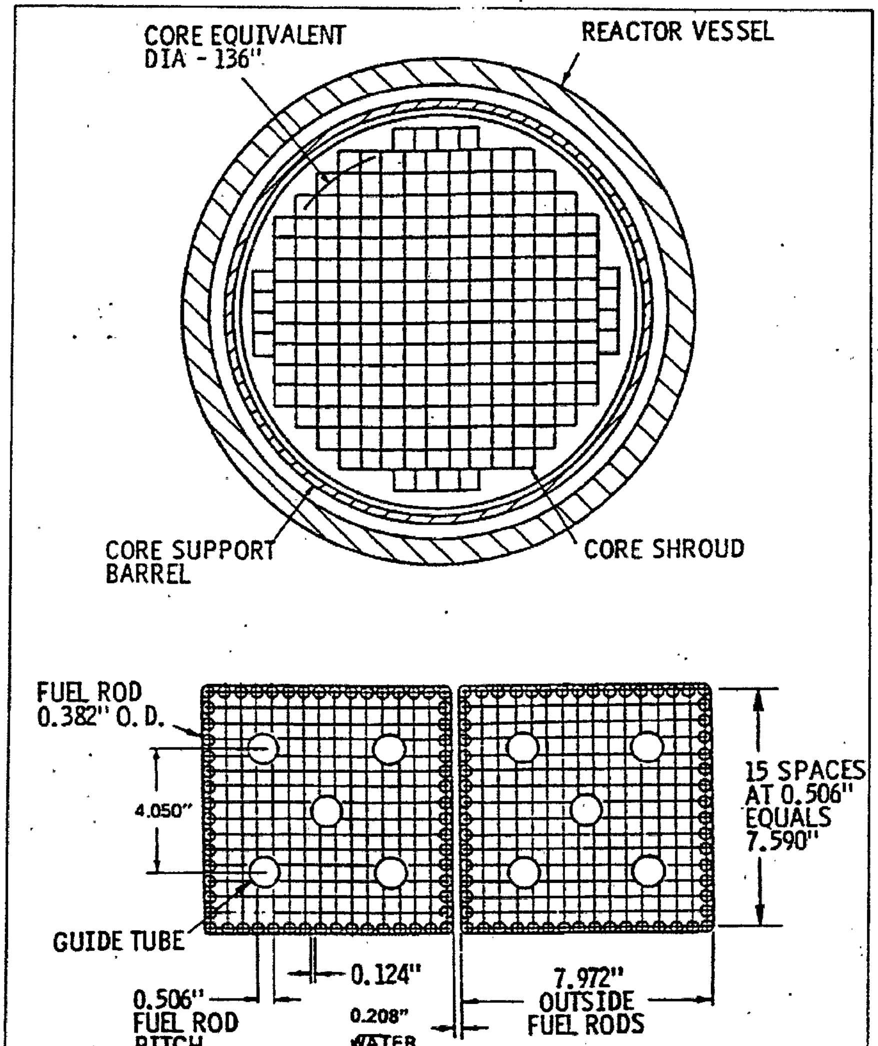


FLORIDA POWER & LIGHT COMPANY ST. LUCIE PLANT UNIT 2
FIGURE 15.3.2-1 Complete Loss of Flow – Four Pumps Coasting Down Total Core Inlet Flow versus Time

15.3-10 Amendment No. 17 (12/06)

Note: Curve represents current analyses.

Figure 3



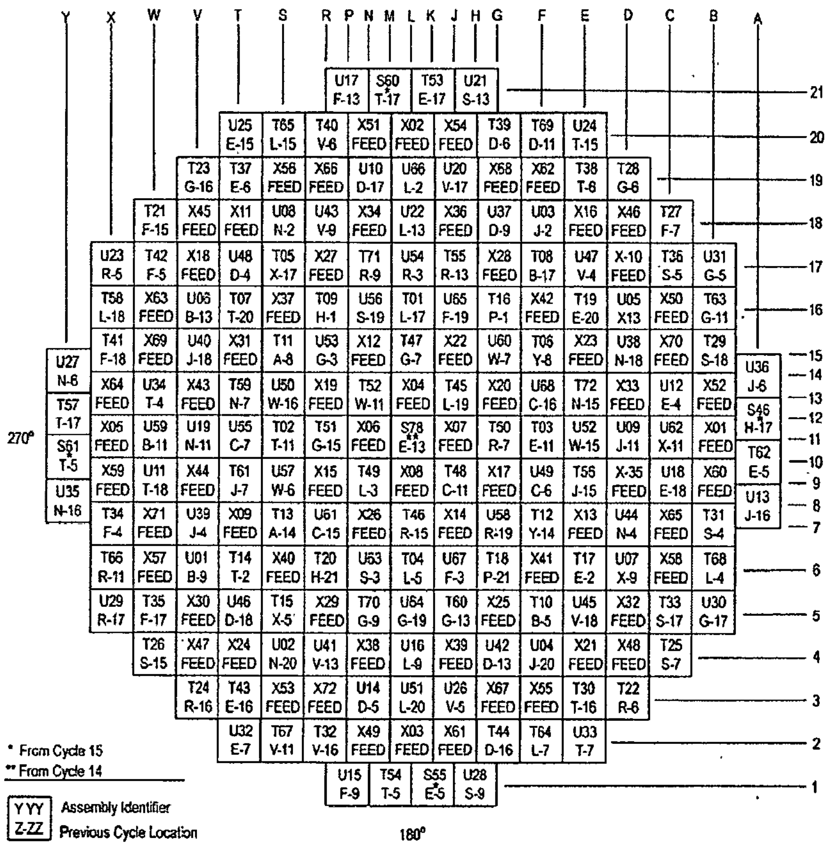
FLORIDA POWER & LIGHT
ST. LUCIE PLANT UNIT 2

REACTOR CORE CROSS SECTION

Amendment No. 13, (05/00)

FIGURE 4.1-2

Figure 4



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

CYCLE 17 REFERENCE
CORE LOADING PATTERN
FIGURE 4.3-65

Amendment No. 18 (01/08)

Table 1 (Not Used)

Table 2 (Not Used)

Table 3
Unit 2 Piping Isometric Drawings by P&ID

Flow Diagram	Component/Isometric Drawing
Reactor Vessel	
2998-G-078, Sheet 110, Rev. 08	2998-769, Rev. 2
Primary Loop Piping (RCS)	
2998-G-078, Sheet 110, Rev. 08	2998-2662, Rev. 4 2998-2132, Rev. 6 2998-3793, Rev. 1 2998-1887, Rev. 3 2998-1886, Rev. 6
Reactor Coolant Pumps	
2998-G-078, Sheet 111A, Rev. 11 2998-G-078, Sheet 111B, Rev. 10 2998-G-078, Sheet 111C, Rev. 13 2998-G-078, Sheet 111D, Rev. 10	2998-455, Rev. 6 2998-457, Rev. 8
Steam Generators	
2998-G-078, Sheet 110, Rev. 8 2998-G-079, Sheet 1, Rev. 41 2998-G-080, Sheet 2A, Rev. 43	2998-21342 Rev 0 (Later)
Pressurizer/Surge Line/Spray Lines/Relief Lines	
2998-G-078, Sheet 109, Rev. 18 2998-G-078, Sheet 108, Rev. 5	2998-506, Rev 4 2998-G-125, Sheet RC-AB-1, Rev 13 2998-G-125, Sheet RC-AB-2, Rev 11 2998-2048, Rev 5
Main Steam Lines Out to the Turbine Stop Valves	
2998-G-079, Sheet 1, Rev. 41 2998-G-079, Sheet 2, Rev. 35	2998-G-125, Sheet MS-L-1, Rev. 22 2998-G-125, Sheet MS-L-2, Rev. 22 2998-G-125, Sheet MS-L-3, Rev. 10 2998-G-125, Sheet MS-L-4, Rev. 16 2998-G-125, Sheet MS-L-13, Rev. 11 2998-G-125, Sheet MS-L-14, Rev. 16
Main Feedwater Lines from the Isolation Valves to the Steam Generator Inlet	
2998-G-080, Sheet 2A, Rev. 43	2998-G-125, Sheet BF-M-6, Rev. 17
Auxiliary Feedwater Lines	
2998-G-080, Sheet 2B, Rev. 36	2998-G-125, Sheet BF-M-7, Rev. 18 2998-G-125, Sheet BF-M-8, Rev. 20 2998-G-125, Sheet BF-M-9, Rev. 16
Safety Injection	
2998-G-078, Sheet 130A, Rev. 19 2998-G-078, Sheet 130B, Rev. 28 2998-G-078, Sheet 131, Rev. 20 2998-G-078, Sheet 132, Rev. 09 2998-G-078, Sheet 110, Rev. 08	2998-G-125, Sheet SI-N-4, Rev. 20 2998-G-125, Sheet SI-N-5, Rev. 19 2998-G-125, Sheet SI-N-6, Rev. 18 2998-G-125, Sheet SI-N-7, Rev. 15 2998-G-125, Sheet SI-N-8, Rev. 18 2998-G-125, Sheet SI-N-9, Rev. 20

	2998-G-125, Sheet SI-N-14, Rev. 25 2998-G-125, Sheet SI-N-16, Rev. 17 2998-G-125, Sheet SI-N-17, Rev. 14 2998-G-125, Sheet SI-N-18, Rev. 12 2998-G-125, Sheet SI-N-19, Rev. 15 2998-G-125, Sheet SI-N-20, Rev. 14 2998-G-125, Sheet SI-N-21, Rev. 13 2998-G-125, Sheet CS-K-1, Rev. 19 2998-G-125, Sheet CS-K-2, Rev. 20 2998-C-124, Sheet SI-1, Rev. 12 2998-C-124, Sheet SI-2, Rev. 10 2998-C-124, Sheet SI-3, Rev. 12 2998-C-124, Sheet SI-4, Rev. 13 2998-C-124, Sheet RC-1, Rev. 9 2998-C-124, Sheet RC-2, Rev. 13
Charging and Letdown System (CVCS)	
2998-G-078, Sheet 110, Rev. 08 2998-G-078, Sheet 120, Rev. 17 2998-G-078, Sheet 121A, Rev. 31 2998-G-078, Sheet 122, Rev. 25	2998-G-125, Sheet CH-G-1, Rev. 21 2998-G-125, Sheet CH-G-2, Rev. 19 2998-G-125, Sheet CH-G-3, Rev. 16 2998-G-125, Sheet CH-G-4, Rev. 21 2998-G-125, Sheet CH-G-10, Rev. 12 2998-G-125, Sheet CH-G-14, Rev. 11 2998-G-125, Sheet CH-G-15, Rev. 15 2998-G-125, Sheet CH-G-16, Rev. 06 2998-G-125, Sheet CH-G-17, Rev. 13 2998-C-124, Sheet CH-1, Rev. 11 2998-C-124, Sheet CH-3, Rev. 12 2998-C-124, Sheet CH-4, Rev. 09 2998-C-124, Sheet CH-6, Rev. 8 2998-C-124, Sheet CH-33, Rev. 7 2998-C-124, Sheet CH-72, Rev. 15 2998-C-124, Sheet CH-75, Rev. 14 2998-C-124, Sheet CH-78, Rev. 12 2998-C-124, Sheet CH-103, Rev. 9 2998-C-124, Sheet CH-104, Rev. 8 2998-C-124, Sheet CH-105, Rev. 6 2998-C-124, Sheet CH-106, Rev. 13 2998-C-124, Sheet CH-108, Rev. 7 2998-C-124, Sheet CH-109, Rev. 17 2998-C-124, Sheet CH-110, Rev. 14 2998-C-124, Sheet CH-111, Rev. 11 2998-C-124, Sheet CH-112, Rev. 13 2998-C-124, Sheet CH-129, Rev. 0 2998-C-124, Sheet RC-2, Rev. 13

Table 4
Spacer Grid Locations

Grid #	Distance (in)
1	5.175
2	22.375
3	38.188
4	54.000
5	69.812
6	85.625
7	101.438
8	117.250
9	133.062
10	148.875

Note: Measured from bottom of fuel assembly to top of grid.

K-Factors

Location	K-Factor
Core inlet region/ bottom grid	1.18
Mid-grid 8 spacers (total)	5.68
Top grid (Top grid representative of inconel top grid)	0.69
Upper End Fitting	0.53

Note: Conditions: 500F isothermal and 388,600 gpm vessel flow rate.

Table 5
RPS, ESFAS and AFAS Setpoints and Safety Analysis Limits

Functional Description	Monthly Surveillance Setpoint	Tech Spec Setpoint	Current Setpoint or Uncertainty Requirement (current cycle)	EPU Setpoint or Uncertainty Requirement	Comments
RPS PZR Press Hi	2360 psia	≤ 2370 psia	± 45 psi (Normal) ± 90 psi (Accident)	± 45 psi (Normal) ± 90 psi (Accident)	
RPS Cont. Press Hi	2.5 psig	≤ 3.0 psig	± 1.65 psi	± 1.65 psi	
RPS S/G Press Lo	626 psia	≥ 626 psia	± 40 psi (Normal) ± 80 psi (Accident)	± 40 psi (Normal) ± 80 psi (Accident)	
RPS S/G Level Lo	20.5%	≥ 20.5%	± 5% (Normal) ± 14% (Accident)	± 5% (Normal) ± 14% (Accident)	Monthly Surveillance Setpoint and Tech Spec Setpoint changed to 35% and ≥ 35% for EPU
RPS RCS Low Flow		≥ 95.4% Design Flow	3.5%	3.5% (Normal) 7.5% (Accident)	
SIAS/CIS Cont. Press Hi	3.41 psig	≤ 3.5 psig	± 1.65 psi	± 1.65 psi	
CSAS Cont. Press Hi-Hi	5.31 psig	≤ 5.4 psig	± 1.65 psi	± 1.65 psi	
SIAS PZR Press Lo	1740 psia	≥ 1736 psia	± 45 psi (Normal) ± 90 psi (Accident)	± 45 psi (Normal) ± 90 psi (Accident)	
MSIS S/G Press Lo	600 psia	≥ 600 psia	± 40 psi (Normal) ± 80 psi (Accident)	± 40 psi (Normal) ± 80 psi (Accident)	
RAS RWT Level Lo	5.67 feet	5.67 feet	± 6 inches	± 6 inches	
AFAS S/G Level Lo	19.5%	≥ 19.0%	± 5% (Normal) ± 14% (Accident)	± 5% (Normal) ± 14% (Accident)	
AFAS S/G Press DP Hi	270 psid	≤ 275 psid	Not specified	± 60 psi (Normal) ± 115 psi (Accident)	
AFAS FW Press DP Hi	142.5 psid	≤ 150.0 psid	Not specified	≤ 245 psid (setpoint)	EPU setpoint requirement based on ± 85 psi (Normal) uncertainty
AFAS logic time delay (minimum actuation time)	210 sec		120 sec	120 sec	
PORV Open Pressure	N/A		2370 psia (nominal)	2370 psia (nominal) (setpoint)	For non-LTOP conditions, PORVs operate on RPS PZR Press Hi
Main Steam Safety RV	N/A	1000 psia (nominal) 1040 psia (nominal)	+1 -3% (Bank 1&2 tolerance) 3% (accumulation)	± 3% (Bank 1 tolerance) +2%, -3% (Bank 2 tol.) 3% (accumulation)	

PZR Safety RV	N/A	2500 psia (nominal)	± 2% (tolerance) 3% (accumulation)	± 3% (tolerance) 3% (accumulation)	

Note: When revised, Safety Analysis limits are set equal to the Tech Spec setpoint plus or minus the defined uncertainty.

Table 6

REACTOR COOLANT SYSTEM GEOMETRY

Component	Flow Path Length (ft)	Top Elevation (ft) (d)	Bottom Elevation (ft) (d)	Minimum Flow Area (ft^2)	Volume (ft^3)
Hot Leg	14.53	2.38	-1.75	9.62	139.81
Suction Leg	22.83	1.04	-7.25	4.91	112.07
Discharge Leg					
Parallel	16.39	1.25	-1.25	4.91	80.46
Non-parallel	16.42	1.25	-1.25	4.91	80.52
Reactor Coolant Pump	22.81	1.25	-1.79	4.91[f]	112
Pressurizer	——	47.20	10.83	—	1500
Liquid level	——	30.66	10.83	50.07[a]	800
Surge Line	54.51	10.83	1.75	0.56	29.30
Steam Generator					
Inlet nozzle (ea)	2.23	2.24	0.95[e]	9.62	21.77
Inlet plenum	4.64	6.91	0.36	61.04	342.94
Tubes (active and passive)	56.81	37.65	6.91	0.0024[c]	1247.71
Outlet plenum	5.50	6.91	0.36	61.04	337.95
Outlet nozzle (ea)	1.72	1.39	0.16[e]	4.91	8.58
Reactor Vessel					
Inlet nozzles	3.6	1.5	-1.5	4.9	78
Downcomer	20.9	1.5	-20.9	30.3	674
Lower plenum	6.4[b]	-20.9	-27.0	43.7	702
Lower support structure and inactive core	3.5	-17.4	-20.9	28.0	473
Active core	11.4	-6.0	-17.4	54.8	669
Upper inactive core	1.5	-4.5	-6.0	47.1	85
Outlet plenum	11.0[g]	2.0	-4.5	23.45	524
CEA shroud	12.2[g]	9.8	2.0	——	430
UGS annulus, outside CEA shroud	4.5	6.5	2.0	——	122
Top Head	——	13.0	6.5	——	753
Outlet nozzles	4.1	2.0	-2.0	9.62	105

Table 6 - Continuation

TABLE 4.4-8 (Cont'd)

Notes:

(a) For the cylinder

(b) Represents a geometrical rather than an actual flow path length

(c) Flow path area per tube

(d) Reactor vessel nozzle centerline is the reference elevation; it has an elevation of 0.0 ft.

(e) Nozzle centerline

(f) RCP outlet

(g) Approximate flow path length

Table 6 – Continuation

Elevation Above SG Tubesheet	Secondary Side Downcomer (ft^3)	SG Riser/Wrapper (ft^3)	SG Total (ft^3)
0 in (secondary face of tubesheet)	0	0	0
265.5 in (start of lower edge of shell cone)	251.5	1465.5	1717.0
270.5 in (start of lower edge of wrapper cone)	258.3	1493.3	1751.6
294.2 inc (end of wrapper cone)	303.3	1669.6	1972.9
329.5 in (end of shell cone)	497.1	2053.6	2550.7
361.6 inc (inside edge of wrapper roof)	789.9	2501.0	3290.9
449.7 inc (top of cyclones)	2413.8	2889.2	5303.0
585.0 in (interior face of venture in steam nozzle)	N/A	N/A	7984.8

Note: Obtained from Reference 28, Exhibit A, page 28 of 30.

Table 7
Reactor Coolant Pump Homologous Curves

VALPHA	HAN	HVN	BAN	BVN	VALPHA	HAD	HVD	BAD	BVD
0.0	1.5800	-1.4200	0.7700	-1.4500	0.0	1.5800	1.2200	0.7700	1.3150
0.1	1.5000	-1.2150	0.8020	-1.1120	-0.1	1.6600	1.2850	0.8100	1.3800
0.2	1.4200	-1.0820	0.8450	-0.8720	-0.2	1.7600	1.3450	0.8800	1.4500
0.3	1.3700	-0.9120	0.8660	-0.6480	-0.3	1.8700	1.4400	0.9800	1.5100
0.4	1.3300	-0.7280	0.8850	-0.4420	-0.4	2.0000	1.5500	1.0900	1.5800
0.5	1.2950	-0.4940	0.9100	-0.2700	-0.5	2.1300	1.7200	1.2350	1.6400
0.6	1.2700	0.0000	0.9300	0.2600	-0.6	2.3000	1.9300	1.3900	1.7200
0.7	1.2400	0.2080	0.9530	0.4300	-0.7	2.4700	2.1800	1.5800	1.8300
0.8	1.1820	0.4350	0.9730	0.6130	-0.8	2.7000	2.4900	1.7850	1.9600
0.9	1.1050	0.7080	0.9890	0.8000	-0.9	2.9300	2.8100	2.0400	2.1200
1.0	1.0000	1.0000	1.0000	1.0000	-1.00	3.1500	3.1500	2.2900	2.2900
VALPHA	**HAT**	**HVT**	**BAT**	**BVT**	**VALPHA**	**HAR**	**HVR**	**BAR**	**BVR**
0.0	0.4330	1.2200	-1.4400	1.3150	0.0	0.4330	-1.4200	-1.4400	-1.4500
0.1	0.4740	1.1820	-0.9200	1.2450	-0.1	0.3430	-1.7150	-1.6600	-1.8500
0.2	0.5020	1.1400	-0.6300	1.1800	-0.2	0.0112	-1.9600	-1.9100	-2.2000
0.3	0.5120	1.0850	-0.4200	1.1100	-0.3	-0.2460	-2.1500	-2.1900	-2.5200
0.4	0.5240	1.0450	-0.2500	1.0420	-0.4	-0.5130	-2.3400	-2.4900	-2.8500
0.5	0.5460	1.0000	-0.1000	0.9750	-0.5	-0.8300	-2.5200	-2.8300	-3.1500
0.6	0.5830	0.9500	0.0200	0.9050	-0.6	-1.0350	-2.6900	-3.2400	-3.4900
0.7	0.6410	0.9000	0.1300	0.8170	-0.7	-1.6000	-2.8100	-3.6000	-3.8400
0.8	0.7120	0.8700	0.2510	0.7280	-0.8	-2.0500	-2.9300	-4.0500	-4.2300
0.9	0.8000	0.8650	0.3900	0.6280	-0.9	-2.5500	-3.0100	-4.5400	-4.6100
1.0	0.9080	0.9080	0.5620	0.5620	-1.0	-3.1000	-3.1000	-5.0300	-5.0300

Note: According to WEC, the definition of the column headings can be found in the reactor coolant pump model input description in the CEFLASH-4A topical report.

Table 8 (Sheet 1 of 2)

SL-2 UFSAR ECCS PERFORMANCE DATA
ONE LPSI PUMP FAILED TO START
EFFECTIVE FOR LARGE BREAK ANALYSIS

(LPSIP B Off, Other Pumps On)

MAXIMUM			MINIMUM	
RCS Pressure (psia)	Flow to Loop A1 or A2 (gpm)		RCS Pressure (psia)	Flow to Loop A1 or A2 (gpm)
1408	0		1165	0
1399	28		1158	23
1382	55		1142	45
1337	83		1105	68
1230	110		1068	90
1160	138		1008	113
1070	165		929	135
948	193		824	158
819	220		711	180
680	248		591	203
511	275		445	225
334	303		290	248
184	700		166	261
178	800		162	262
173	850		157	262
166	950		150	263
158	1050		143	264
149	1150		135	370
139	1250		125	660
128	1350		116	825
116	1450		105	990
103	1550		93	1080
89	1650		81	1170
74	1750		67	1260
58	1850		52	1350
39	1900		35	1440
20	2000		18	1530
0	2050		0	1620

Table 8 (Sheet 2 of 2)

**SL-2 UFSAR ECCS PERFORMANCE DATA
ONE LPSI PUMP FAILED TO START
EFFECTIVE FOR LARGE BREAK ANALYSIS**

(LPSIP B Off, Other Pumps On)

MAXIMUM			MINIMUM	
RCS Pressure (psia)	Flow to Loop B1 or B2 (gpm)		RCS Pressure (psia)	Flow to Loop B1 or B2 (gpm)
1408	0		1165	0
1399	28		1158	23
1382	55		1142	45
1337	83		1105	68
1230	110		1068	90
1160	138		1008	113
1070	165		929	135
948	193		824	158
819	220		711	180
680	248		591	203
511	275		445	225
334	303		290	248
121	330		105	270
0	341		0	279

Table 9 (Sheet 1 of 2)

SL-2 SAFETY INJECTION DATA
ONE EMERGENCY GENERATOR FAILED TO START
EFFECTIVE FOR NON-LOCA ANALYSES

(HPSIP B & LPSIP B Off, Other Pumps On)

MAXIMUM			MINIMUM	
RCS Pressure (psia)	Flow to Loop A1 or A2 (gpm)		RCS Pressure (psia)	Flow to Loop A1 or A2 (gpm)
1408	0		1165	0
1399	14		1158	12
1382	28		1142	23
1337	42		1105	34
1230	55		1068	45
1160	69		1008	57
1070	83		929	68
948	97		824	79
819	110		711	90
680	124		591	102
511	138		445	113
334	152		290	124
184	650		167	130
183	700		165	130
177	750		161	130
170	850		154	131
162	950		146	131
151	1100		137	280
141	1250		127	570
128	1400		116	760
116	1500		105	900
101	1600		91	990
85	1700		77	1080
68	1750		62	1170
49	1850		45	1260
30	1950		28	1350
8	2000		7	1440
0	2050		0	1535

Table 9 (Sheet 2 of 2)

SL-2 SAFETY INJECTION DATA
ONE EMERGENCY GENERATOR FAILED TO START
EFFECTIVE FOR NON-LOCA ANALYSES

(HPSIP B & LPSIP B Off, Other Pumps On)

MAXIMUM			MINIMUM	
RCS Pressure (psia)	Flow to Loop B1 or B2 (gpm)		RCS Pressure (psia)	Flow to Loop B1 or B2 (gpm)
1408	0		1165	0
1399	14		1158	12
1382	28		1142	23
1337	42		1105	34
1230	55		1068	45
1160	69		1008	57
1070	83		929	68
948	97		824	79
819	110		711	90
680	124		591	102
511	138		445	113
334	152		290	124
122	165		105	135
0	168		0	138

Table 10

SL-2 SAFETY INJECTION DATA
NO FAILURE IN ECCS
EFFECTIVE FOR NON-LOCA ANALYSIS

(All Pumps On)

MAXIMUM			MINIMUM	
RCS Pressure (psia)	Flow to Loop A1, A2 B1 or B2		RCS Pressure (psia)	Flow to Loop A1, A2 B1 or B2
1408	0		1165	0
1399	28		1158	23
1382	55		1142	45
1337	83		1105	68
1230	110		1068	90
1160	138		1008	113
1070	165		929	135
948	193		824	158
819	220		711	180
680	248		591	203
511	275		445	225
334	303		290	248
184	700		166	261
178	800		162	262
173	850		157	262
166	950		150	263
158	1050		143	264
149	1150		135	370
139	1250		125	660
128	1350		116	825
116	1450		105	990
103	1550		93	1080
89	1650		81	1170
74	1750		67	1260
58	1850		52	1350
39	1900		35	1440
20	2000		18	1530
0	2050		0	1620

Table 11 (Sheet 1 of 2)

SL-2 UFSAR ECCS PERFORMANCE DATA ONE EMERGENCY GENERATOR FAILED TO START EFFECTIVE FOR SMALL BREAK ANALYSIS

(HPSIP B & LPSIP B Off, Other Pumps On)

MAXIMUM			MINIMUM	
RCS Pressure (psia)	Flow to Loop A1 or A2 (gpm)		RCS Pressure (psia)	Flow to Loop A1 or A2 (gpm)
1408	0		1198	0
1399	14		1177	25
1382	28		1104	50
1337	42		1035	62.5
1230	55		943	75
1160	69		829	87.5
1070	83		699	100
948	97		551	112.5
819	110		393	125
680	124		217	137.5
511	138		167	140.6
334	152		165	140.7
184	650		161	141.0
183	700		154	141.4
177	750		146	141.9
170	850		137	291
162	950		127	580
151	1100		116	770
141	1250		105	910
128	1400		91	1000
116	1500		77	1090
101	1600		62	1181
85	1700		45	1271
68	1750		28	1362
49	1850		7	1453
30	1950		0	1548
8	2000			
0	2050			

Table 11 (Sheet 2 of 2)

SL-2 UFSAR ECCS PERFORMANCE DATA
ONE EMERGENCY GENERATOR FAILED TO START
EFFECTIVE FOR SMALL BREAK ANALYSIS

(HPSIP B & LPSIP B Off, Other Pumps On)

MAXIMUM	
RCS Pressure (psia)	Flow to Loop B1 or B2 (gpm)
1408	0
1399	14
1382	28
1337	42
1230	55
1160	69
1070	83
948	97
819	110
680	124
511	138
334	152
122	165
0	168

MINIMUM	
RCS Pressure (psia)	Flow to Loop B1 or B2 (gpm)
1198	0
1177	25
1104	50
1035	62.5
943	75
829	87.5
699	100
551	112.5
393	125
217	137.5
0	151

Table 12
Component Data Required

Component	Flow Diagram	Component Information
Pressurizer PORVs		
V1474 V1475	2998-G-078 Sheet 108 Rev. 5	2998-18810 Rev. 3
Pressurizer Safety Valves		
V1200 V1201 V1202	2998-G-078 Sheet 109 R18	2998-19690 Rev. 1 2998-19691 Rev. 1
Main Steam Safety Valves		
V8201 V8202 V8203 V8204 V8205 V8206 V8207 V8208 V8209 V8210 V8211 V8212 V8213 V8214 V8215 V8216	2998-G-079, Sheet 1, Rev. 41	2998-2381, Rev 11
Atmospheric Dump Valves		
MV-08-18A MV-08-19A MV-08-18B MV-08-19B	2998-G-079, Sheet 1, Rev. 41	2998-11458 Rev. 10
Turbine Control Valves (Governor)		
FCV-08-644 FCV-08-645 FCV-08-646 FCV-08-647	2998-G-079 Sheet 2, Rev.35	2998-2184 Rev. 10 2998-31, Rev 17
Turbine By-Pass Valves		
PCV- 8801	2998-G-079 Sheet 2 Rev. 35	2998-625 Rev.11 2998-4091 Rev. 2 2998-4092 Rev. 1
Turbine Stop Valves (Throttle)		
FCV-08-640 FCV-08-641 FCV-08-642 FCV-08-643	2998-G-079 Sheet 2, Rev.35	2998-2184 Rev. 10 2998-31, Rev 17
Main Feed Isolation Valves		

HCV-09-1A	2998-G-080 Sheet 2A Rev. 43	2998-9486 Rev. 4
HCV-09-1B		2998-9487 Rev. 4
HCV-09-2A		
HCV-09-2B		
Main Steam Isolation Valves		
HCV-08-1A	2998-G-079 Sheet 1, Rev. 41	2998-1011 Rev. 3 Sheet 1/9
HCV-08-1B		2998-1012 Rev. 0 Sheet 2/9
Miscellaneous Components		
V09107	2998-G-080 Sheet 2B Rev.36	2998-20110 Rev. 1
V09108		2998-741 Rev. 3
SE-09-2		2998-13008 Rev. 3
		2998-13006 Rev. 1
		2998-13009 Rev. 2
MV-09-9		2998-19745 Rev. 2
		2998-1872 Rev. 6
		2998-5616 Rev. 0
V09119		2998-3033 Rev. 4
V09120		2998-742 Rev. 2
V09123		2998-20110 Rev. 1
V09124		2998-741 Rev. 3
SE-09-3		2998-13008 Rev. 3
		2998-13006 Rev. 1
		2998-13009 Rev. 2
MV-09-10		2998-19745 Rev. 2
		2998-1872 Rev. 6
		2998-5617 Rev. 0
V09135		2998-3033 Rev. 4
V09136		2998-742 Rev. 2
V09139		2998-752 Rev. 5
V09140		2998-751 Rev. 2
SE-09-4		2998-13007 Rev. 1
		2998-13008 Rev.3
		2998-13009 Rev. 2
MV-09-11		2998-19745 Rev. 2
		2998-1871 Rev. 7
		2998-5617 Rev. 0
V09151		2998-3033 Rev. 4
V09152		2998-742 Rev. 2
SE-09-5		2998-13007 Rev. 1
		2998-13008 Rev.3
		2998-13009 Rev. 2
MV-09-12		2998-19745 Rev. 2
		2998-1871 Rev. 7
		2998-5616 Rev. 0
V09157		2998-3033 Rev. 4
V09158		2998-742 Rev. 2
V3225	2998-G-078 Sheet 132 Rev. 9	2998-19174 Rev. 2
		2998-4353 Rev. 5
V3624		2998-784 Rev. 6
V3258		2998-655 Rev. 1

V3227		2998-658 Rev. 1
V3215		2998-19174 Rev. 2
		2998-4353 Rev. 5
V3614		2998-784 Rev. 6
V3259		2998-655 Rev. 6
V3217		2998-658 Rev. 1
V3245		2998-4353 Rev. 5
		2998-19174 Rev. 2
V3644		2998-784 Rev. 6
V3261		2998-655 Rev. 1
V3247		2998-658 Rev. 1
V3235		2998-19174 Rev. 2
		2998-4353 Rev 5
V3634		2998-784 Rev. 6
V3260		2998-655 Rev. 1
V3237		2998-658 Rev. 1
FE-3312	2998-G-078 Sheet 131 Rev. 20	
HCV-3615		2998-1219 Rev. 9
V3114		2998-655 Rev. 1
V3805		2998-2076 Rev. 19
FE-3311		
V3113		2998-19800 Rev. 0
HCV-3616		2998-20356 Rev. 0
		2998-20355 Rev. 0
HCV-3617		2998-20356 Rev. 0
		2998-20355 Rev. 0
FE-3322		
HCV-3625		2998-1219 Rev. 9
V3124		2998-655 Rev. 1
HCV-3626		2998-1218 Rev. 9
FE-3321		
V3766		8770-14084 Rev. 1
		8770-14099 Rev. 1
HCV-3627		2998-1218 Rev. 9
FE-3332		
HCV-3635		2998-1219 Rev. 9
V3134		2998-655 Rev. 1
FE-3331		
V3133		2998-1530 Rev. 5
HCV-3636		2998-1218 Rev. 9
HCV-3637		2998-1218 Rev. 9
FE-3342		
V3144		2998-655 Rev. 1
FE-3341		
V3143		2998-20097 Rev. 0
HCV-3646		2998-1218 Rev. 9
HCV-3647		2998-1218 Rev. 9
V3106	2998-G-078 Sheet 130B Rev. 28	2998-657 Rev. 2
V3206		2998-1024 Rev. 3

FCV-3306		2998-4815 Rev. 7 2998-4816 Rev. 6	
FE-3306			
V3107		2998-657 Rev. 2	
V3207		2998-1024 Rev. 3	
FCV-3301		2998-4815 Rev. 7 2998-4816 rev. 6	
FE-3301			
SO-03-19			
V3427		2998-679 Rev. 7	
V3656		2998-781 Rev.3	
SO-03-20	2998-G-078 Sheet 130A Rev. 19		
V3414		2998-679 Rev. 7	
V3654		2998-780 Rev.3	
V2674	2998-G-078 Sheet 121A Rev. 31	2998-16238 Rev. 0	
V2501		2998-3386 Rev. 4	
V2118		2998-1036 Rev. 1	
V2322	2998-G-078 Sheet 122 Rev. 25	2998-1033 Rev. 0	
SS-02-1A		2998-7437 Rev. 3	
Suction Stabilizer for CHG PP 2A		2998-9068 Rev. 5 2998-9067 Rev. 4	
Pulsation Damper for CHG PP 2A		2998-9070 Rev. 2 2998-9069 Rev. 2	
V2169		8770-14084 Rev. 1 8770-14099 Rev. 1	
V2336		8770-14345 Rev. 1	
V2319		2998-1033 Rev. 0	
SS-02-1B		2998-7437 Rev. 3	
Suction Stabilizer for CHG PP 2B		2998-9068 Rev. 5 2998-9067 Rev. 4	
Pulsation Damper CHG PP 2B		2998-9070 Rev. 2 2998-9069 Rev. 2	
V2168		8770-14084 Rev. 1 8770-14099 Rev. 1	
V2464		8770-12770 Rev. 1 2998-17048 Rev. 0	
V2316		2998-1033 Rev. 0	
SS-02-1C		2998-7437 Rev. 3	
Suction Stabilizer for CHG PP 2C		2998-9068 Rev. 5 2998-9067 Rev. 4	
Pulsation Damper for CHG PP 2C		2998-9070 Rev. 2 2998-9069 Rev. 2	
V2167		8770-14084 Rev. 1 8770-14099 Rev. 1	
V2339		2998-1031 Rev. 5	

FE-2212			
V2429		2998-560 Rev. 2	
V2523		2998-2786 Rev. 5	
V2462		8770-14084 Rev. 1	
		8770-14099 Rev. 1	
V2535		2998-560 Rev. 2	
V2598		2998-15232 Rev. 3	
V2485		2998-3487 Rev. 2	
V2433		2998-1749 Rev. 3	
SE-02-2		2998-18973 Rev. 0	
		2998-18974 Rev. 0	
		2998-19677 Rev. 0	
		2998-19678 Rev. 0	
V2484		2998-3487 Rev. 2	
V2432		2998-1749 Rev. 3	
SE-02-1		2998-18973 Rev. 0	
		2998-18974 Rev. 0	
		2998-19677 Rev. 0	
		2998-19678 Rev. 0	
V2593		2998-1009 Rev. 2	
V2515		2998-548 Rev. 14	
V2516		2998-548 Rev. 14	
V2522	2998-G-078 Sheet 120 Rev. 17	2998-2785 Rev. 5	
V2341		2998-560 Rev. 2	
		2998-17024 Rev. 0	
V2342		2998-560 Rev. 2	
		2998-17023 Rev. 0	
(Letdown Heat Exchanger) LTDN HT EXCH		2998-1611 Rev. 1	
V2347		2998-557 Rev. 3	
		2998-17023 Rev. 0	
PCV-2201Q		2998-2586 Rev. 6	
V2349		2998-4013 Rev. 0	
		2998-17023 Rev. 0	
FE-2202			
V2358		2998-1037 Rev. 1	
		2998-17025 Rev. 0	
(Purification Filter) Purif Filter 2A		2998-19775 Rev. 0 2998-6065 Rev. 3 2998-16332 Rev. 1 2998-5498 Rev. 4	
V2360		2998-1037 Rev. 1	
		2998-17025 Rev. 0	
V2520		2998-2584 Rev. 6	
V2359		2998-590 Rev. 5	
		2998-17042 Rev. 1	

V2370		2998-1029 Rev. 2	
(Purification Ion Exchanger) Purif IX 2A		2998-3642 Rev. 2	
V2378		2998-1037 Rev. 1	
		2998-17025 Rev. 0	
V2382		2998-1037 Rev. 1	
		2998-17025 Rev. 0	
V2395		2998-17025 Rev. 0	
		2998-1037 Rev. 1	
(Letdown Strainer) S2900		2998-5064 Rev. 1	
V2415		2998-17025 Rev. 0	
		2998-1037 Rev. 1	
V2418		2998-17025 Rev. 0	
		2998-1037 Rev. 1	
V2452		2998-17025 Rev. 0	
		2998-1037 Rev. 1	
(Purification Filter) Purif Filter 2B		2998-19775 Rev. 0 2998-5498 Rev. 4 2998-6065 Rev. 3 2998-16332 Rev. 1	
FE-8011	2998-G-079 Sheet 1, Rev. 41	2998-1420 Rev.6	
FE-8021		2998-1421 Rev. 4	
		2998-2646 Rev. 1	
V1442	2998-G-078 Sheet 109 Rev. 18	2998-3066 Rev. 5	
		2998-17056 Rev. 0	
V1249		2998-187 Rev. 3	
PCV-1100F		2998-546 Rev. 13	
V1444		2998-3066 Rev. 5	
		2998-17057 Rev. 0	
V1477	2998-G-078 Sheet 108 Rev. 5	2998-13278 Rev. 3	
V1479		2998-13277 Rev. 0	
V1476		2998-13278 Rev. 3	
V1478		2998-13277 Rev. 0	
V1443	2998-G-078 Sheet 109 Rev. 18	2998-3066 Rev. 5	
		2998-17057 Rev. 0	
PCV-1100E		2998-546 Rev. 13	
V1248		2998-187 Rev. 3	
V1441		2998-3066 Rev. 5	
		2998-17055 Rev. 0	
FE-01-2	2998-G-078 Sheet 108 Rev. 5	2998-13912 Rev. 1	
FE-01-1		2998-13912 Rev. 1	
FE-09-2A	2998-G-080 Sheet 2B Rev.36	2998-2595 Rev. 2	
FE-09-2B		2998-2595 Rev. 2	
FE-09-2C		2998-2595 Rev. 2	
MV-08-14	2998-G-079 Sheet 1 Rev. 41	2998-10622 Rev. 5	
MV-08-15		2998-10622 Rev. 5	

MV-08-16		2998-10621 Rev. 6
MV-08-17		2998-10621 Rev. 6
V08359	2998-G-079 Sheet 2 Rev. 35	2998-3012 Rev. 8
V08360		2998-3012 Rev. 8
V09294	2998-G-080 Sheet 2A Rev 43	2998-2143 Rev. 5
V09252		2998-2143 Rev. 5

Table 13
Primary Loop Pressure Drop Distribution

	LBLOCA			SBLOCA		
		Geometry ΔP	Geometry ΔP		Geometry ΔP	Geometry ΔP
Station	Friction ΔP	Forward Flow	Reverse Flow	Friction ΔP	Forward Flow	Reverse Flow
Pre-EPU Values	(psi)	(psi)	(psi)	(psi)	(psi)	(psi)
Reactor Vessel	4.90	27.84	38.42	5.14	28.93	39.90
Outlet RV to Inlet SG	0.30	0.66	0.66	0.28	0.64	0.64
Inlet SG to SG outlet	26.62	10.22	8.90	26.06	10.00	8.71
Outlet SG to Inlet RCP	0.58	2.73	2.73	0.56	2.65	2.65
RCPs	----	75.16	84.42	----	75.55	85.23
RCP outlet to RV inlet	0.42	0.89	0.89	0.42	0.87	0.87
EPU Values	(psi)	(psi)	(psi)	(psi)	(psi)	(psi)
Reactor Vessel	6.13	34.82	48.09	6.41	36.13	49.84
Outlet RV to Inlet SG	0.38	0.83	0.83	0.36	0.80	0.80
Inlet SG to SG outlet	33.34	12.81	11.17	39.24	11.65	15.17
Outlet SG to Inlet RCP	0.72	3.42	3.42	0.70	3.31	3.31
RCP	----	94.09	105.72	----	100.21	117.44
RCP outlet to RV inlet	0.52	1.12	1.12	0.52	1.09	1.09

Note: Pressure drops include uncertainties of +10% friction and +20% geometry.

Table 13 – CONT. - Associated Conditions

	LBLOCA	SBLOCA
Pre-EPU Values		
Power Level - MWTh	2754	2754
Vessel Flow Rate - lbm/sec	35,796	34,868
Core Flow Rate - lbm/sec	34,471	34,868
Bypass Flow - %	3.7	3.7
EPU Values		
Power Level - MWTh	3030	3030
Vessel Flow Rate - lbm/sec	40,072	38,884
Core Flow Rate - lbm/sec	38,589	38,884
Bypass Flow - %	4.2	4.2

Table 14
Heat Balance Information

% EPU Power	Feedwater Flow lbm/hr (2 SG)	Steam Flow lbm/hr (2 SG)	Feedwater Temperature, F	Turbine Inlet Pressure, psia
100	13,345,890	13,247,580	436.2	803.3
90	11,872,120	11,773,810	426.9	711.0
75	9,696,551	9,598,249	410.1	576.4
50	6,223,793	6,125,495	374.6	361.7
25	2,994,037	2,895,675	322.7	190.0

Table 15
RCS Pressure Boundary Material Property Data

Material	Density (lbm/ft^{3})	Specific Heat (Btu/lbm-F)	Thermal Conductivity (Btu/hr-ft-F)	Emissivity vs Temp	Comment
Carbon Steel	483.8*	0.129*	22.92*	0.78-0.82 @130-530 C**	*SA-516 Gr 70 **smooth oxidized iron
Stainless Steel	499.4*	0.13*	10.44*	0.57-0.66 @230-870 C**	*304/304L SS **316 SS repeated heating
Inconel 600	528.8	0.106	8.58	0.85-0.98 @480-1090 C	
Inconel 690	511.5	0.107	7.75	0.85-0.98 @480-1090 C	Emissivity assumed same as Inconel 600

FIGURE 16
PRESSURIZER PRESSURE CONTROL PROGRAM

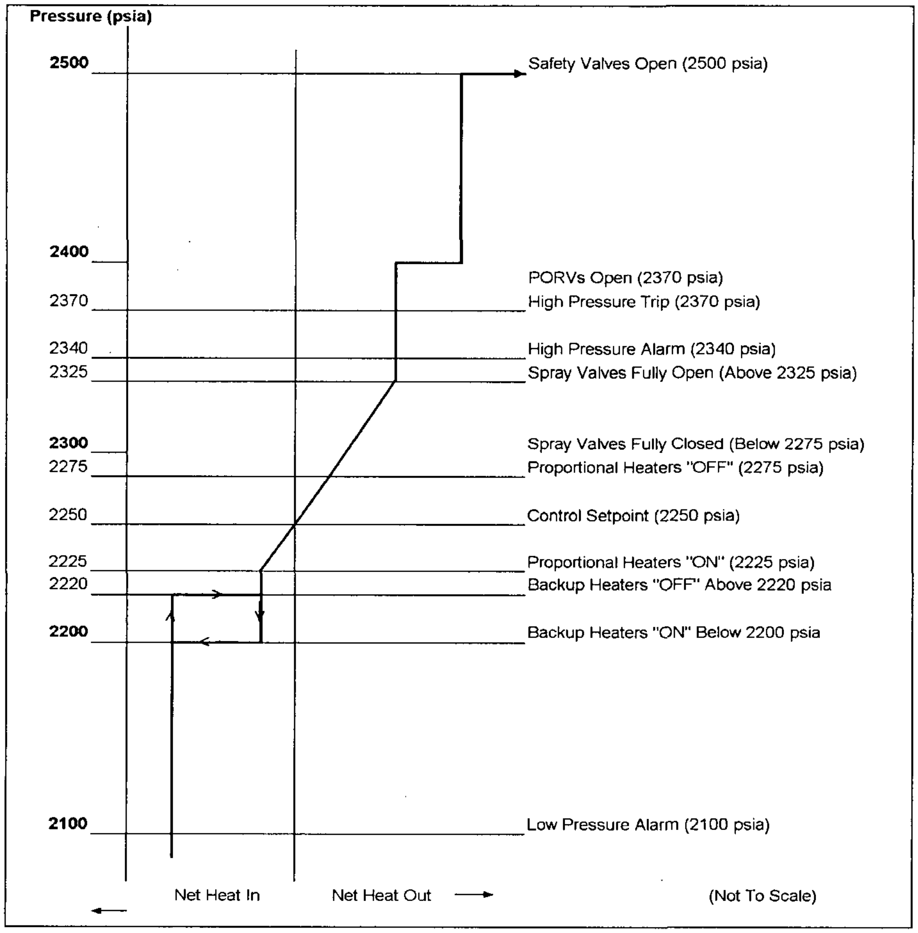
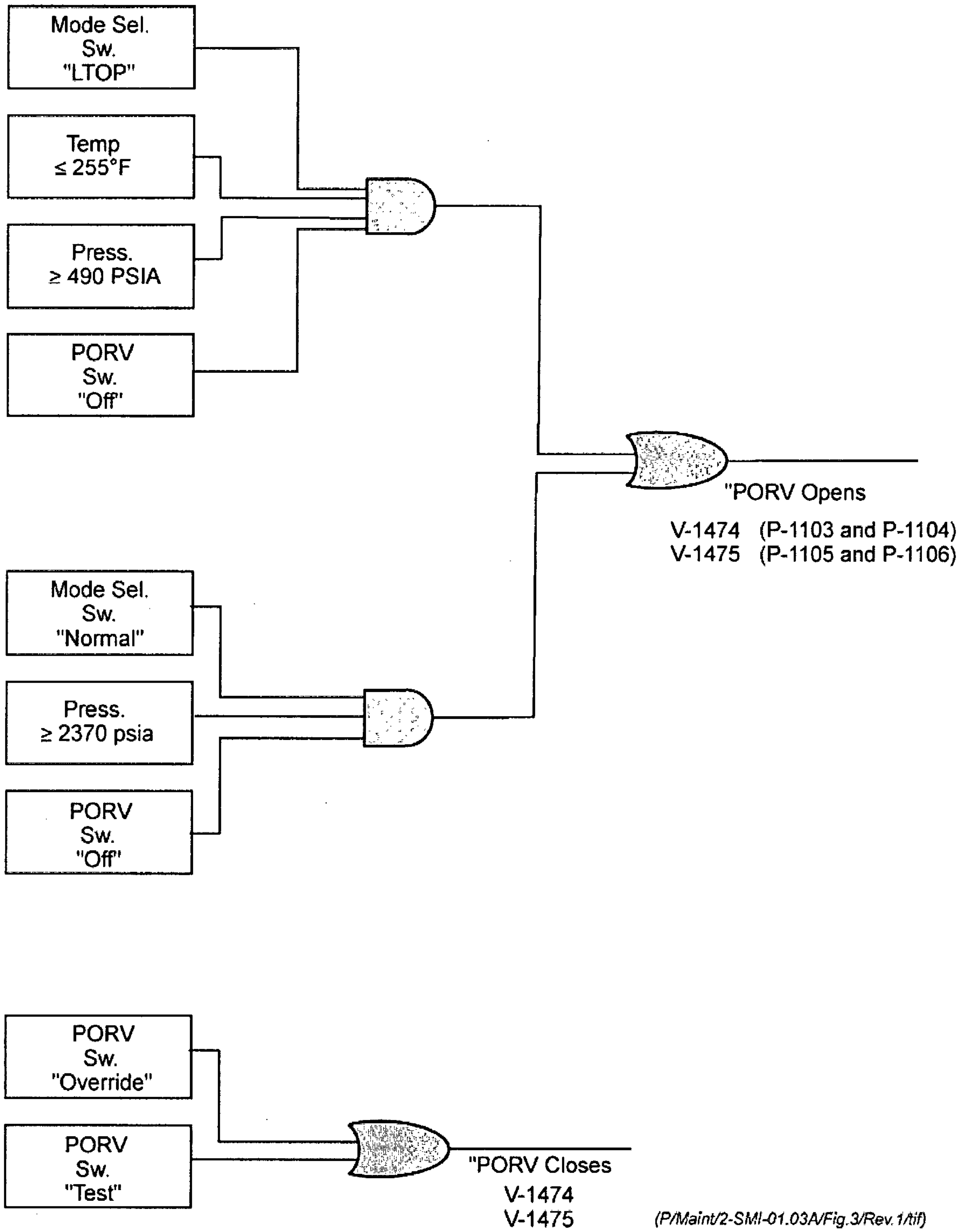


FIGURE 17
PRESSURIZER LEVEL ERROR CONTROL

Item	Description	Level Error From Nominal (% Span)
1	First Backup Charging Pump Start Signal	- 2.5
2	First Backup Charging Pump Stop Signal	- 1.1
3	Backup Signal to Start All Charging Pumps	- 5
4	Backup Signal to Stop Backup Charging Pumps	+ 4
5	High Level Error Alarm	+ 5
6	Low Level Error Alarm	- 5
7	All Pressurizer Heaters Energized	+ 4
8	Minimum Letdown	- 1.1
9	Maximum Letdown	+ 12.5

Figure 18 – LTOP PORV ACTUATION SCHEMATIC



(P/Maint/2-SMI-01.03A/Fig.3/Rev.1/tif)

Figure 19 – Unit 2 SBCS Simplified Block Diagram

See Next Page

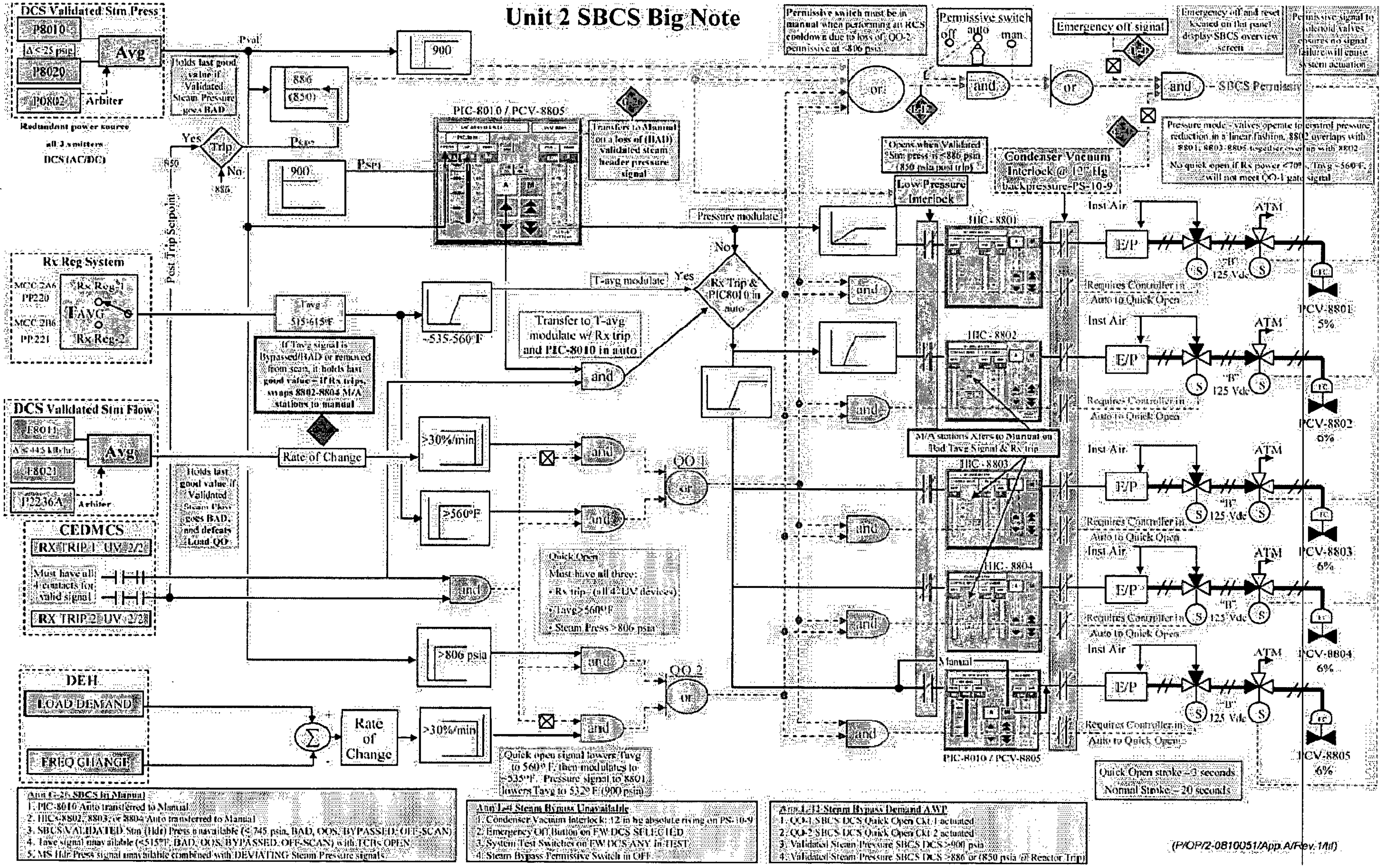

Unit 2 SBCS Big Note
DCS Validated Stm Press
P8010
Δ < 25 psig
P8020
P0802
Avg
Arbiter
Redundant power source
all 3 xmitters
DCS(AC/DC)
Pval
Holds last good value if Validated Steam Pressure goes BAD
900
886
(850)
Trip
Yes
No
Psp2
Psp1
PIC-8010 / PCV-8805
Transfer to Manual for a loss of (BAD) validated steam header pressure signal
Permissive switch must be in manual when performing an RCS cooldown due to loss of QO-2 permissive at <806 psia
Permissive switch
off auto man.
Emergency off signal
or
and
SBCS Permissive
Opens when Validated Stm press is <886 psia (850 psia post trip)
Low Pressure Interlock
Condenser Vacuum Interlock @ 12" Hg backpressure-PS-10-9
Pressure modulate
Post Trip Setpoint
Rx Reg System
Rx Reg 1
Rx Reg 2
TAVG
MCC 2A6 PP220
MCC 2B6 PP221
Tavg 515-615°F
~535-560°F
T-avg modulate
Rx Trip & PIC8010 in auto
Transfer to T-avg modulate w/ Rx trip and PIC-8010 in auto
If Tavg signal is Bypassed/BAD or removed from scan, it holds last good value = if Rx trips, swaps 8802-8804 M/A stations to manual
DCS Validated Stm Flow
F8011
F8021
J2236A
Arbiter
Rate of Change
>30%/min
>560°F
QO 1
QO 2
Holds last good value if Validated Steam Flow goes BAD, and defeats Load QO
CEDMCS
RX TRIP 1 UV 2/2
RX TRIP 2 UV 2/2
Must have all 4 contacts for valid signal
Quick Open
Must have all three:
• Rx trip (all 4 UV devices)
• Tavg ≥ 560°F
• Steam Press > 806 psia
>806 psia
DEH
LOAD DEMAND
FREQ CHANGE
Rate of Change
Quick open signal lowers Tavg to 560° F, then modulates to ~535°F. Pressure signal to 8801 lowers Tavg to 532° F (900 psia)
HIC-8801
HIC-8802
HIC-8803
HIC-8804
Manual
M/A stations Xfers to Manual on Bad Tavg Signal & Rx trip
Inst Air
E/P
ATM
"B" 125 Vdc
Requires Controller in Auto to Quick Open
PCV-8801 5%
PCV-8802 6%
PCV-8803 6%
PCV-8804 6%
PCV-8805 6%
Pressure mode - valves operate to control pressure reduction in a linear fashion. 8802 overlaps with 8801, 8803-8805 together overlap with 8802
No quick open if Rx power <70%, Tavg <560°F, will not meet QO-1 gate signal
Quick Open stroke ~3 seconds
Normal Stroke ~20 seconds
Ann G-26 SBCS in Manual
1. PIC-8010 Auto transferred to Manual
2. HICs-8802, 8803, or 8804 Auto transferred to Manual
3. SBCS VALIDATED Stm (Hdr) Press unavailable (< 745 psia, BAD, OOS, BYPASSED, OFF-SCAN)
4. Tave signal unavailable (<515°F, BAD, OOS, BYPASSED, OFF-SCAN) with TCRs OPEN
5. MS Hdr Press signal unavailable combined with DEVIATING Steam Pressure signals
Ann L-4 Steam Bypass Unavailable
1. Condenser Vacuum Interlock: 12 in hg absolute rising on PS-10-9
2. Emergency Off Button on FW DCS SELECTED
3. System Test Switches on FW DCS ANY in TEST
4. Steam Bypass Permissive Switch in OFF
Ann L-12 Steam Bypass Demand AWP
1. QO-1 SBCS DCS Quick Open Ckt 1 actuated
2. QO-2 SBCS DCS Quick Open Ckt 2 actuated
3. Validated Steam Pressure SBCS DCS >900 psia
4. Validated Steam Pressure SBCS DCS >886 or (850 psia @ Reactor Trip)

Table 20 – Unit 2 Essential Valve Characteristics

Component	Full Open Flow Area	Forward/ Backward CV	Open/Close Rate	Min Flow at Rated Conditions	Open/Close Logic
Pressurizer PORVs	0.0202 Ft^2 This is an effective area, back calculated from the identified flow rate.	N/A	1 sec open (this value is for non-LTOP evaluations)	398,000 lbm/hr steam per valve	PORVs are actuated on high PZR pressure using 2/4 logic. The nominal (TS) setpoint is ≤2370 psia. This setpoint will not change for EPU. See Table 5 for additional information. PORVs are also actuated by the LTOP logic. The PORV logic and existing setpoints is shown in Figure 18.
Pressurizer Safety Valves	0.01 Ft^2 This is an effective area, back calculated from the identified flow rate.	N/A	0.05 sec open	212,182 lbm/hr steam per valve @ setpressure + 3% accumulation	Spring loaded valve that opens at nominal set pressure, achieves full open position at 103% of setpressure; recloses at a pressure of 99% to 85% of setpressure; see Table 5 for additional information
Main Steam Safety Valves	0.1054 Ft^2 for the 1000 psia valves. This is an effective area, back calculated from the identified flow rate; 0.1052 Ft^2 for the 1040 psia valves. This is an effective area, back calculated from the identified flow rate.	N/A	1.0 sec open	744,210 lbm/hr per valve @ 1000 psia 774,000 lbm/hr per valve @1040 psia	Spring loaded valve that opens at nominal set pressure, full open at 103% of setpressure; see Table 5 for additional information
Atmospheric Dump Valves			Open / Close (sec)		

Component	Full Open Flow Area	Forward/ Backward CV	Open/Close Rate	Min Flow at Rated Conditions	Open/Close Logic
MV-08-18A MV-08-19A MV-08-18B MV-08-19B	0.0396 sq ft per valve, effective area back calculated from identified flow rate.	553	37.2-50.3/35.5-47.9 35.5-47.9/35.8-48.3 36.9-49.9/35.6-48.1 37.2-50.2/36.6-49.6	275,000 lbm/hr @985 psia; 54,000 lbm/hr @ 55 psia (design capacity)	ADV control is via pressure indicating controllers PIC-08-1A, PIC-08-1B, PIC-08-3A, PIC-08-3B. In the Manual mode of operation, the controller is used to directly set valve position. In the Automatic mode of operation, valve position is varied to maintain the desired pressure. PSL2 ADV controllers are maintained in Manual during full power plant operation. This normal control mode is based on PSL-2 TS LCO 3.7.1.7. ADV control will not change for EPU.
Turbine Control Valves (Governor)	1256.6 in^2 for 4 valves PRELIMINARY: Assumed the same as Unit 1.	Data unavailable; was not used in design	N/A	12,222,940 lbm/hr at EPU for total of four valves	Valves close on Turbine Trip. Trip logic includes: Reactor Trip, High-High SG Level, Overspeed, Generator Lockout and various equipment protection functions. Turbine governor valves are currently operated in Sequential Valve mode with valve position controlled by the DEH computer. Various control strategies (feedback loops) are available including: Impulse Pressure, Megawatt Control and Speed Control. As part of EPU main turbine upgrades, the governor valves will be operated in Single Valve mode.
Turbine By-Pass Valves	Not available due to planned valve capacity upgrade		An upgraded valve open time in the quick open mode of approximately 2 sec is planned as part of EPU	An upgraded system capacity of approximately 6.9E6 lbm/hr. is planned as part of EPU	Steam Bypass Control System (SBCS) has both modulation and quick open control modes. A control block diagram, including setpoints where applicable, is shown in Figure 19. Minor changes to the SBCS logic are planned as part of EPU. QO load rejection setpoint will be reduced to ~15%. Valve demand curves will be revised to reflect new valve capacities and valve trim. Transition from QO to modulation mode will be enhanced.

Component	Full Open Flow Area	Forward/ Backward CV	Open/Close Rate	Min Flow at Rated Conditions	Open/Close Logic
Turbine Stop Valves (Throttle)	2375.8 in^2 for 4 valves PRELIMINARY: Assumed the same as Unit 1.	Data unavailable; was not used in design	0.26 sec (close)	12,222,940 lbm/hr at EPU for total of four valves	Valves close on Turbine Trip. Trip logic includes: Reactor Trip, High-High SG Level, Overspeed, Generator Lockout and various equipment protection functions. Turbine stop valves are normally full open during power operation. The stop valves are opened in a DEH speed control mode during initial turbine startup (to 1700 RPM).
Main Feed Isolation Valves	1.268 Ft^2 (Estimate based on full flow of 18" Sch 120 pipe)	13,750	Close stroke time 1.0 to 2.4 sec.	13,345,890 lbm/hr 100% Flow	MFIVs close on either AFAS or MSIS. See Table 5 for AFAS/MSIS actuation signals and associated setpoints.
Main Steam Isolation Valves	4.665 sq ft (estimate based on 29.245" diameter port size)	N/A	After MSIS signal is generated. 6.75 sec- value includes sensor response time of 1.15 secs and valve closure time of 5.6 secs.	13,247,580 lbm/hr 100% Flow	MSIVs close on MSIS. See Table 5 for MSIS actuation signals and associated setpoints.

ATTACHMENT 3

Westinghouse

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Our ref: CAW-09-2675

September 18, 2009

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: Florida Power and Light Company Letter L-2009-208, "Extended Power Uprate Data for NRC Confirmatory EPU Analyses"

The proprietary information for which withholding is being requested in the subject letter is further identified in Affidavit CAW-09-2675 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes use of the accompanying affidavit by Florida Power and Light Company.

Correspondence with respect to this application for withholding or the accompanying Westinghouse affidavit should reference this letter, CAW-09-2675, and should be addressed to J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

G. L. Hess for

J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

Enclosures

CAW-09-2675

AFFIDAVIT

STATE OF CONNECTICUT:

ss

COUNTY OF HARTFORD:

Before me, the undersigned authority, personally appeared Michael J. Gancarz, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Michael J. Gancarz
Product Manager,
Systems and Equipment Engineering II

Sworn to and subscribed before me
this 17th day of September, 2009

Laurie J. White
Notary Public

My Commission Expires: 8/31/14

(1) I am Michael J. Gancarz, Product Manager, Systems and Equipment Engineering II in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse "Application for Withholding" accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in Florida Power and Light Company letter L-2009-208, "Extended Power Uprate Data for NRC Confirmatory EPU Analyses," accompanied by Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information pertains to the hot rod heatup calculations performed in the Supplement 2 version of Westinghouse's small break LOCA evaluation model for Combustion Engineering designed plants.

Further this information has substantial commercial value as follows:

(a) Westinghouse can sell the use of similar information to its customers for the purpose of meeting NRC requirements for licensing documentation.

(b) Westinghouse can sell support and defense of the analysis methodology to its customers in the licensing process.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar analytical services and licensing defense services for commercial power reactors without incurring commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information sought to be withheld is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

COPYRIGHT NOTICE

The documents transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these documents which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.390 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these documents, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

ATTACHMENT 4

NONPROPRIETARY VERSION OF ATTACHMENT 2

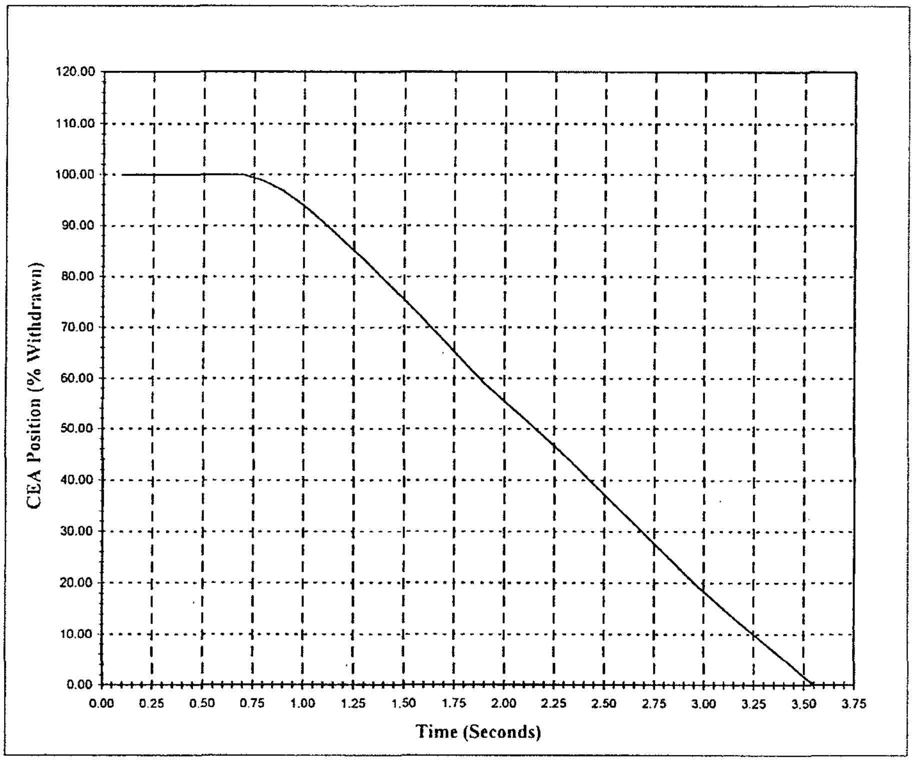
18.1 Control Rod Insertion versus Time after Scram

SBLOCA

Figure 1 and Table 1 (below) provide the St. Lucie Unit 2 Control Element Assembly (CEA) insertion versus time after scram. Bounding margin that is added for conservatism in the Westinghouse SBLOCA analysis is not included in the data provided.

Figure 1 and Table 1

ST. LUCIE UNIT 2 - CONTROL ELEMENT ASSEMBLY (CEA) INSERTION POSITION VS TIME



Time (Sec)	% Withdrawn	% Inserted
0.10	100.00	0.00
0.20	100.00	0.00
0.30	100.00	0.00
0.40	100.00	0.00
0.50	100.00	0.00
0.60	100.00	0.00
0.70	100.00	0.00
0.80	98.75	1.25
0.90	96.80	3.20
1.00	93.98	6.02
1.10	90.68	9.32
1.30	83.31	16.69
1.60	71.44	28.56
1.90	58.95	41.05
2.28	45.63	54.37
2.65	31.43	68.57
2.95	20.00	80.00
3.05	16.67	83.33
3.15	13.33	86.67
3.25	10.00	90.00
3.55	0.00	100.00

18.2 CEA Worth versus Insertion
(with and without highest worth rod stuck out of core)

SBLOCA

Table 2 provides the St. Lucie Unit 2 Scram Curve used in the Westinghouse LOCA Evaluation Model for SBLOCA analyses.

Table 2

Scram Curve

Rod Insertion Fraction	Normalized Trip Shape Limit
0.00	0.0000
0.05	0.0011
0.10	0.0054
0.15	0.0113
0.20	0.0170
0.25	0.0234
0.30	0.0294
0.35	0.0358
0.40	0.0436
0.45	0.0532
0.50	0.0651
0.55	0.0805
0.60	0.1006
0.65	0.1279
0.70	0.1660
0.75	0.2196
0.80	0.2987
0.85	0.4226
0.90	0.6226
0.95	0.8856
1.00	1.0000

Note: For use with a trip reactivity up to an absolute value of 5.2%$\Delta\rho$

18.3 Reactivity versus fuel temperature and reactivity versus moderator density

LBLOCA and SBLOCA

Table 3-1 provides bounding Doppler Reactivity. The most negative data extreme is used in Westinghouse LOCA analyses with a 1.15 multiplier for conservatism. Table 3-2 provides Moderator Reactivity for the most positive MTC at full power.

Table 3-1

		Bounding Doppler Reactivity (Uncertainties Included)				Bounding Input for LOCA
Fuel Temperature		Reactivity (Δρ)		FTC (Δρ/°F)		Maximum Reactivity for the Most Negative Full Power FTC with 1.15 Multiplier
(°F)	(SQRT k)	Least Neg	Most Neg	Least Neg	Most Neg	(Δρ)
100	17.63	0.0137	0.0322	-1.70E-05	-3.99E-05	0.0370
200	19.14	0.0121	0.0284	-1.57E-05	-3.67E-05	0.0327
300	20.54	0.0106	0.0249	-1.46E-05	-3.42E-05	0.0286
400	21.85	0.0092	0.0215	-1.37E-05	-3.22E-05	0.0247
500	23.09	0.0079	0.0184	-1.30E-05	-3.04E-05	0.0212
600	24.26	0.0066	0.0154	-1.24E-05	-2.90E-05	0.0177
700	25.38	0.0054	0.0126	-1.18E-05	-2.77E-05	0.0145
800	26.45	0.0042	0.0099	-1.13E-05	-2.66E-05	0.0114
900	27.48	0.0031	0.0073	-1.09E-05	-2.56E-05	0.0084
1000	28.48	0.0020	0.0048	-1.05E-05	-2.47E-05	0.0055
1100	29.44	0.0010	0.0024	-1.02E-05	-2.39E-05	0.0028
1200	30.37	0.0000	0.0000	-9.87E-06	-2.32E-05	0.0000
1300	31.27	-0.0010	-0.0023	-9.59E-06	-2.25E-05	-0.0026
1400	32.14	-0.0019	-0.0045	-9.33E-06	-2.19E-05	-0.0052
1500	33.00	-0.0028	-0.0067	-9.09E-06	-2.13E-05	-0.0077
1600	33.84	-0.0037	-0.0088	-8.86E-06	-2.08E-05	-0.0101
1700	34.64	-0.0046	-0.0108	-8.66E-06	-2.03E-05	-0.0124
1800	35.43	-0.0055	-0.0128	-8.46E-06	-1.98E-05	-0.0147
1900	36.21	-0.0063	-0.0148	-8.28E-06	-1.94E-05	-0.0170
2000	36.97	-0.0071	-0.0167	-8.11E-06	-1.90E-05	-0.0192
2100	37.71	-0.0079	-0.0186	-7.95E-06	-1.86E-05	-0.0214
2200	38.44	-0.0087	-0.0204	-7.80E-06	-1.83E-05	-0.0235
2300	39.16	-0.0095	-0.0222	-7.66E-06	-1.80E-05	-0.0255
2400	39.86	-0.0102	-0.0240	-7.52E-06	-1.76E-05	-0.0276
2500	40.55	-0.0110	-0.0258	-7.39E-06	-1.73E-05	-0.0297
3000	43.84	-0.0145	-0.0341	-6.84E-06	-1.60E-05	-0.0392
3500	46.90	-0.0179	-0.0419	-6.39E-06	-1.50E-05	-0.0482
4000	49.78	-0.0210	-0.0491	-6.02E-06	-1.41E-05	-0.0565
5000	55.07	-0.0267	-0.0625	-5.44E-06	-1.28E-05	-0.0719
		Least Neg	Most Neg			
FTC (Δρ/√°K)		-0.00108	-0.00253			

Table 3-2

Maximum Reactivity Versus Moderator Density for the Most Positive MTC at Full Power

$$\Delta\rho = a0 + a1*d + a2*d^2 + a3*d^3 + a4*d^4$$

where:

$\Delta\rho$ = inserted reactivity in absolute units relative to 572.378°F, 2250 psia
d = density, gm/cc
d = 0.72627 gm/cc at 572.378°F and 2250 psia

and:

a0 = -0.38999
a1 = 1.74698
a2 = -2.85463
a3 = 2.06340
a4 = -0.587815

18.4 Moderator temperature coefficient

LBLOCA and SBLOCA

MTC associated with moderator density curve, when applied to St. Lucie Unit 2 EPU is +1.75 pcm/°F.

Note that the Technical Specifications only permit an MTC of zero at full power, so the moderator density curve is slightly more adverse than is required.

18.5 Typical top peaked axial power profile

LBLOCA

For LBLOCA, Table 5-1 and Figure 5-1 provide typical top peaked axial power profiles utilized in the ECCS Performance analysis Evaluation Model for St. Lucie Unit 2 with EPU. The LBLOCA generic axial power shape is referred to as "Shape B." This shape, which is part of the LBLOCA Evaluation Model for CE plants, was selected from actual physics shape sets for its conservative impact on ECCS Performance analysis calculations using the Westinghouse Evaluation Model for CE plants. For application to a particular CE plant and particular plant core design, such as St. Lucie Unit 2 EPU, the axial peak for Shape B ($F_{z,min}$) is adjusted based on the PLHGR of the hot rod, the CALHR of the core, and the Technical Specification COLR maximum integrated radial peaking factor at full power ($F_{r,max}$). A representative calculation for St. Lucie Unit 2 EPU is as follows:

$$F_{z,min} = PLHGR / CALHR / F_{r,max}$$

PLHGR=12.5 kW/ft

CALHR=5.2 kW/ft

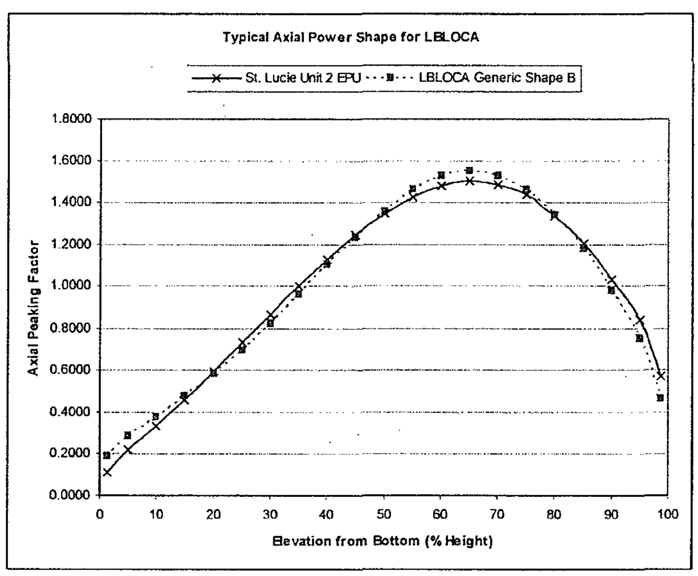
$F_{r,max}$ =1.6

$$F_{z,min} = 12.5 / 5.2 / 1.6 = 1.5$$

Table 5-1

Node	Elevation from Bottom % Height	LBLOCA Generic Shape B	St. Lucie Unit 2 EPU
0	1.25	0.1896	0.1120
1	5	0.2865	0.2217
2	10	0.3769	0.3338
3	15	0.4758	0.4596
4	20	0.5817	0.5931
5	25	0.6980	0.7336
6	30	0.8253	0.8662
7	35	0.9614	0.9993
8	40	1.1012	1.1277
9	45	1.2365	1.2445
10	50	1.3594	1.3448
11	55	1.4577	1.4264
12	60	1.5242	1.4801
13	65	1.5491	**1.5000**
14	70	1.5287	1.4855
15	75	1.4592	1.4343
16	80	1.3424	1.3355
17	85	1.1811	1.2021
18	90	0.9770	1.0316
19	95	0.7506	0.8391
20	98.75	0.4650	0.5699
TOTAL		20.0000	20.0000
LOWER		7.3178	7.3080
UPPER		12.6822	12.6920
ASI		-0.2682	-0.2692

Figure 5-1



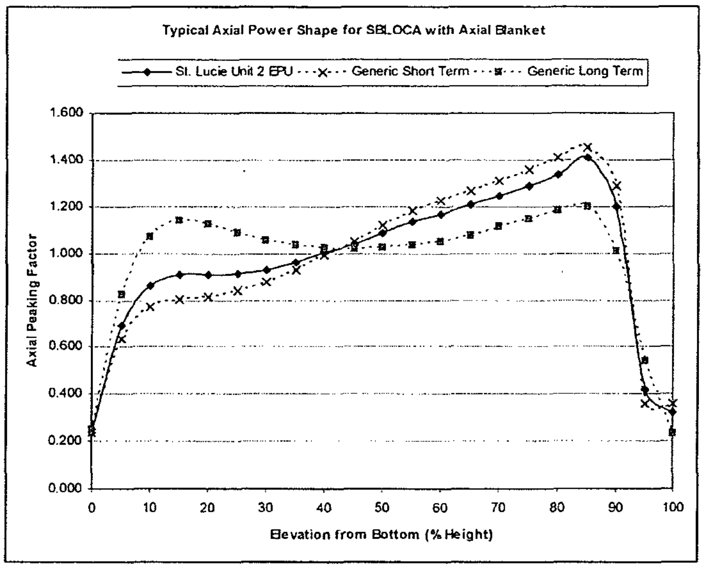
SBLOCA

For SBLOCA, Table 5-2 and Figure 5-2 provide typical top peaked axial power profiles utilized in the ECCS Performance analysis Evaluation Model for St. Lucie Unit 2 with EPU. The SBLOCA generic short term and long term axial power shapes were selected from actual physics shape sets for their conservative impact on ECCS Performance analysis calculations using the Westinghouse Evaluation Model for CE plants. For application to a particular CE plant and particular plant core design, such as St. Lucie Unit 2 EPU, the axial shape is conservatively adjusted based on the SBLOCA limiting break sizes to be analyzed in the spectrum and the time of core uncovery and the time of peak cladding temperature.

Table 5-2

Node	Elevation from Bottom % Height	Generic Short Term	Generic Long Term	St. Lucie Unit 2 EPU
1	0	0.2353	0.2488	0.239
2	5	0.6322	0.8242	0.690
3	10	0.7712	1.0740	0.863
4	15	0.8052	1.1382	0.907
5	20	0.8152	1.1235	0.909
6	25	0.8392	1.0899	0.915
7	30	0.8792	1.0573	0.932
8	35	0.9312	1.0356	0.962
9	40	0.9951	1.0228	1.002
10	45	1.0531	1.0188	1.040
11	50	1.1207	1.0218	1.088
12	55	1.1813	1.0336	1.133
13	60	1.2253	1.0524	1.169
14	65	1.2683	1.0790	1.207
15	70	1.3113	1.1116	1.247
16	75	1.3593	1.1452	1.290
17	80	1.4103	1.1847	1.338
18	85	1.4522	1.2005	1.412
19	90	1.2903	1.0070	1.200
20	95	0.3615	0.5400	0.416
21	100	0.3605	0.2310	0.321
TOTAL		20.0000	20.0000	20.0000
LOWER		8.3996	10.0196	8.8835
UPPER		11.6004	9.9804	11.1165
ASI		-0.1600	0.0020	-0.1117

Figure 5-2



18.6 Minimum and Maximum [Core] Average Fuel Clad Gap Conductivity at Rated Power Conditions

The values requested in this item are not used in Westinghouse LOCA methods. However, the Westinghouse FATES3B fuel rod design methodology utilizes the results of a generic study from 1985 to characterize the core average maximum and minimum gap conductivity for all CE fuel rod designs where a conservative estimate of core average behavior is required.

For St. Lucie Unit 2 at EPU rated power, the values for the minimum and maximum core average gap conductivity are based on the core average linear heat rate (CALHR) of 5.2039 kW/ft as follows:

(For conservatism in this calculation, the number of fuel rods in the core is reduced by 100 to allow for future reconstitution with non-fuel rods.)

$$\text{CALHR} = \frac{(3030\text{ MWt}) * (1000\text{ kW/MW}) * (12\text{ in/ft})}{(51212 - 100\text{ rods}) * (136.7\text{ in/rod})} = 5.2039\text{ kW/ft}$$

The minimum and maximum core average gap conductivity values for St. Lucie Unit 2 with EPU are as follows:

Minimum core average gap conductivity = 635 Btu/hr-ft^2-°F

Maximum core average gap conductivity = 6009 Btu/hr-ft^2-°F at rated power
= 5056 Btu/hr-ft^2-°F at hot zero power

18.7 Minimum Local Gap Conductance as a Function of LHGR

LBLOCA and SBLOCA

The extreme value data given in Tables 7-1.a through 7-1.d are for the average rod in the hot assembly and are listed for each of the fuel rod designs in the St. Lucie Unit 2 EPU core design, namely, a UO_2 fuel rod, and three types of Gadolinia fuel rods with integral fuel burnable absorber of 4, 6, and 8 wt%. The data given in Table 7-1 is for Optimized ZIRLO™ cladding but for purposes of this response to the data request, it is applicable for both Standard ZIRLO™ and Optimized ZIRLO™ cladding fuel rod designs.

The tabulated results are based on the Westinghouse FATES3B fuel rod design methodology for CE plants. This methodology is applied to the St. Lucie Unit 2 EPU core design at the fuel rod power associated with the actual core design and not at the hot rod LOCA limiting PLHGR. Westinghouse LOCA methodology includes further adjustments to the stored energy initial conditions appropriate for the hot rod and for the hot assembly being analyzed. This data is adjusted with additional conservatism and then used by the Westinghouse LOCA methodology to initialize the core average stored energy. In the tables below, to cover the possible need for slightly higher local linear heat rates, a FATES3B calculation for the short term power using the peak power at the highest axial node is included.

Table 7-1.a
Extreme Values as a Function of Power
For Columbia Optimized ZIRLO™ Clad 3 wt% Enriched UO_2 Fuel

LONG TERM POWER EXTREME VALUE TABLE
(AVG ROD)
(DATA SUPPLIED TO FATES CYCLE NUMBER 23)

POWER (KW/FT)	MAXIMUM FUEL AVERAGE TEMPERATURE (DEG F)	MAXIMUM FUEL CENTERLINE TEMPERATURE (DEG F)	MINIMUM GAP CONDUCTANCE (BTU/HR-FT2-F)
4.00	1171.	1413.	450.
6.40	1405.	1843.	735.
8.02	1553.	2141.	879.
8.81	1622.	2286.	978.
SHORT TERM POWER EXTREME VALUES USING THE PEAK POWER AT THE HIGHEST AXIAL NODE			
10.99	1834.	2727.	1260.

Table 7-1.b
Extreme Values as a Function of Power
For SFE Optimized ZIRLO™ Clad 4 wt% Gadolinia Fuel

LONG TERM POWER EXTREME VALUE TABLE
(AVG ROD)
(DATA SUPPLIED TO FATES CYCLE NUMBER 05)

POWER (KW/FT)	MAXIMUM FUEL AVERAGE TEMPERATURE (DEG F)	MAXIMUM FUEL CENTERLINE TEMPERATURE (DEG F)	MINIMUM GAP CONDUCTANCE (BTU/HR-FT2-F)
3.85	1174.	1448.	590.
6.17	1443.	1936.	738.
7.71	1597.	2250.	890.
8.48	1669.	2404.	994.
SHORT TERM POWER EXTREME VALUES USING THE PEAK POWER AT THE HIGHEST AXIAL NODE			
10.58	1889.	2861.	1302.

Table 7-1.c
Extreme Values as a Function of Power
For SFE Optimized ZIRLO™ Clad 6 wt% Gadolinia Fuel

LONG TERM POWER EXTREME VALUE TABLE
(AVG ROD)
(DATA SUPPLIED TO FATES CYCLE NUMBER 05)

POWER (KW/FT)	MAXIMUM FUEL AVERAGE TEMPERATURE (DEG F)	MAXIMUM FUEL CENTERLINE TEMPERATURE (DEG F)	MINIMUM GAP CONDUCTANCE (BTU/HR-FT2-F)
3.67	1169.	1448.	584.
5.88	1432.	1929.	755.
7.35	1593.	2248.	893.
8.08	1636.	2373.	1111.
SHORT TERM POWER EXTREME VALUES USING THE PEAK POWER AT THE HIGHEST AXIAL NODE			
10.09	1885.	2852.	1272.

Table 7-1.d
Extreme Values as a Function of Power
For SFE Optimized ZIRLO™ Clad 8 wt% Gadolinia Fuel

LONG TERM POWER EXTREME VALUE TABLE
(AVG ROD)
(DATA SUPPLIED TO FATES CYCLE NUMBER 05)

POWER (KW/FT)	MAXIMUM FUEL AVERAGE TEMPERATURE (DEG F)	MAXIMUM FUEL CENTERLINE TEMPERATURE (DEG F)	MINIMUM GAP CONDUCTANCE (BTU/HR-FT2-F)
3.51	1163.	1446.	580.
5.62	1402.	1902.	826.
7.03	1560.	2217.	983.
7.73	1633.	2370.	1086.
SHORT TERM POWER EXTREME VALUES USING THE PEAK POWER AT THE HIGHEST AXIAL NODE			
9.65	1882.	2844.	1243.

18.8 Gap Conductance

LBLOCA and SBLOCA

See responses to Items 18.7 and 18.10.

18.9 Linear Heat Rate

LBLOCA and SBLOCA

For St. Lucie Unit 2 at EPU rated power the core average linear heat rate (CALHR) used in LOCA analyses is 5.2039 kW/ft. (See Item 18.6 for calculation.) For conservatism in this calculation, the number of fuel rods in the core is reduced by 100 to allow for future reconstitution with non-fuel rods.

For LBLOCA, for St. Lucie Unit 2 at EPU rated power, the hot rod peak linear heat generation rate is 12.5 kW/ft.

For SBLOCA, for St. Lucie Unit 2 at EPU rated power, the hot rod peak linear heat generation rate is 13 kW/ft.

ECCS Performance for LBLOCA is typically more limiting than SBLOCA and is analyzed at a lower PLHGR.

18.10 Fuel Average and Centerline Temperature as a Function of Burnup for the Hot Rod in the Hot Bundle

LBLOCA and SBLOCA

The hot rod in the hot assembly is a UO_2 fuel rod without Gadolinia integral fuel burnable absorber. As specified by the physics core design, the maximum power of any Gadolinia fuel rod with 4, 6, or 8 wt% Gadolinia is 90% relative to the power of the peak UO_2 fuel rod in its assembly, for average burnups less than 10 GWD/MTU. The data given in Table 10-1 is for Optimized ZIRLO™ cladding but for purposes of this response to the data request, it is applicable for both Standard ZIRLO™ and Optimized ZIRLO™ cladding fuel rod designs.

The tabulated results are based on the Westinghouse FATES3B fuel rod design methodology for CE plants. This methodology is applied to the St. Lucie Unit 2 EPU core design at the hot rod power associated with the actual core design (11.43 kw/ft) and not at the LOCA limiting PLHGR (12.5 kw/ft). Westinghouse LOCA methodology includes further adjustments to the stored energy initial conditions appropriate for the hot rod PLHGR being analyzed. Also, the burnup power variation (referred to as the "radial falloff curve") is represented with time-in-life "burn-down" consistent with the "no-clad-liftoff" methodology. In other words, the local power defined at a given burnup point for the calculation of the fuel stored energy is selected to bound physics depletion calculations, without resulting in the cladding separating from the pellet during the later stages of the life of the fuel. This Westinghouse method for representing fuel rod power degradation with burnup conservatively bounds actual physics calculated hot rod power for purposes of defining the fuel initial stored energy and rod internal pressure for LOCA analyses.

Table 10-1
Hot Rod Results for Columbia Optimized ZIRLO™ UO_2 Clad Fuel – Hot Rod

CYCLE	ROD AVG BURNUP (GWD/MTU)	LOCAL BURNUP (GWD/MTU)	AXIAL NODE	POWER (KW/FT)	GAP CONDUCTANCE (BTU/HR-FT2-F)	FUEL AVG TEMPERATURE (DEG F)	FUEL CENTERLINE TEMPERATURE (DEG F)
1	0.0000	0.0000	18	11.43	1603.	1803.	2740.
2	0.0500	0.0500	18	11.43	1545.	1812.	2748.
3	0.1000	0.1000	18	11.43	1490.	1826.	2763.
4	0.5000	0.5000	18	11.43	1322.	1866.	2802.
5	1.0000	1.0000	18	11.43	1338.	1859.	2790.
6	2.0000	2.0000	3	11.43	1237.	1831.	2753.
7	4.0000	4.0000	3	11.43	1281.	1811.	2726.
8	6.0000	6.0000	3	11.43	1452.	1756.	2659.
9	8.0000	8.0000	3	11.43	1674.	1703.	2593.
10	10.0000	10.0000	3	11.43	1959.	1650.	2527.
11	12.0000	12.0000	3	11.43	2350.	1600.	2464.
12	14.0000	14.0000	3	11.43	2925.	1551.	2401.
13	16.0000	17.6000	17	11.43	5111.	1529.	2375.
14	18.0000	19.8000	17	11.43	4809.	1537.	2387.
15	20.0000	22.0000	17	11.43	4495.	1547.	2402.
16	22.0000	24.2000	17	11.43	4182.	1559.	2418.
17	24.0000	26.4000	17	11.43	3876.	1572.	2435.
18	26.0000	28.6000	17	11.43	3582.	1586.	2455.
19	28.0000	30.8000	17	11.43	3299.	1601.	2476.
20	30.0000	33.0000	17	11.43	3042.	1618.	2499.
21	31.0000	34.1000	17	11.43	2919.	1627.	2511.
22	32.0000	35.2000	17	11.43	2805.	1636.	2524.
23	33.0000	36.3000	17	11.43	2697.	1646.	2536.
24	34.0000	37.4000	17	11.37	2619.	1647.	2534.
25	35.0000	38.5000	17	11.37	2521.	1656.	2546.
26	36.0000	39.6000	17	11.37	2429.	1666.	2559.
27	37.0000	40.7000	17	11.37	2341.	1676.	2573.
28	38.0000	41.8000	17	11.37	2259.	1686.	2586.
29	39.0000	42.9000	17	11.32	2203.	1687.	2583.
30	40.0000	44.0000	17	11.27	2145.	1689.	2583.
31	41.0000	45.1000	17	11.22	2091.	1692.	2583.

32	42.0000	46.2000	17	11.17	2041.	1692.	2580.
33	43.0000	47.3000	17	11.11	1997.	1693.	2576.
34	44.0000	48.4000	17	11.05	1955.	1693.	2572.
35	45.0000	49.5000	17	11.00	1915.	1693.	2568.
36	46.0000	50.6000	17	10.95	1874.	1694.	2567.
37	47.0000	51.7000	17	10.93	1829.	1700.	2572.
38	48.0000	52.8000	17	10.90	1787.	1705.	2577.
39	49.0000	53.9000	17	10.85	1756.	1704.	2572.
40	50.0000	55.0000	17	10.73	1740.	1694.	2550.
41	51.0000	56.1000	17	10.57	1738.	1675.	2514.
42	52.0000	57.2000	17	10.42	1734.	1659.	2482.
43	53.0000	58.3000	17	10.29	1731.	1643.	2452.
44	54.0000	59.4000	17	10.14	1730.	1626.	2418.
45	55.0000	60.5000	17	10.00	1727.	1611.	2388.
46	56.0000	61.6000	17	9.87	1718.	1597.	2362.
47	57.0000	62.7000	17	9.73	1705.	1584.	2333.
48	58.0000	63.8000	17	9.60	1688.	1573.	2309.
49	59.0000	64.9000	17	9.46	1672.	1559.	2282.
50	60.0000	66.0000	17	9.34	1658.	1547.	2257.
51	61.0000	67.1000	17	9.21	1645.	1535.	2232.
52	62.0000	68.2000	17	9.10	1632.	1524.	2210.
53	63.0000	69.3000	17	8.98	1621.	1513.	2188.
54	64.0000	70.4000	17	8.87	1610.	1501.	2164.
55	65.0000	71.5000	17	8.77	1599.	1491.	2145.

18.11 Additional Supporting Data (Loop Seal Clearing related and Hot Channel Conservatisms)

The Westinghouse response is as follows[2]:

Specifications for Modeling SBLOCA Loop Seal Clearing with the S2M for Discharge Leg Break Locations

1. The S2M model for loop seal clearing is specified in the following SBLOCA Topical Report and Section:
   CENPD-137P, Section B.1.1.5.
2. For St. Lucie Unit 2 EPU, the limiting loop seal clearing configuration used in the SBLOCA analysis was full clearing of the broken side intact loop.

Specifications for Modeling SBLOCA Hot Channel Conservatisms with the S2M for Hot Rod Heatup Calculations

1. The S2M model for the hot channel thermal-hydraulics during the period of time of core uncovery with cooling by heat transfer to steam boiloff is specified in the following SBLOCA Topical Report and Section:
   CENPD-138P, Section 2
2. A specific submittal to NRC regarding the S2M hot rod steaming rate conservatisms is documented in the following Topical Report and Section:
   CENPD-137 Supplement 2-P-A, Appendix J
3. For St. Lucie Unit 2 EPU, the hot rod PLHGR used in the SBLOCA analysis was conservatively specified above the COLR limit as 13.0 kW/ft (COLR limit is 12.5 kW/ft), which was used with a conservatively defined top peaked axial power profile.
4. For St. Lucie Unit 2 EPU, the hot channel steam flow rate from boiloff was conservatively defined [ ] (a, c)
5. For St. Lucie Unit 2 EPU, the hot channel coolant energy balance for calculating steam superheat above the mixture level was conservatively defined [ ] (a, c)
6. [ ] (a, c)
7. No return to nucleate boiling allowed
8. [ ] (a, c)
9. Licensing values of PCT and PLO were determined by special study [ ] (a, c) that maximized PCT and/or PLO.

Plots of Key Variables for the EPU LBLOCA and SBLOCA

The plots of key variables including the containment pressure are not included. The analyses have not been completed and the calculation documentation has not been finalized at this time.

[2] Westinghouse proprietary information is bracketed for future considerations.