UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

February 26, 2010

Mr. Mano Nazar
Executive Vice President
and Chief Nuclear Officer
Florida Power and Light Company
P.O.Box 14000
Juno Beach, FL 33408-0420

SUBJECT: MEETING SUMMARY– CATEGORY 1 PUBLIC MEETING – REGULATORY CONFERENCE WITH ST. LUCIE NUCLEAR PLANT REGARDING ISSUES WITH THE COMPONENT COOLING WATER – DOCKET NOS. 50-335 AND 50-389

Dear Mr. Nazar:

This refers to the meeting conducted at your request at the NRC Region II Office on February 19, 2010, at 2:00 pm. The meeting's purpose was for Florida Power and Light (FP&L) to discuss issues related to the October16, 2008 air intrusion event into the Component Cooling Water (CCW) system and the completed and planned corrective actions by FP&L.

The topics discussed included the two apparent violations associated with the event, sequence of events associated with the air intrusion, operational insights related to the identification and recovery of the event, risk significance, root cause, and completed and planned corrective actions.

Enclosed are a list of attendees and the presentation handouts.

In accordance with Section 2.390 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and its enclosures will be placed in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agency wide Document Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at *http://www.nrc.gov/reading-rm/adams.html* (the Public Electronic Reading Room).

Should you have any questions concerning this meeting, please contact me at (404) 562-4519.

Sincerely,

Binoy B. Desai, Chief
Engineering Branch 1
Division of Reactor Safety

Docket Nos.: 50-335, 50-389
License Nos.: DPR-67, NPF-16

Enclosures: As stated

cc w/encl: (See page 3)

cc w/encl:
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Jack Southard
Director
Public Safety Department
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St Lucie Nuclear Plant Public Meeting
Atlanta, GA
February 19, 2010

NAME	TITLE AND ORGANIZATION
FLORIDA POWER AND LIGHT	
Rich Anderson	Site Vice President, St Lucie
Tom Cosgrove	Nuclear Engineering Chief, FP&L
Roger Weller	Senior Reactor Operator, St Lucie
Jim Porter	Engineering Design Manager, St Lucie
Ching Guey	Risk Analyst, St Lucie
Eric Katzman	Licensing Manager, St Lucie
George Tulledge	Risk Analyst, St Lucie
Carl Bible	Nuclear Director of Nuclear Programs, FP&L
Amol Limaye	MPR associates
Dr. Tom George	Numerical Applications Inc. (NAI)
Mark Pope	Numerical Applications Inc. (NAI)
NRC	
Luis A. Reyes	Regional Administrator, Region II (RII)
Leonard Wert	Director, Division of Reactor Projects, RII
Kriss Kennedy	Director, Division of Reactor Safety, RII
Binoy B. Desai	Chief, Engineering Branch 1, DRS, RII
Scott Sparks	Senior Enforcement Specialist, RII
Steven D. Rose	Senior Project Engineer, RII
Mike McCoppin	CIB2, RII
Robert Patterson	Reactor Inspector, RII
Joyce Hamman	Reactor Inspector, RII
Alejandro Alen	Reactor Inspector, RII
Delza Mas-Penaranda	Reactor Inspector, RII
Melanie Checkle	Allegation Coordinator, RII
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Jeff Circle	Senior Reliability/Risk Analyst, NRR
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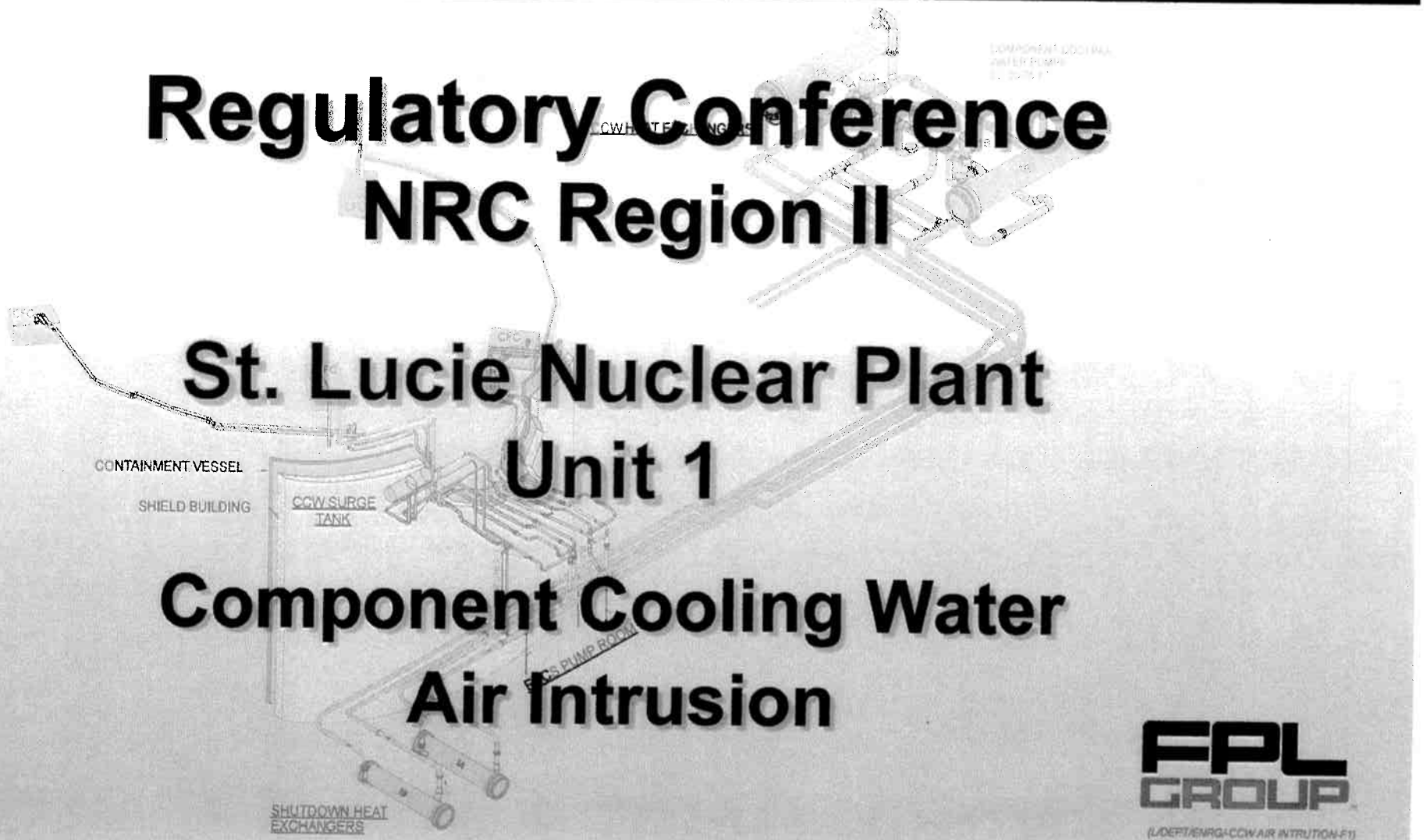
Carolyn Evans	Regional Counsel, RII
Doug Andrews	Senior Communicator Advisor, FPL St Lucie
Thomas Saporito	Advocate, Greenpeace USA
Julie Patel	Press, Sun Sentinel
Jim Breman	Analyst, Div. of Economic Regulation-State of FL

St. Lucie Nuclear Plant

Regulatory Conference
NRC Region II

St. Lucie Nuclear Plant
Unit 1

Component Cooling Water
Air Intrusion



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(I:\DEPT\ENRG\CCW AIR INTRUTION-F1)

Enclosure 2

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Regulatory Conference
NRC Region II

St. Lucie Nuclear Plant
Unit 1

Component Cooling Water Air Intrusion

February 19, 2010

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Agenda

- **Introductions**
- **Purpose of Presentation and Opening Remarks –** *Rich Anderson*
- **System and Air Intrusion Overview –** *Tom Cosgrove*
- **Operations Insights –** *Roger Weller*
- **Root Cause and Corrective Actions –** *Jim Porter*
- **Air Intrusion Significance –** *Ching Guey*
- **Closing Remarks –** *Rich Anderson*

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Purpose and Opening Remarks

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Purpose of Presentation

- Present FPL conclusions regarding apparent violations of 10 CFR 50 Appendix B Criterion III and Criterion XVI

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Opening Remarks

- In October 2008, St. Lucie Unit 1 experienced air intrusion into the Component Cooling Water (CCW) System
- This presentation focuses on the two preliminary "greater than green" potential violations identified in the January 19, 2010 Component Design Basis Inspection (CDBI) Report

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Opening Remarks

- **Criterion XVI Corrective Action apparent violation is based upon the NRC's determination in the CDBI that corrective actions after the 2008 air intrusion were less than adequate**
  - FPL agrees with this determination
  - Risk Significance
- **Criterion III Design Control apparent violation is based upon an assumption that the CCW System was outside its design basis**
  - Containment Air and the CCW System were at all times in accordance with plant design basis
  - FPL respectfully disagrees that a violation of Criterion III occurred

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System and Air Intrusion Overview

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CCW System Overview

- **CCW includes two safety related trains and a non-essential "N-Header"**
- **N-Header is aligned to both safety related CCW headers during normal power operation**
- **The N-Header cools various non-nuclear safety related equipment such as:**
  - Spent Fuel Pool Heat Exchanger (Unit 1 only)
  - Reactor Coolant Pump Seal Coolers
  - Containment Instrument Air Compressors (Unit 1 only)
  - Waste Gas Compressor Heads and aftercoolers
- **N-Header automatically isolates from safety related CCW on Safety Injection Actuation Signal (SIAS)**

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CCW System Overview

- **Unit 1 has two 100% capacity Containment Instrument Air Compressors (CIACs) which are cooled by CCW**
- **Unit 2 does not have CIACs**
- **CIACs provide air in containment for equipment such as:**
  - Pressurizer Spray Valves
  - Letdown Isolation Valves
  - Blowdown Isolation Valves

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CCW Air Intrusion Description

Initial conditions: Unit 1 in Mode 1, 100% Power operation

- **Sequence of events**

T=0.0 Hours: Control room receives CIAC System Trouble Annunciator. Operators swap from "A" CIAC to "B" CIAC

T=3.9 Hours: Control room receives CCW Surge Tank Level Annunciator

T=4.3 Hours: Operators validate increasing level in the CCW surge tank – CCW Off Normal Procedure entered

T=14.5 Hours: Control room receives B CCW Radiation Monitor Low Flow Annunciator

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CCW Air Intrusion Description

- **Sequence of events, continued**

T=16.3 Hours: Control room receives both CCW Header Flow Annunciators. CCW Pump motor amps indication affected. Operators investigate possible air intrusion [the cue]

T=17.6 Hours: Operators conclude air intrusion is occurring from the CIAC System [completion of diagnosis]

T=17.9 Hours: CIAC secured, containment instrument air aligned to outside air [event actions complete]

T=18.5 Hours: CCW System venting commences

T=20.1 Hours: CCW venting complete

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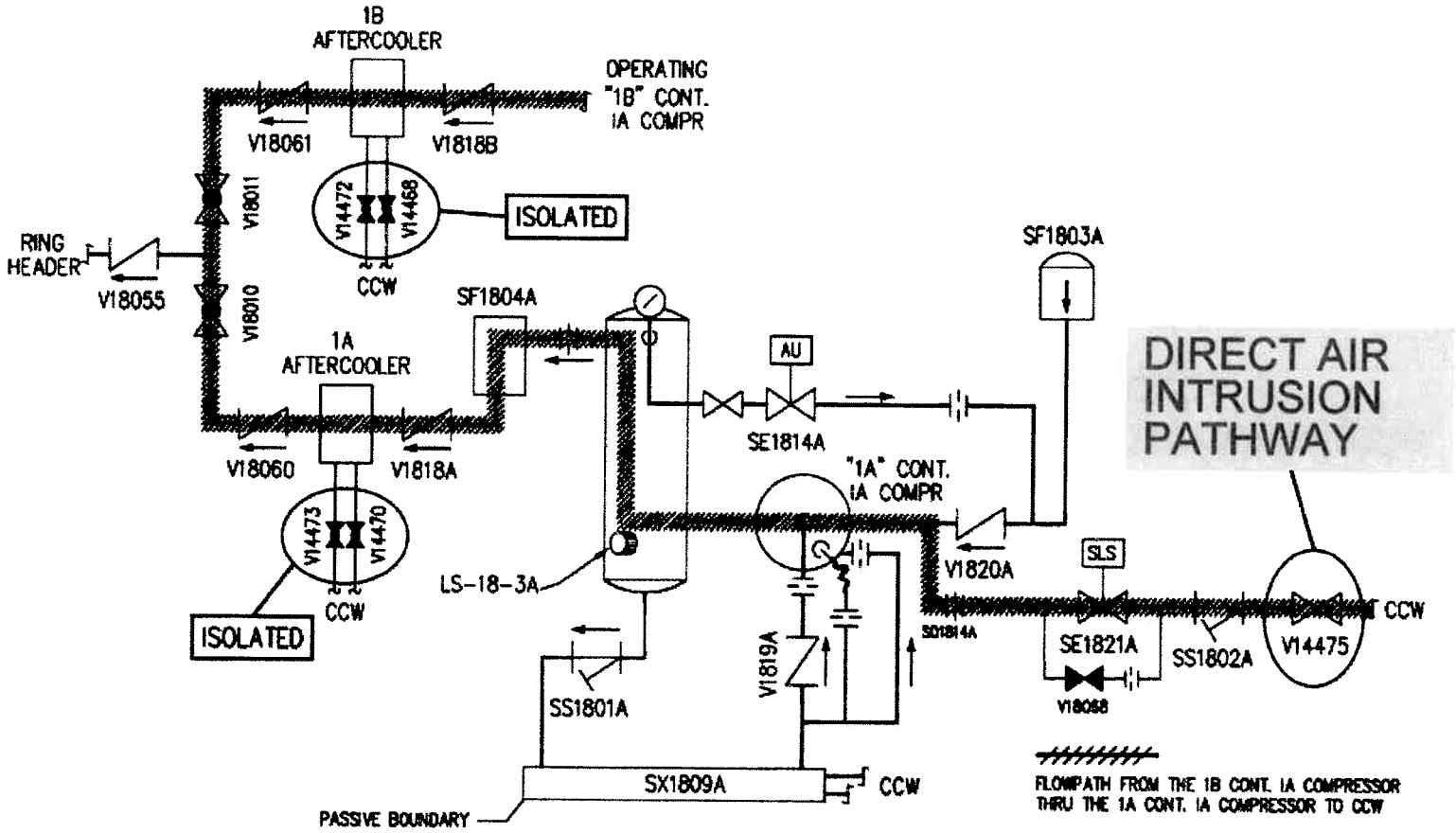
CCW Air Intrusion Description

Air Intrusion Flow Path



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CCW Air Intrusion Description

- Operators terminated air intrusion and recovered stable CCW operation within 1.6 hours of diagnosing air intrusion
- CCW parameters such as CCW header flow and CCW pump motor amps returned to normal values upon venting

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CCW Air Intrusion Description

- CCW System was capable of performing all normal operating functions
- The CCW System was not OPERABLE
- CCW System was capable of mitigating the effects of a Loss of Offsite Power assuming no single failure with both trains of CCW in-service
- CCW System was capable of mitigating the effects of a Loss of Coolant Accident assuming no single failure with both trains of CCW in-service

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CCW Air Intrusion Description

- **Operators had 24+ hours to respond after observing pump motor amp and header flow fluctuations before CCW functionality would have been challenged**
- **Following the 2009 CDBI, the cause of the October 2008 air intrusion was determined to be leakage through a compressor seal water make-up line**
- **Corrective actions included:**
  - Operations order and training to improve awareness and response
  - Development of system alteration to isolate the seal water make-up

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CCW Air Intrusion Description

- **A second CCW air intrusion occurred in November 2009 before system alteration was implemented**
- **Operator response was improved as a result of the Operations order and training**
  - Conclusion that air intrusion was occurring based on surge tank level increase reached earlier than for 2008 air intrusion
  - Determination that source was CIAC reached earlier than for 2008 air intrusion
  - Decision made to split/isolate the safety trains of CCW to limit exposure
- **Flow fluctuations and pump amp effects were avoided during the 2009 air intrusion**
- **Seal water was isolated to the CIACs following the 2009 air intrusion**

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Operational Insights

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Operational Insights

- 2008 air intrusion commenced following routine equipment rotation of CIACs
- Air leaked into CCW System at a slow rate
- Alarms and indication of air intrusion took several hours to develop
- The air intrusion into CCW was managed by operators in a low-stress environment

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Operational Insights

- A high level in the CCW Surge Tank was confirmed and initially led operators to investigate water in-leakage into the CCW System
- Subsequent alarms and indications such as pump motor amps and CCW header flow led operators to conclude that air intrusion was occurring
- Operators quickly identified CIAC as the source of air intrusion

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Operational Insights

- Operators secured CIAC and realigned containment instrument air to an outside make-up supply
- Operators developed, briefed and executed a plan for venting the CCW System
- CCW System parameters returned to normal values upon securing of the compressor and venting of the CCW System

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Operational Insights

- **Several control room alarms indicate degraded CCW Flow:**
  - Reactor Coolant Pump Seal Cooling Water
  - CCW Main Header Flow
  - Containment Fan Cooler Flow
  - CCW Heat Exchanger Temperature
  - Spent Fuel Pool Heat Exchanger Flow
  - CCW Flow to Letdown
  - Control Element Drive Mechanisms CCW Flow

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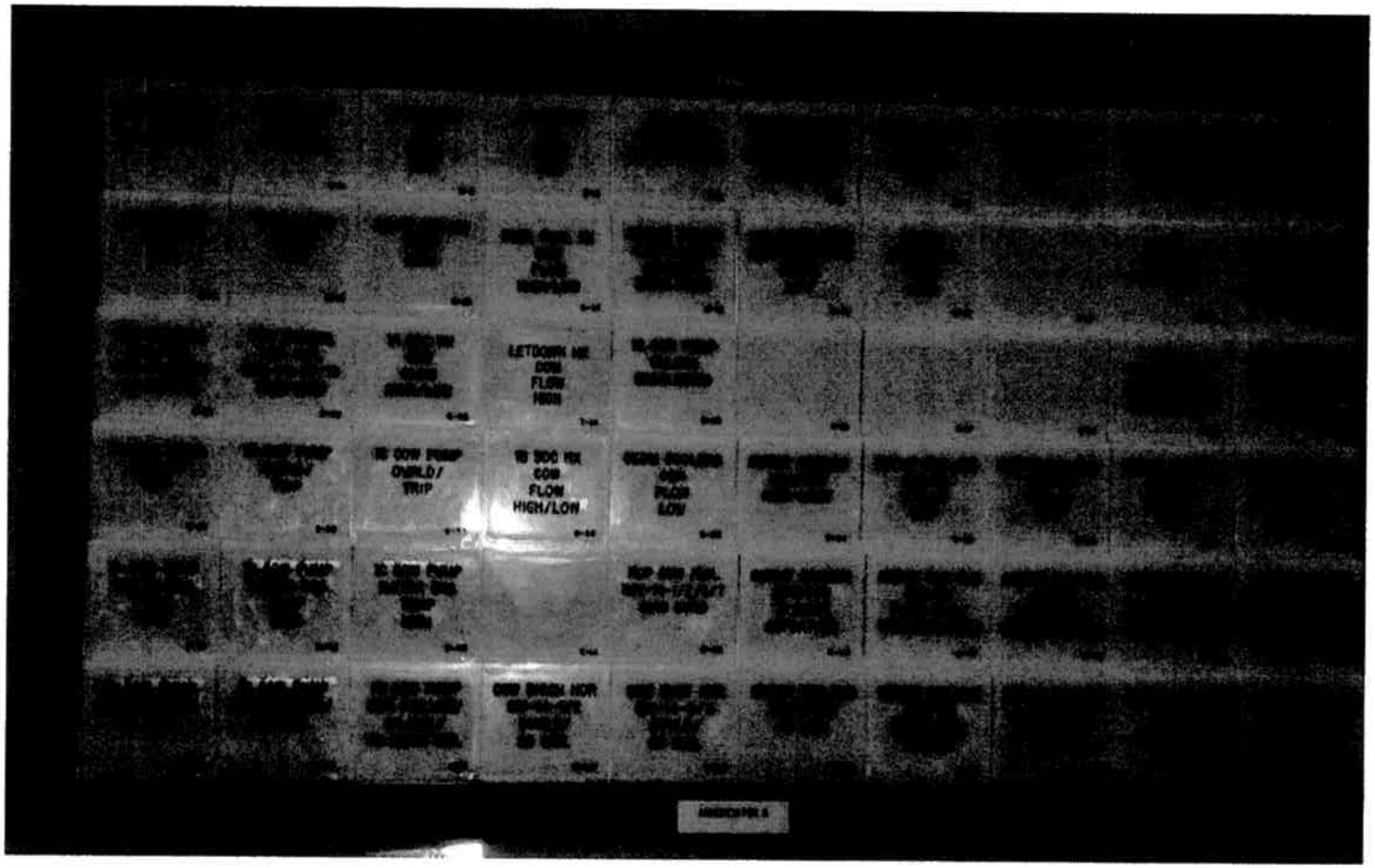
Operational Insights

Control Room Annunciators



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Operational Insights

- **Annunciator Response and Off-Normal Operating Procedures clearly prescribe actions for a potential loss of CCW flow**
- **Operators are very familiar with these procedures**
  - "Loss of CCW Flow" scenario is a frequent training exercise in the simulator

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Operational Insights

- **Off-normal procedures require operators response to degrading CCW flow to the RCP seals:**
  - Trip the Reactor and Turbine
  - Stop Reactor Coolant Pumps
- **Further operator actions associated with protection of RCP seals post-trip include:**
  - Isolate CCW to the Reactor Coolant Pump
  - Isolate Reactor Coolant Pump controlled bleedoff
- **This strategy is fundamental operator knowledge**
  - This is a frequently tested simulator scenario with a very high success rate

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Root Cause Analysis
And
Corrective Actions

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Root Cause Analysis

Two Preliminary Apparent Violations in NRC letter dated January 19, 2010:

10 CFR 50, Appendix B, Criterion XVI, Corrective Action: ***"Failure to identify and correct a condition adverse to quality following the air intrusion event into the CCW System that occurred In October 2008."***

10 CFR 50, Appendix B, Criterion III, Design Control: ***"Failure to translate the design basis as specified in the license application into specifications, drawings, procedures, and instructions resulting In the CCW System being susceptible to a common cause failure."***

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Root Cause Analysis

A formal cross-functional Root Cause Team evaluated the 2008 air intrusion and the two Apparent Violations:

- **Design Engineering**
- **Operations**
- **Training**
- **The 42 Group, LLC**
- **System Engineering**
- **Licensing**
- **Performance Improvement**

Other Consultants:

NAI, Sulzer Pump, MPR, Shaw

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Root Cause Analysis

Root cause tools employed:

- Fault Tree Analysis
- Causal Factors Analysis
- Barrier Analysis
- "Why" Staircase

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Root Cause Analysis

10 CFR 50, Appendix B, Criterion XVI, Corrective Action:

Root Cause: When the CR screening was performed for the air intrusion event, the station failed to recognize or understand the importance of gas intrusion and its potential impact to CCW and other safety related systems

- Condition report review committees, Operations, and Engineering all missed the significance

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Root Cause Analysis

Root Cause Team Insights:

- A thorough causal analysis of the 2008 air intrusion under the FPL Corrective Action Program would have resulted in corrective actions to improve the CCW N-header design
- Inadequate use of the Operational Decision Making process led to the 2009 CCW air intrusion

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Root Cause Analysis

10 CFR 50, Appendix B, Criterion III, Design Control:

Root Cause: Potential for gas intrusion is a latent issue and was not considered when the original CCW System design was developed

- Non-nuclear safety related non-essential CCW header design is common in the industry
- Failures of non-nuclear safety related components such as the CIACs were not required to be considered in the design basis

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Root Cause Analysis

Perspective on Design Control Performance Deficiency:

- There was no failure to "translate the design basis as specified in the license application into specifications, drawings, procedures, and instructions"
- Containment Instrument Air and CCW was at all times in accordance with the St. Lucie SER and FSAR
- There is no Criterion III performance deficiency because there was no requirement or standard when St. Lucie Unit 1 was licensed (or subsequently) to design for a single failure of a non-nuclear safety related component

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Root Cause Analysis

Perspective on Design Control Performance Deficiency:

- Design met regulatory requirements at the time of licensing and still meets the design basis
- There was no performance deficiency related to Design Control
- FPL respectfully disagrees that a violation of 10 CFR 50 Appendix B Criterion III occurred

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Corrective Actions

Completed:

- Seal water make-up to CIACs isolated - no other piping system interfaces with gas systems exist
- Implemented Operations monitoring program to provide early detection of CCW gas intrusion on both units via CCW Surge Tank level trending
- Reviewed a sampling of Condition Reports to ensure proper screening – no similar deficiencies noted

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Corrective Actions

Completed:

- **Operating procedures were upgraded and operators trained to address the possibility of gas intrusion into CCW**
  - **Annunciator Response**: Direction provided based upon CCW parameters such as surge tank level increase and fluctuating header flow
  - **Off Normal**: Instructions improved for possible gas sources and mitigating actions
  - **Normal Operation**: Improved venting procedures

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Corrective Actions

Completed:

- **Training bulletin issued on lessons-learned related to gas-intrusion to increase organizational sensitivity**
  - Operations
  - Engineering
  - Condition Report Initial Screening Team
  - Condition Report Management Review Committee
- **Conducted Extent Of Condition review for potential gas sources**

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Corrective Actions

Planned:

All planned corrective actions are captured in the FPL Corrective Action Program (CAP)

- **Operations and Engineering Training Programs will be upgraded to periodically review gas intrusion issues and related industry OE (Q2 2010)**
- **Modification options are being evaluated to further improve CCW reliability (Q1 2010)**

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Corrective Actions

Planned:

All planned corrective actions are captured in the FPL CAP

- CCW air intrusion Operating Experience (OE) will be included in Condition Report Review Committee (IST/MRC) initial training (Q2 2010)
- Fleet Operational Decision Making procedure will be upgraded and training performed to reinforce the role of individuals in identifying the significance of potential issues (Q3 2010)
- Specific OE will be added to Engineering Quality Instructions (Q3 2010)

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CCW Air Intrusion Risk Insights

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Risk Insights

- Dominant risk contributor (assuming loss of CCW) is operator failure to trip the RCPs
- Alarms and indications will lead the crew to conclude that air intrusion is occurring
- Operations will then terminate the event by isolating the air intrusion source and performing venting as was accomplished in 2008
- Assuming air intrusion to CCW is not diagnosed and secured, operators would respond to degrading CCW flow through clear procedural requirements
- Due to preponderance of alarms, it is highly likely that operator will trip the reactor and stop RCP before total failure of CCW

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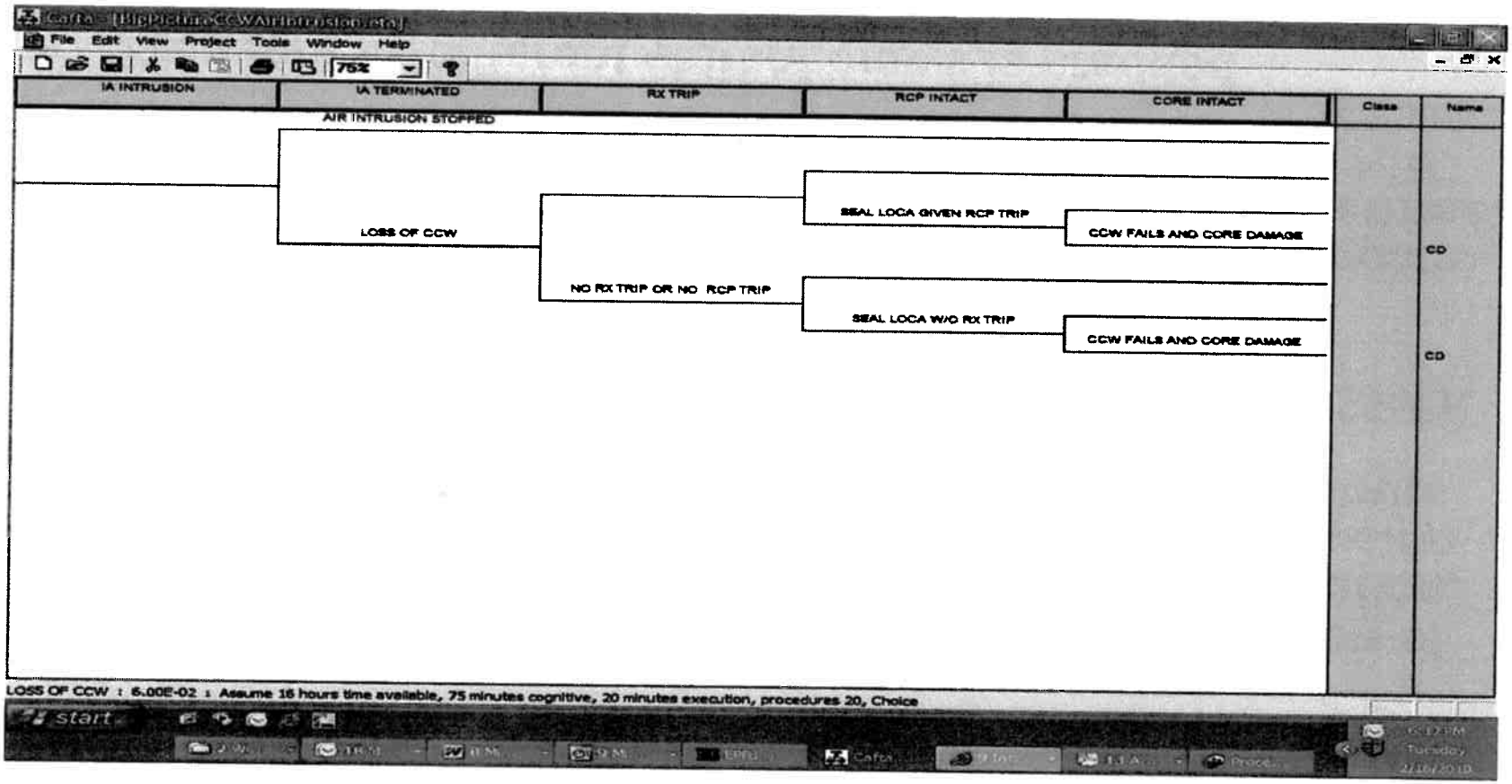
Risk Insights (2008 Air Intrusion)

Best-Estimate Air-Intrusion Event Tree



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Risk Insights

- For CCW air entrainment with estimated void fraction of 2% at the point of pump motor amp and flow fluctuation, the time available to recognize and mitigate air intrusion before air binding of CCW pumps is more than 24 hours
- CCDP based on latest plant specific PRA and NRC SPAR model varies from approximately 1.0E-4 to 6.0E-4
- Probability of operator failure (to recognize and mitigate air intrusion before failure of CCW pumps) is two to three orders of magnitude less than that assigned by the NRC
- Recovery by different shift of crews is credited
- Dependency is considered
- Delta CDF increase less than 1.0E-6 per year based on best-estimate assumptions

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Risk Insights

- **CCW was at all times in accordance with its design basis**
- **Scoping and risk sensitivity was considered qualitatively**
- **Risk is similar to that associated with air intrusion**
- **Three factors make the risk low:**
  - Reactor Trip (fault exposure of DBAs smaller)
  - 8 hour endurance of an idle RCP seal after total loss of CCW
  - CCW failure is not instantaneous

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Risk Insights

Significance of Design Basis:

- Risk significance for CCW air intrusion was very low
- CDF increase is less than 1.0E-6 per year based on best-estimate assumptions
- Change in core damage frequency is less than 1.0E-6/Yr for performance deficiency

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Closing Remarks

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Closing Remarks

- **Prompt corrective action was not taken in response to the 2008 air intrusion. Screening decision making was flawed**
- **A performance deficiency in Criterion XVI Corrective Action occurred**
- **The completed and planned corrective actions will prevent future gas intrusion through a "defense in depth" strategy including**
  - design upgrades
  - procedure enhancements
  - detection strategies
- **The risk significance for CCW air intrusion is very low**

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Closing Remarks

- **Containment Instrument Air and CCW configurations are in accordance with design basis**
  - System design will be upgraded to improve reliability
- **FPL respectfully disagrees that a violation of 10 CFR50 Appendix B Criterion III occurred**

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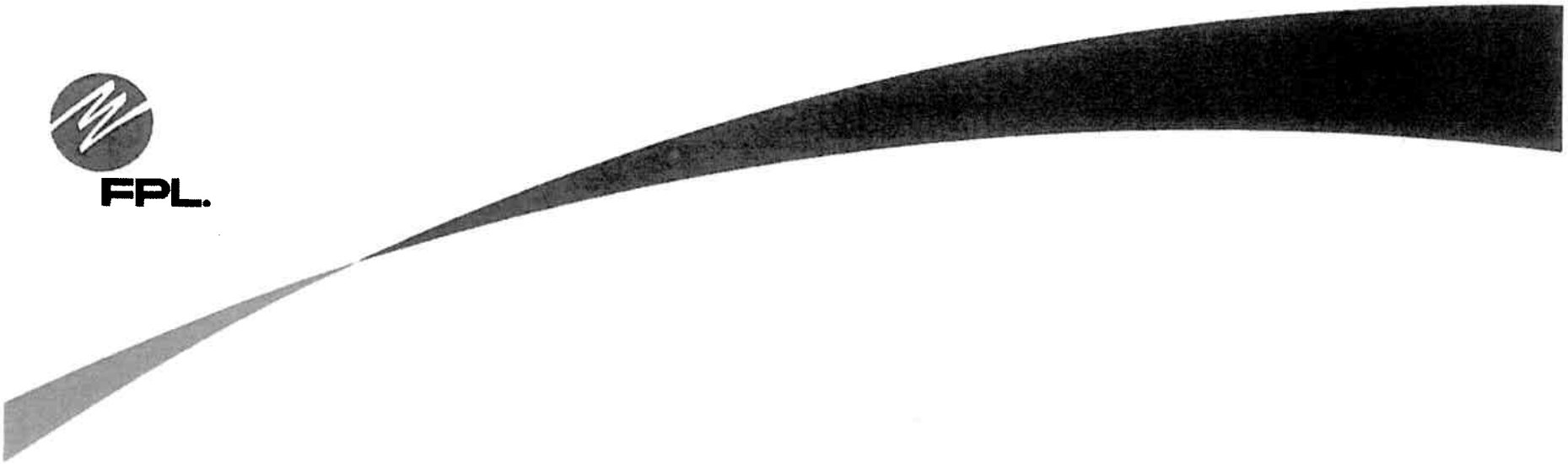
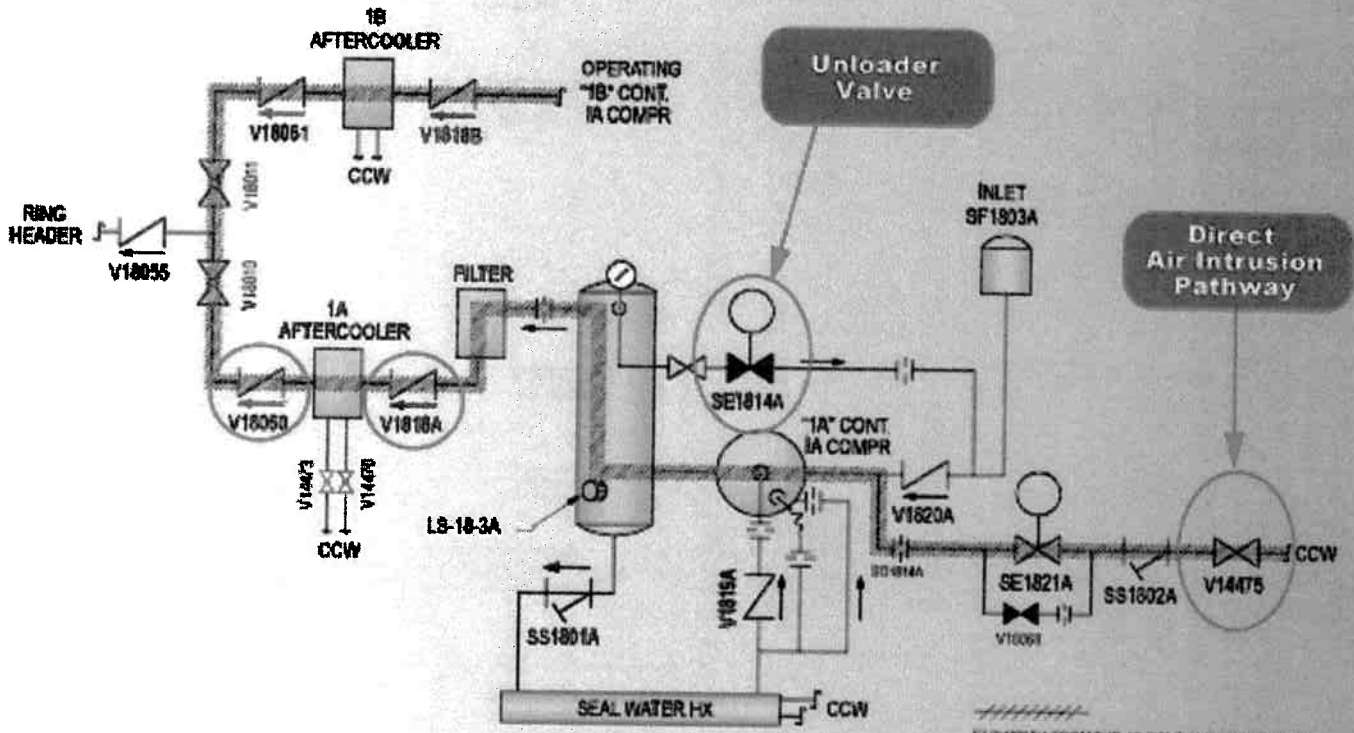


Questions?

FLOW PATH Air Intrusion

(Simplified Schematic For information Only)



Three concurrent conditions are required to establish air intrusion pathway:

- Two Check Valves Leak

and

- Unloader Valve Sticks Closed

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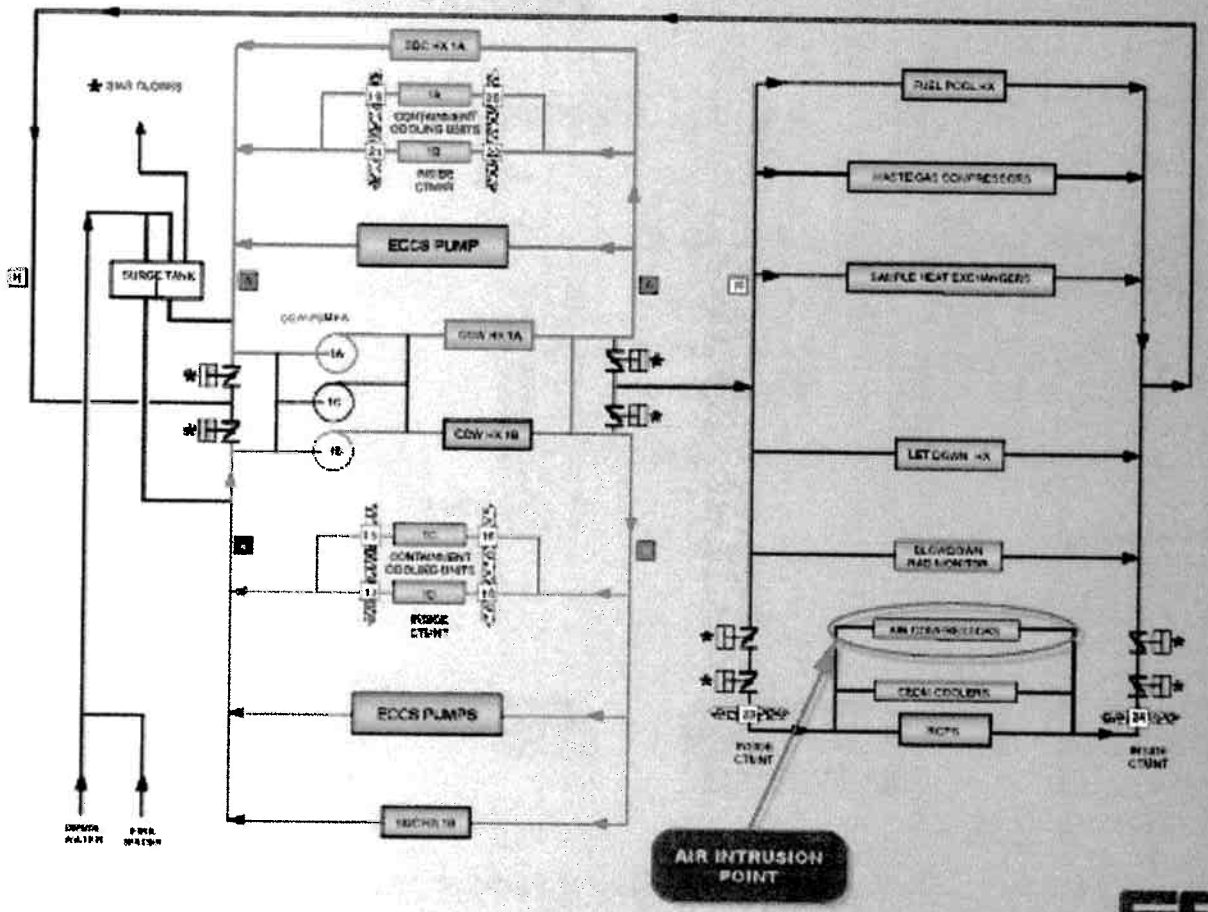
St. Lucie Nuclear Plant

UNIT 1 Component Cooling Water System

(Simplified Schematic For information Only)



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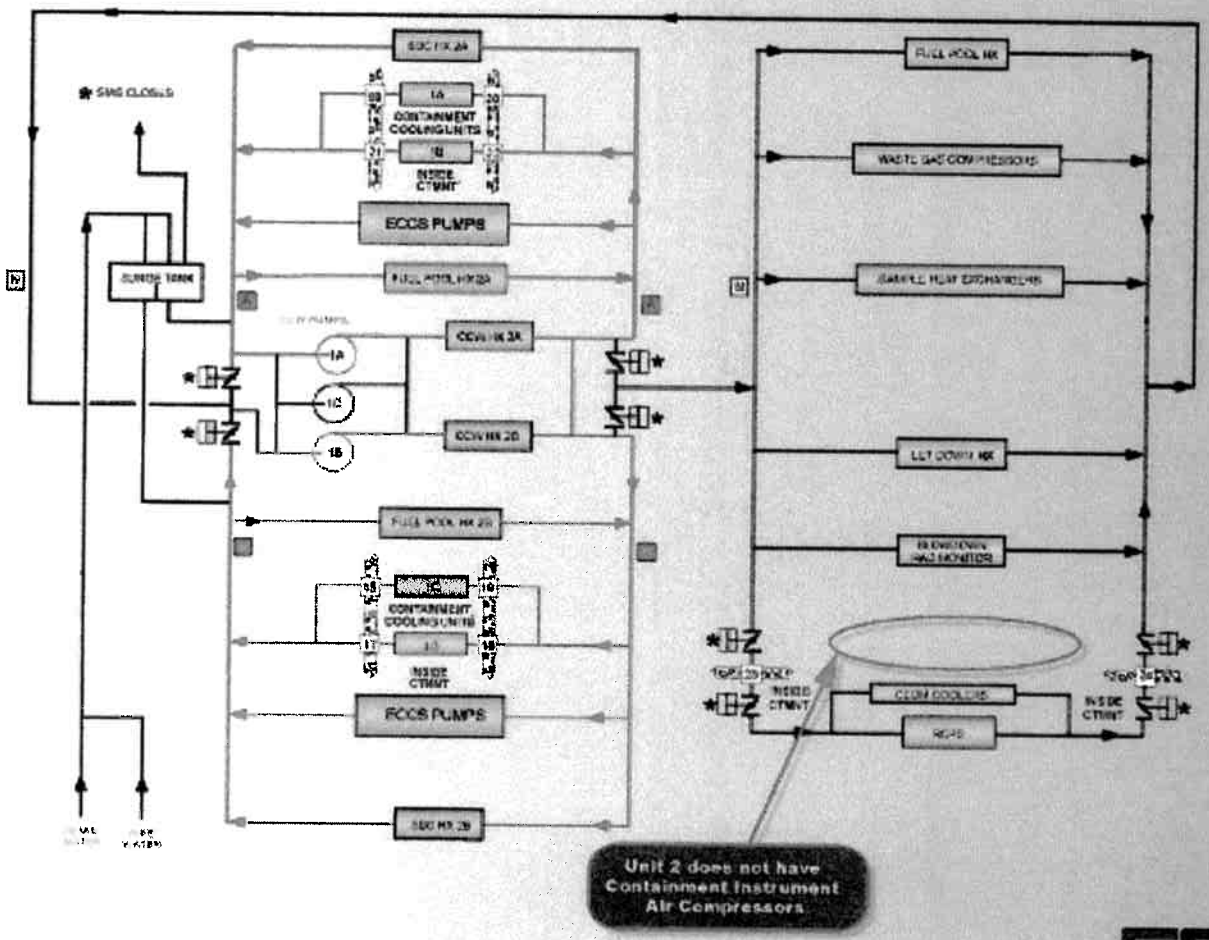
UNIT 2 Component Cooling Water System

(Simplified Schematic For information Only)



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