

February 22, 2000

LICENSEE: Florida Power and Light Company
 FACILITY: St. Lucie Nuclear Plant, Units 1 and 2
 SUBJECT: SUMMARY OF MEETING ON FEBRUARY 22, 2000, REGARDING ST. LUCIE UNIT 2 STEAM GENERATOR INSPECTION PROGRAM (TAC NO. M15005)

On February 22, 2000, the U.S. Nuclear Regulatory Commission staff met with Florida Power and Light Company (FPL) representatives to discuss the inspection program for St. Lucie Unit 2 steam generators. The meeting was open to the public, as stated in the meeting notice dated February 8, 2000. FPL plans to perform the steam generator inspection during its Cycle 12 refueling outage currently scheduled for this spring. Enclosure 1 is a list of attendees and Enclosure 2 is the meeting agenda. Enclosure 3 contains a copy of the FPL handout distributed during the meeting.

The licensee described the steam generator inspection program for the St. Lucie Cycle 12 refueling outage. The licensee also described its event-driven freespan inspection program and the industry experience with freespan cracking. The staff notes that the meeting was beneficial in gaining an understanding of FPL's inspection program. However, the staff does not concur or endorse the steam generator inspection plan presented by FPL during this meeting.

/RA/

Kahtan N. Jabbour, Senior Project Manager, Section 2
 Project Directorate II
 Division of Licensing Project Management
 Office of Nuclear Reactor Regulation

Docket Nos. 50-335 and 50-389

Enclosures: 1. Attendance List
 2. Meeting Agenda
 3. FPL Handout

cc w/enclosures: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 22, 2000

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ATTENDANCE LIST
NUCLEAR REGULATORY COMMISSION MEETING WITH FLORIDA PWER

AND LIGHT COMPANY

ST. LUCIE UNIT 2 STEAM GENERATOR INSPECTION PROGRAM

FEBRUARY 22, 2000

NRC

K. Jabbour

E. Sullivan

E. Murphy

L. Lund

J. Tsao

FPL

A. Stall

G. Madden

R. Gil

G. Boyers

MEETING AGENDA

U.S. Nuclear Regulatory Commission and

Florida Power & Light Company

St. Lucie Unit 2 Steam Generator Inspection Program

February 22, 2000

- Introduction by the NRC staff and FPL
- Steam Generator Design/Operation
- Steam Generator Inspection History
- Inspection Program for the Upcoming Outage
- Freespan/Statistical Program
- Summary
- Concluding Remarks By FPL and the NRC staff



**Florida Power & Light Company
St. Lucie Nuclear Plant**

UNIT 2

STEAM GENERATOR INSPECTION PLAN
CYCLE 12 REFUELING OUTAGE (4/17/2000)



AGENDA

Introduction

Art Stall, VP
Engineering

S/G Design & Operation

Rudy Gil, Manager
Component, Support
& Inspections

Inspection History &
SL2-R12 Inspection Plan

Gary Boyers, S/G
Program Coordinator

Event Driven Freespan
Inspection Program

Gary Boyers, S/G
Program Coordinator

Summary

Art Stall, VP
Engineering



INTRODUCTION

ART STALL

VICE PRESIDENT
NUCLEAR ENGINEERING



INTRODUCTION

- Purpose of Meeting
 - Describe Inspection Plans for St. Lucie Unit 2, Cycle 12
 - Identify & Address Staff Concerns Prior to SL2-12 RFO

- FPL's Philosophy of Inspection
 - Committed to Safe Operation
 - Incorporate Industry Experience
 - Conservative Repair Plans

- Industry Initiative on NEI 97-06
 - Participation in NEI/NRC Meetings on Generic PLA
 - S/G Program Incorporates Industry Guidance for:
 - Tube Examination
 - Primary & Secondary Water Chemistry
 - Primary-to-Secondary Leak Monitoring
 - In Situ Pressure Testing
 - Tube Integrity Assessment



S/G DESIGN & OPERATION

RUDY GIL

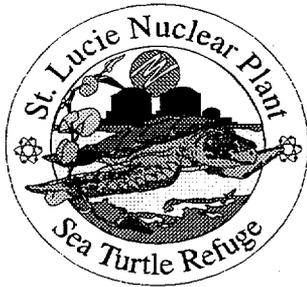
**MANAGER, COMPONENT, SUPPORT &
INSPECTIONS**



S/G DESIGN & OPERATION

- Two Model 3410 CE Designed Steam Generators
 - Commercial Operation - August 1983
 - 13.8 EFPY at End of Cycle 12 - 4/17/00
 - Hot Leg Temperature ~600°F

- Design
 - High Temperature Mill Annealed Tubes
 - Tube to Tube Sheet Crevices Closed by Shop Expansion Process
 - Seven Full Diameter Carbon Steel Egg Crates
 - Two Partial Diameter Carbon Steel Egg Crates
 - Carbon Steel Bat Wings and Five Vertical Straps in Upper Bundle



S/G DESIGN & OPERATION

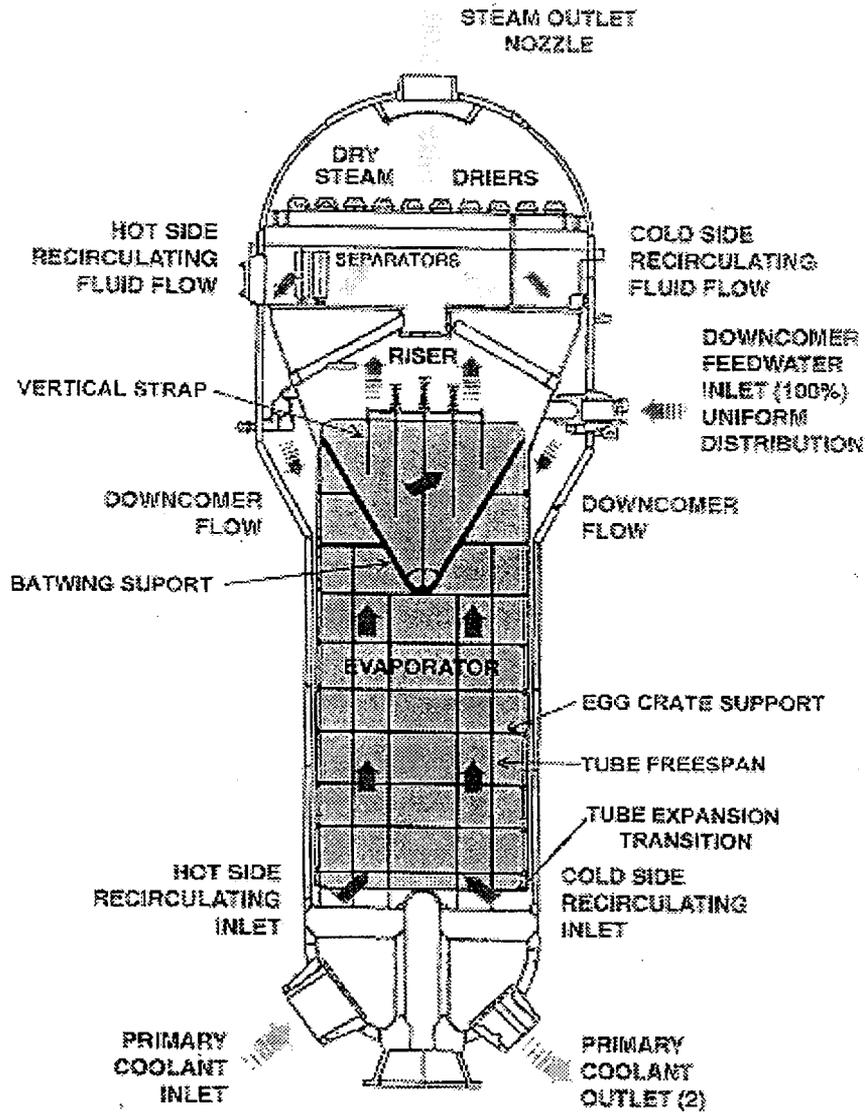
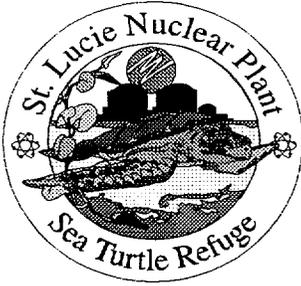


Figure 3-4 Schematic of St. Lucie Unit 2 Steam Generator



S/G DESIGN & OPERATION

- S/G Chemistry - Meets Industry Practice
 - All Volatile Treatment Chemistry Since Start-up
 - Dimethylamine 1 ppm (DMA) started in 1999
 - Evaluating ETA - Reduce Iron Transport
 - Boric Acid Addition Since 1990
 - HYDRAZINE @ 8x DO₂
 - AMMONIA @ ~ 7 ppm
 - Elevated Feedwater pH ~9.8
 - Continuous Blowdown
 - Condensate Polishers Used on Startup



S/G DESIGN & OPERATION

- Primary to Secondary Leakage
 - Technical Specification Requirements
 - EPRI Leak Guidelines Incorporated in Procedures
 - Current Primary to Secondary Leakage < LLD*
 - Only Tube Leak Occurred in 3/85 at Batwing Contact
 - Leak Rate at Shutdown was 18 -20 GPD

- Primary to Secondary Leak Monitoring
 - 3 Samples/7 Days - 5 ml Gross Activity
 - Monthly Sample - 4000 ml Dose Equivalent Iodine
 - On-line Blowdown & Air Ejector Monitors
 - Grab Samples - 400 Liter Sample On Resin
 - Weekly if >LLD
 - Secondary Side Tritium - Monthly if <LLD
 - Weekly if >LLD
 - Main Steam Line Radiation Monitors

* LOWER LEVEL OF DETECTABILITY



INSPECTION HISTORY & SL2-12 INSPECTION PLAN

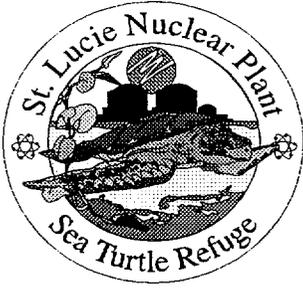
GARY BOYERS

**FPL STEAM GENERATOR PROGRAM
COORDINATOR**



SL-2 INSPECTION HISTORY

- **Steam Generators Are in Good Condition**
 - **Upper Tube Bundle Region - Batwings and Vertical Straps**
 - Change in Batwing Design Resulted in 400 - 500 Tubes Susceptible to Wear Over Life of Plant
 - Wear Occurs Randomly at Tube Contacts with Vertical Straps
 - Wear Reported in 442 Tubes Currently in Service
 - 257 in Steam Generator A
 - 185 in Steam Generator B
 - **Tube Plugging History**
 - 426 Due to Wear - U-Bend
 - 94 Due to Axial Cracks - Sludge Pile
 - 17 Circumferential Cracks - Sludge Pile
 - 11 Loose Parts & Other
 - 50 Preservice
 - Total - 319 in S/G A and 279 in S/G B



SL-2 INSPECTION HISTORY

- **Prior Inspection Scope - SL2-R11 (11/98)**
 - **Bobbin Coil Inspections**
 - Full Length of All Active Tubes
 - **Plus Point Inspections**
 - All Hot Leg Active Tubesheet Expansion Transitions
 - All Freespan Indications that are New or show Change
 - All Freespan Indications were Inspected in 4/97
 - 20% of Row 1 & 2 U-Bends
 - All Dents not Inspected in 4/97 (~60/SG)
 - 14 Mechanical Wear Indications
 - **Visual Inspection of All Tube Plugs**
 - **In Situ Pressure Testing**



SL-2 INSPECTION HISTORY

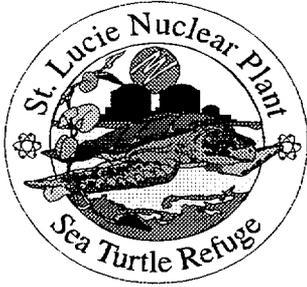
- Prior Inspection Results - SL2-R11 (11/98)

- Tube Plugging

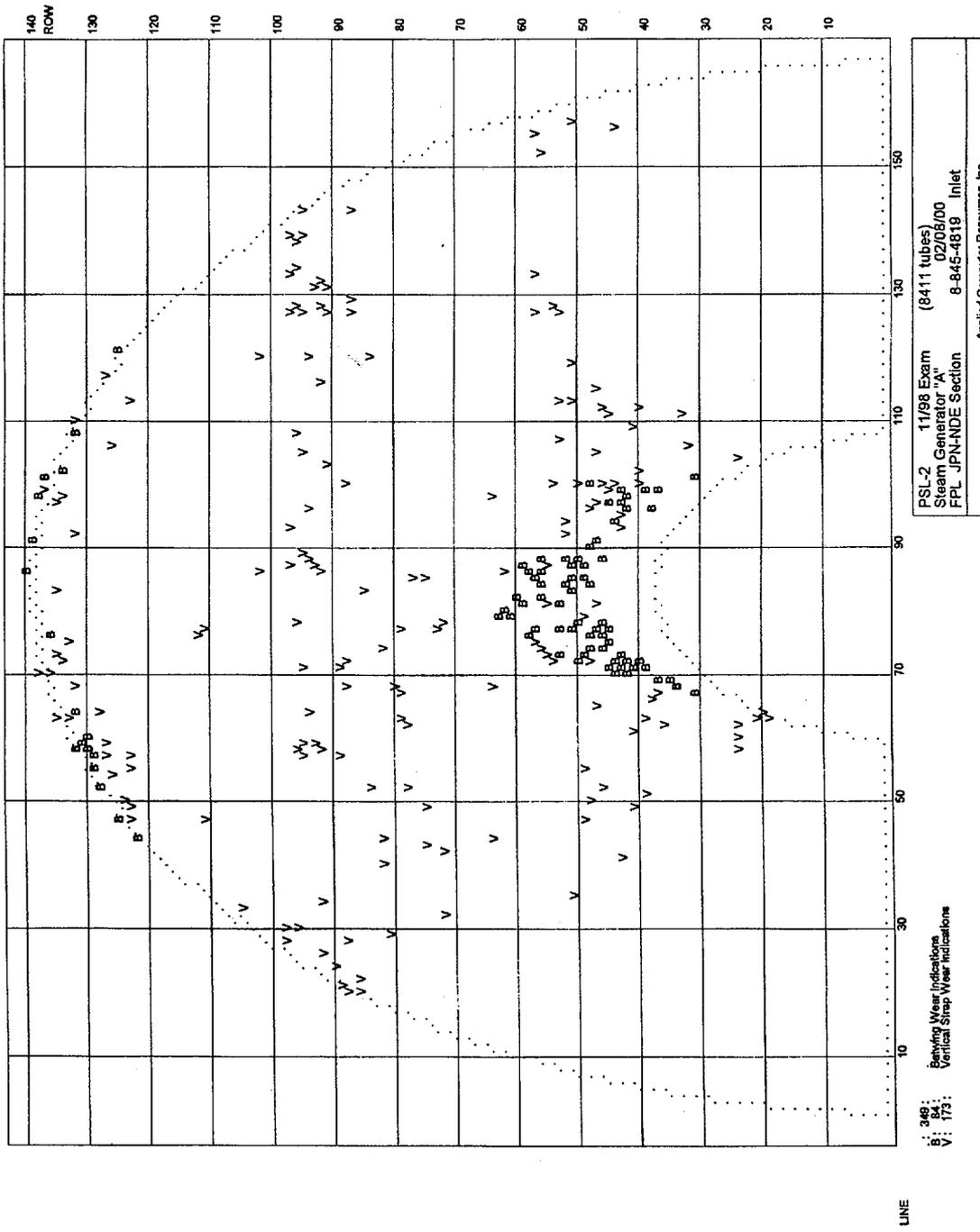
<u>Cause</u>	<u>S/G 2A</u>	<u>S/G 2B</u>
Mechanical Wear	2	3
Volumetric Flaws	1	0
Loose Parts	2	1
HL Sludge Pile/Axial	6	6
HL Sludge Pile /Circumferential	0	1
Preventive	<u>1</u>	<u>0</u>
	12	11

- In-Situ Pressure Tests Completed

- 5 Largest Axial Indications
 - 1 Volumetric (Pit) Indication
 - 1 Loose Part Wear Indication
 - All Met Structural Limits / No Leakage



SL-2 INSPECTION HISTORY S/G "A" MAP SHOWING WEAR INDICATIONS CURRENTLY INSERVICE



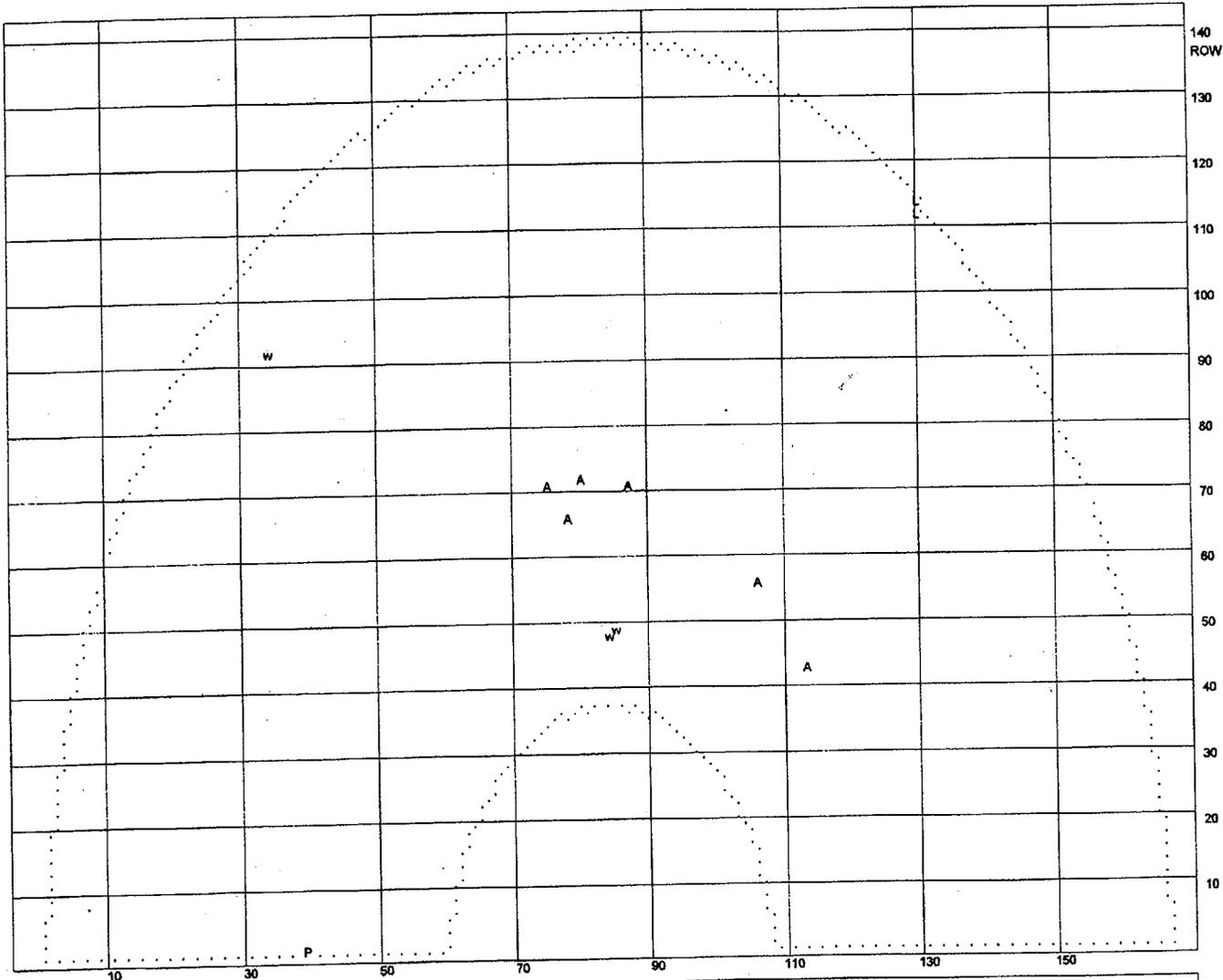
SL-2 INSPECTION HISTORY S/G "A" MAP SHOWING WEAR INDICATIONS CURRENTLY INSERVICE



SL-2 INSPECTION HISTORY

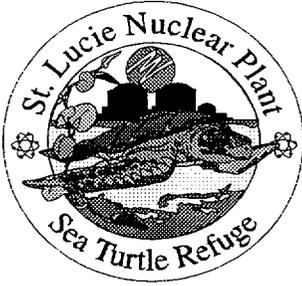
SL2-R11 PLUGGABLE INDICATIONS

IN S/G "A"



: 367 :
 w : 3 : Wear Indications
 P : 1 : Pit Indications
 L : 2 : Loose Part Indications
 A : 6 : Axial Crack Indications
 C : 0 : Circumferential Crack Indications

PSL-2 11/98 Exam (8411 tubes)
 Steam Generator "A" 02/08/00
 FPL JPN-NDE Section 8-845-4819 Inlet
 Applied Computer Resources, Inc.



SL-2 INSPECTION HISTORY

- History for Evaluation of Freespan Regions
 - 1993 - Upper Bundle Freespan Tube Rupture at CE Plant. Deposits & Concentration of Contaminants.
 - 1994 - ATHOS Evaluation of S/G Tube Bundles to Determine High Deposit Potential Regions.
 - 1994 - MRPC Examination of High Deposit Potential Regions (376 Tubes/~1400 Tube Spans). No Indications Reported.
 - 1995 - Re-inspection of High Deposit Potential Regions (19 Tubes/~100 Tube Spans). No Indications Reported.
 - 1997 - All Freespan Indications Regardless of Origin Examined by Plus Point (89 in S/G A & 71 in S/G B).
 - ~75% Were Traceable to 1982 Preservice Data
 - Remainder were Traceable to 1987 Data
 - No Cracking Reported
 - 1 Volumetric Indication Plugged
 - 1998 - Plus Point Inspect Freespan Indications that Show Change or Growth from Prior Inspection.



SL2-R12 INSPECTION PLAN APRIL 2000

INSPECTION PLAN OVERVIEW

- **Basic Inspection Strategy**
 - Technical Specifications
 - EPRI PWR S/G Examination Guidelines

- **Inspection Plan Incorporates**
 - Site & Industry Experience
 - EPRI Qualified & Site Validated Techniques
 - Strong Utility Oversight
 - Schedule Critical Decisions Early

- **Demonstrate Tube Integrity if Required**
 - In Situ Pressure Test



SL2-R12 INSPECTION PLAN APRIL 2000

BASE SCOPE INSPECTION PLAN

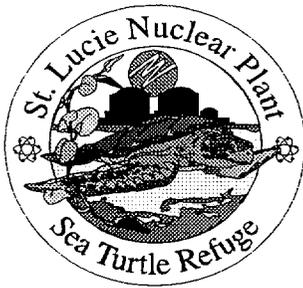
- **Bobbin Coil Inspect Full Length All Active Tubes**
 - Tube Condition Screening
- **Plus Point Inspections**
 - All Hot Leg Active Tubesheet Expansion Transitions
 - 20% of Row 1 & 2 U-Bends
 - 20% of Hot Leg Dents
 - Small Sample of Mechanical Wear Indications
 - All Freespan Indications that are New or show Change
 - If Freespan Cracking is Confirmed
 - Inspect Tube Full Length on Leg with Confirmed Crack-Like Bobbin Indication
 - Inspect 6 Adjacent Neighbor Tubes at Span of Confirmed Crack-Like Bobbin Indication
- **Demonstrate Tube Integrity if Required**
 - EPRI In Situ Pressure Test Guideline
 - Test Indications that Exceed Criteria
 - Up To 5 or 20% if >25
 - Each Degradation Mechanism
- **Visual Inspection of All Tube Plugs**



SL2-R12 INSPECTION PLAN APRIL 2000

BASE SCOPE INSPECTION PLAN

- Expansion Plans (Per Generator Basis)
 - Sample 20% of Cold Leg Transitions if Hot Leg Transitions are >1% Defective
 - If Low Row U-Bend Cracking Detected, Inspect Remainder of Affected Row(s) & 20% of Next Row
 - If Cracking Detected in Hot Leg Dented Regions, Inspect Remaining Hot Leg Dents. Sample 20% of Cold Leg Dents if HL is >1% Defective.
 - If Cracking Detected in Wear Scars, Examine Remaining Wear Scars \geq 20% Depth by Bobbin



SL2-12 INSPECTION PLAN APRIL 2000

EVENT DRIVEN FREESPAN INSPECTION PROGRAM

- Basic Inspection Strategy
 - 100% Coverage of Tube Bundle Using Bobbin Coil
 - Plus Point Inspect All Bobbin Coil Indications Showing Change from St. Lucie 2 - R11
 - Continuous Review of Results
 - Utilize Industry Data to Assess Expansion Scope
 - If Freespan Cracking is Confirmed by Plus Point
 - Immediate Expansion
 - Remainder of Leg of Affected Tube
 - Six Neighbor Tubes at Elevation Span



SL2-12 INSPECTION PLAN APRIL 2000

EVENT DRIVEN FREESPAN INSPECTION PROGRAM

- **As Planned Inspections are Completed**
 - Evaluate Locations of All Confirmed Freespan Cracks
 - Determine Applicable Inspection Scenario
 - Select Most Appropriate Plus Point Sampling Scheme
 - Maximize Use of Resources
 - Maximize Potential for Demonstrating Full Cycle Tube Integrity

<u>Scenario</u>	<u>Degree</u>	<u>Clustered</u>	<u># Cracks</u>	<u>Sample Scheme</u>
Case 1	None	n/a	None	None
Case 2	Minimal	Yes	<15	LHS*
Case 3	Minimal	No	<15	LHS
Case 4	Moderate	Yes	15-50	Importance
Case 5	Moderate	No	15-50	Reduced LHS
Case 6	Severe	Yes	>50	Importance
Case 7	Severe	No	>50	Systematic

*LHS - Latin Hypercube



SL2-12 INSPECTION PLAN APRIL 2000

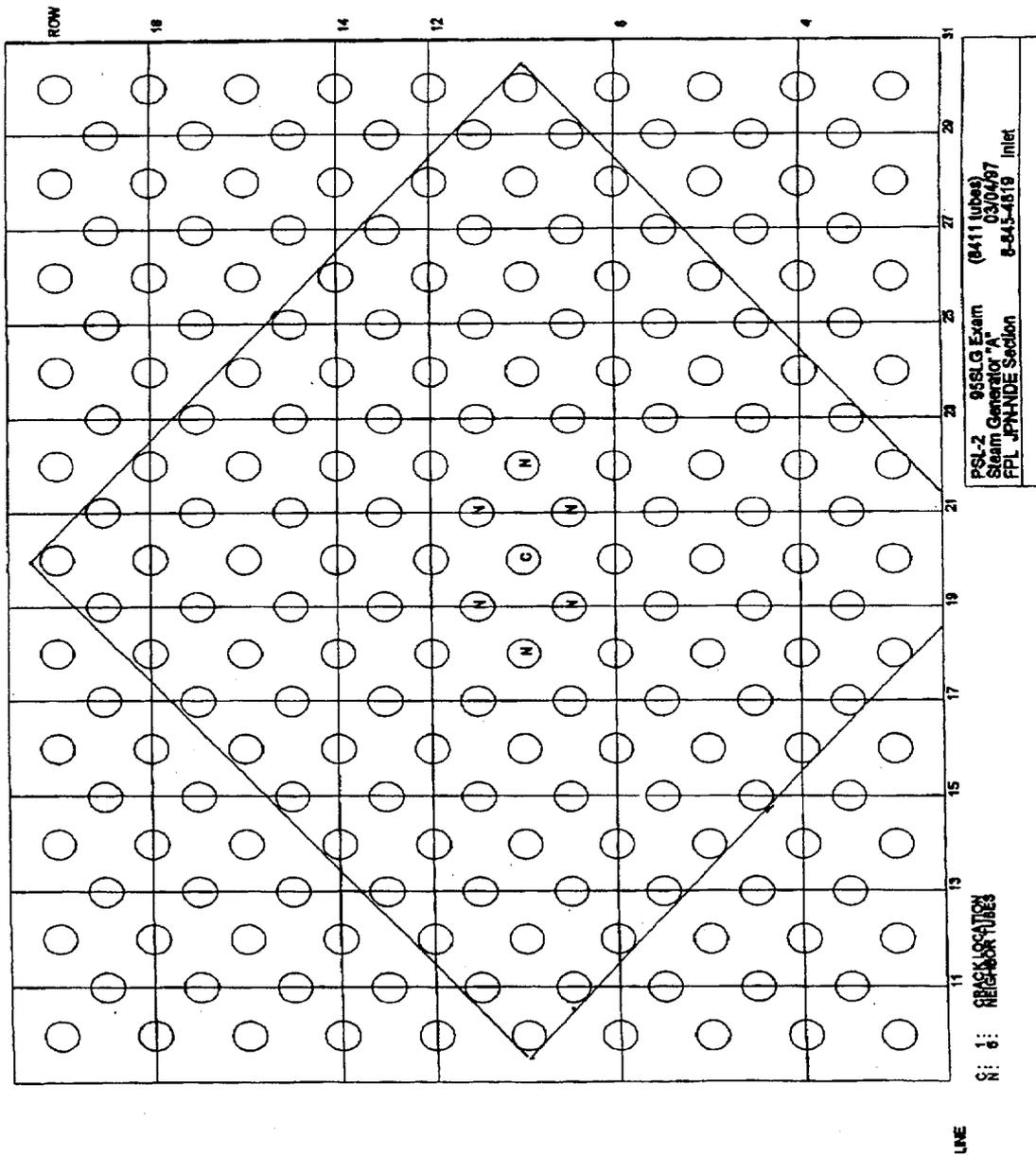
EVENT DRIVEN FREESPAN INSPECTION PROGRAM

- **Latin Hypercube Sample Scheme Considered Most Likely Scenario**
 - **Proven Efficiency vs. Random Sampling**
 - **Process Provides Optimal Coverage vs. Inspection Cost**
 - **Widely Used Strategy in Monte-Carlo Simulation**
 - **Good Approach for Case of High Uncertainty in Risk Stratification**
 - **Robust Approach**



SL2-12 INSPECTION PLAN APRIL 2000

Latin Hypercube Example





SUMMARY

ART STALL

VICE PRESIDENT
NUCLEAR ENGINEERING



SUMMARY

- St. Lucie 2 S/G Inspection Plans
 - Meet or Exceed Industry Guidance
 - Incorporate Site & Industry Experience
 - Provide Reasonable Assurance of Tube Integrity
- Identify & Address Staff Concerns Prior to SL2-12 RFO

Florida Power and Light Company

ST. LUCIE PLANT

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