



**FLORIDA POWER & LIGHT
ST. LUCIE UNIT 2
STEAM GENERATOR INSPECTION**

PLANNING FOR SL2-16, APRIL 2006

**St. Lucie Unit 2 - Steam Generator
Inspection Planning for SL2-16**

AGENDA

- Purpose of Meeting
- Background & S/G Condition
- SL2-16 Inspection Scope
- Projected Tube Plugging
- Operating Experience
- Contingency Planning
- Generic Letter 2006-01
- Summary & Closing



St. Lucie Unit 2 - Steam Generator Inspection Planning for SL2-16

Purpose of Meeting

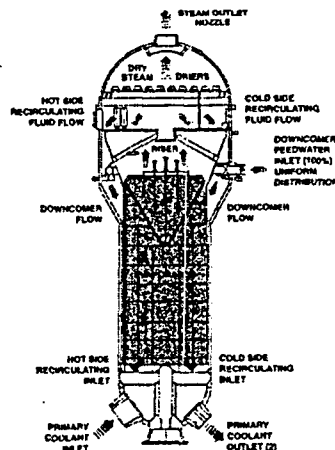
- Review SL2 S/G Condition
- Review SL2-15 Inspection Planning
- Address Staff Concerns



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St. Lucie Unit 2 - Steam Generator Inspection Planning for SL2-16

Background & S/G Condition



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- S/G Design
- CE Model 3410
- 8411 Tubes / SG
- ~19.3 EFPY @ SL2-16
- A-600 HTMA Tubing
- CS Lattice Support System (eggcrates)
- Tubesheet Joint - Explosive
- Total Tubes Plugged
 - SG A - 1469 (17.5%)
 - SG B - 1709 (20.3%)
- T-Hot ~600°F

St. Lucie Unit 2 - Steam Generator Inspection Planning for SL2-16

Background & S/G Condition

FPL Steam Generator Program

- Committed to Safe Operation
- Full Implementation of NEI 97-06, S/G Program Guidelines
 - Inspection
 - Chemistry
 - Leak Monitoring
- Incorporate Industry Experience
- Extensive Examination History at Unit 2
- Conservative Approach
 - In Situ Pressure Test at Last 6 Inspections



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St. Lucie Unit 2 - Steam Generator Inspection Planning for SL2-16

Background & S/G Condition

- Last Inspection - SL2-15 in January 2005
- Results Discussed with NRR During Outage
 - Damage Mechanisms Generally as Expected
 - 1 Tube Ding with ODSCC
 - Limited PWSCC in Tubesheet (3 in Upper 2", 1 at Tack Roll)
 - Increase in Axial ODSCC at Eggcrate Supports
 - RCL Indications Detected During Pull Out Scans
 - Addressed in OA Model
 - Tested with Qualified Technique if > .35 Volts
 - No Tube Integrity Issues



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Indication Count Summary for SL2-15

<u>Mechanism</u>	<u>S/G A</u>	<u>S/G B</u>	<u>Total</u>
Axial ODSCC at Eggcrate Supports	1184	1266	2450
Axial ODSCC at Diagonal Supports	1	8	9
Axial ODSCC at Tube Dings	0	1	1
Axial ODSCC in Freespans	0	1	1
Axial ODSCC at Top of HL Tubesheet	14	2	16
Axial IDSCC Below Top of HL Tubesheet	1	1	2
Circ. ODSCC at Top of HL Tubesheet	7	10	17
Circ. IDSCC at Top of HL Tubesheet	0	1	1
Circ. IDSCC at HL Tube End	0	1	1
Wear Due to Foreign Objects	1	1	2
Wear at Diagonal & Vertical Supports	672	443	1115
Wear at Eggcrate Tube Supports	67	73	140



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Background & S/G Condition

TUBE PLUGGING HISTORY

<u>Damage Mechanism (1)</u>	<u>4/00</u>	<u>11/01</u>	<u>4/03</u>	<u>1/05</u>
OD Cracks at Tube Supports	14	259	482	1592
Mech. Wear at Tube Supports	18	11	-	1
OD Cracks at Tubesheet	17	20	27	20
Preservice, FO, Preventative	-	51	6	2
Circ. OD Cracks at Tubesheet	5	13	10	15
OD Volumetric - Various	-	2	-	-
ID Cracks in Tubesheet	-	-	4	3
OD Cracks at Dings	-	5	-	1
OD Cracks in Freespan	-	-	1	1
	54	361	530	1635
Cumulative Plugging	652	1013	1543	3178
Cumulative Percent	3.9%	6.0%	9.2%	18.9%



(1) Axial unless noted otherwise

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Background & S/G Condition

Benchmark of Predicted (best estimate) vs. Observed Indications

<u>Mechanism</u>	<u>Case</u>	<u>Predicted</u>	<u>Observed</u>
Axial ODSCC at Eggcrates	Worst SG	928	1217
Axial ODSCC at Tube Dings	All SGs	2	1
Axial ODSCC at Transition	All SGs	43	16
Axial IDSCC below Transition	All SGs	15	2
Circ. ODSCC at Transition	All SGs	25	17



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Background & S/G Condition

Probability of Burst (POB)

<u>Mechanism</u>	<u>S/G A</u>	<u>S/G B</u>
ODSCC at Eggcrates	0.0269	0.0222
ODSCC at Dings	0.009	
ODSCC at Top-of-Tubesheet	~0	
Cumulative POB	0.0356	

- Significant Axial Degradation Mechanisms
- Cycle 15 Length for 10% POB Criterion - 17.4 EFPM
- Cycle 15 Length for 5% POB Criterion - 16.2 EFPM
- Planned Cycle 15 Length is ~14.5 EFPM



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Background & S/G Condition

In Situ Pressure Testing SL2-9 Through SL2-15

- 73 Total Indications (19 at SL2-15)
- Mechanisms Include
 - Axial ODSCC at Eggcrates
 - Axial ODSCC at Dings
 - Axial ODSCC at TTS
 - Axial IDSCC below TTS
 - Circ ODSCC at TTS
 - Circ IDSCC at TTS
 - OD Volumetric TTS
- No Leakage or Burst



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St. Lucie Unit 2 - Steam Generator Inspection Planning for SL2-16

SL2-16 Inspection Scope

- Visual Examination of All Tube Plugs
- Bobbin Probe All Active Tubes
 - Screen Dings <5 Volts in Straight Sections
 - Full Length Row 3-140, Straight Length Row 1-2
- Plus Point Probe
 - 100% Hot Leg Top of Tubesheet (+3" / -13")
 - Cold Leg Periphery Tubes (+3" / -2")
 - 20% Row 1-2 U-bends (A-23, B-25)
 - 20% Wear at Vertical Straps (A-86, B-58)
 - 100% Wear at Eggcrates, HL & CL Diagonals (A-274, B-202)
 - Full Tubesheet if No Tube Expansion (A-21, B-1)



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SL2-16 Inspection Scope (con't)

■ Plus Point Probe for Dings

	<u>SGA</u>	<u>SGB</u>
▸ All Dings Hot Leg Tubesheet to 1st Support	68	78
▸ All Dings >5 volts 1st Support to HL Bend	57	80
▸ All Dings in HL & CL Square Bends Row 19-140	90	68
▸ All Dings >5 volts in Horizontal Run Row 19-140	71	102
▸ All Dings in Rows 1-18 U-Bends	113	89
▸ 20% Dings >5 volts CL Tubesheet to CL Bend	<u>17</u>	<u>23</u>
	416	440

■ In Situ Testing Based on Industry Screening Guidance



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St. Lucie Unit 2 - Steam Generator Inspection Planning for SL2-16

Projected Tube Plugging

Mechanism/Location	Predicted Number of Indications at EOC 15		Predicted Number of Tubes Repaired at EOC 15	
	S/G A	S/G B	S/G A	S/G B
Axial ODSCC at Eggcrate Supports				
Lower 5%	2400	2178	1458	1257
Best Estimate	2561	2331	1556	1345
Upper 95%	2722	2485	1654	1434
Axial ODSCC Near TTS	30	10	30	10
Circumferential ODSCC at TTS	15	20	15	20
Axial IDSCC Below TTS	5	5	5	5
Circumferential IDSCC Below TTS	5	5	5	5
Axial ODSCC at Dings	5	5	5	5

Best Estimate Cumulative Repairs ~3050 ~3075
Current Tube Plugging Limit 2520 2520



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Tube Sleeving Plans

- Westinghouse Alloy 800 Leak Limiting Sleeve
- 60-70% of Repairable Tubes are Candidates
- Sleeve Tubes that Require Only 1 Sleeve
- Maintain 30% Effective Tube Plugging Margin
- Contingency for 42% Tube Plugging
 - Required Repairs Exceed Expectations
 - Sleeving Field Effort Difficulties



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Operating Experience

- Continue Emphasis on Dings/Dents & Anomalous Indications
- Foreign Object Damage
- Batwing Support Condition (Waterford)
- Fabrication Issues (Byron & Davis Besse)
- Tube to Tube Wear (Tube Sever)
 - Susceptible Locations to be Reviewed by Lead Analysts



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Contingency Planning

<u>Issue or Inspection Item</u>	<u>Contingency Action</u>
Leaking Plug	Replace as Necessary
Crack in Row 1&2 U-bend	Test 100% Affected Rows & 20% Row 3, etc.
Crack in U-bend Wear Scar	Test All (A~430, B~290)
Crack in Cold Leg Ding	Test All (A~85, B~115)
Foreign Object Wear	Bound FO Wear
CL Expansion Transition Cracking	Test 100% in Affected SG
Freespan Cracking	Validate Bobbin POD
RCL Indications on Pull Out Scan	Retest if >.35 Volts



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St. Lucie Unit 2 - Steam Generator Inspection Planning for SL2-16

Generic Letter 2006-01

Submit LAR to Adopt TSTF-449

- By May 31, 2006
 - Replacement SG Program
 - Original SG Program
 - Include Sleeving Repair Method
 - Include Tubesheet Inspection Provisions (C*)
 - Administrative Controls
 - Limit Pri-Sec Leakage to 108 gpd/SG
 - Address Leakage Predictions for Tubesheet & Sleeves



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St. Lucie Unit 2 - Steam Generator Inspection Planning for SL2-16

Summary & Closing

- FPL Program Meets Industry Guidance
- Comprehensive Inspection Program
- Reasonable Assurance of Tube Integrity
- Compliance with Tech Specs & NRC Positions
- Amend License for TSTF-449
- Identify & Address Staff Concerns

