UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-8064

MAY - 1 2002

Joseph E. Venable
Vice President Operations
Waterford 3
Entergy Operations, Inc.
17265 River Road
Killona, Louisiana 70066-0751

SUBJECT: MEETING SUMMARY FOR THE APRIL 24, 2002, WORKING LEVEL MEETING TO REVIEW WATERFORD 3 REFUEL 11

Dear Mr. Venable:

This refers to the open public meeting conducted in the Region IV office on April 24, 2002. The meeting was conducted to review the Waterford 3 Refuel 11 outage, including an event that occurred on March 23, 2002, involving the inability to initiate shutdown cooling for about 1½ hours (reference PNO-IV-02-016). During the event, operators declared an ALERT, and Region IV activated its incident response center to monitor plant conditions until shutdown cooling was established.

Other topics discussed during the meeting included the failure of the anti-rotation device on Reactor Coolant Pump 2B, voiding in the shutdown cooling suction piping, results of the reactor vessel head inspection, and overall plant performance during the outage. A copy of the attendance list and the handouts are attached. You did not make any commitments to the NRC during the meeting.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter will be placed in the NRC's Public Document Room.

Should you have any questions concerning this matter, we will be pleased to discuss them with you.

Sincerely,

William B. Jones, Chief
Project Branch E
Division of Reactor Projects

Docket: 50-382
License: NPF-38

Enclosures:
1. Attendance List
2. Licensee Presentation

cc w/enclosures:
Executive Vice President and
Chief Operating Officer
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Jackson, Mississippi 39286-1995

Vice President, Operations Support
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Jackson, Mississippi 39286-1995

Wise, Carter, Child & Caraway
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General Manager, Plant Operations
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Entergy Operations, Inc.
17265 River Road
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Manager - Licensing Manager
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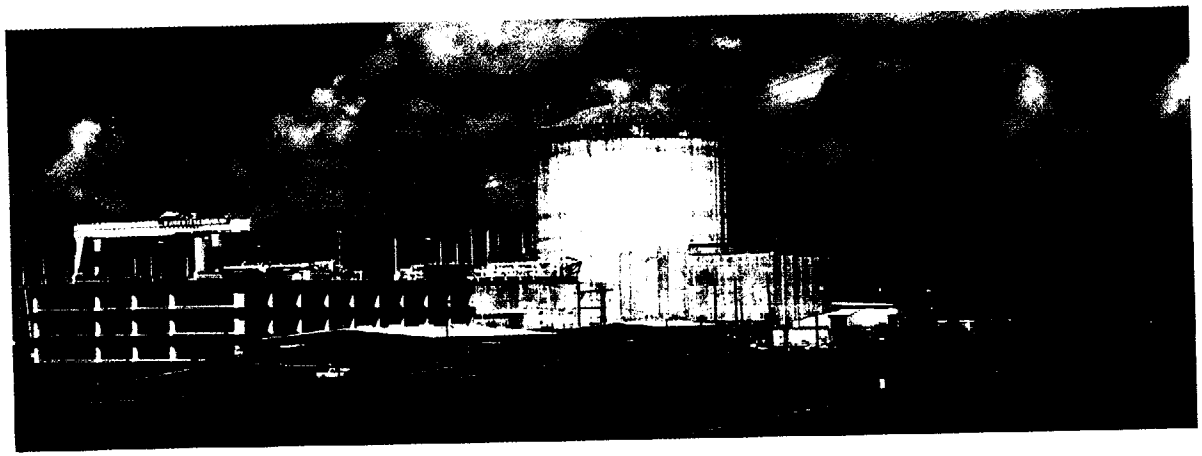
LICENSEE/FACILITY	Entergy Operations, Inc. Waterford 3
DATE/TIME	April 24, 2002, 1 p.m.
CONFERENCE LOCATION	Training Conference Center, Region IV Offices

REPRESENTATIVES

NAME (PLEASE PRINT)	ORGANIZATION	TITLE
Joseph Reese	Entergy	Design Manager
William McKinney	Entergy	Control Room Supervisor
Jerry Holman	Entergy	Safety Analysis Manager
Jay Thayer	Entergy	V.P. Operations Support
Craig Lambert	Entergy	Director-Engineering
Joe Venable	Entergy	WF-3 Site V. P.
Mike Brandon	Entergy	Manager, Licensing
Ellis W. Merschoff	NRC	RA
Arthur T. Howell III	NRC-RIV	Director, DRS
Elmo Collins	NRC	Dep. Dir. DRP RIV
W.B. Jones	NRC	Chief, Project Branch E
Thomas R. Farnholtz	NRC	SR. Resident Insp. W3
Randy Douet	Entergy	Ops Manager
Michael Vasquez	NRC RIV	DRP / PBE

Troy Pruitt	NRC	Sr. Reactor Analyst
Paul Gage	NRC	DRS / OLB

Waterford 3 SES
Review of Refuel 11



April 24, 2002

Arlington, Texas

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Introduction/Overview

Joe Venable

Agenda

- Refuel 11 Events
  - Shutdown Sequence
  - Event Summary / Review Teams
  - RCP Anti-Rotation Device
  - Voiding of SDC Suction Piping
  - SI-405 A & B Failure to Open
- Operations
- Emergency Plan Performance
- Reactor Vessel Head Inspection
- Outage Overview
- Closing Remarks

Douet	2 min
Thayer	5 min
Lambert	10 min
Lambert	15 min
Lambert	15 min
Douet	5 min
Douet	5 min
Venable	5 min
Venable	5 min
Venable	5 min

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Shutdown Sequence

Randy Douet

Entergy

Shutdown Sequence

3/22	2300	Opened breakers - outage start
3/23	0135	Vented SI-405 B piping (7 minutes)
	0403	Vented SI-405 A piping (11 minutes)
	0508	Secured RCP 1B
	0509	Secured RCP 2B
	0550	Control Room contacted - RCP2B rotating @ 630 RPM
	0645	Secured RCP 1A & 2A, transfer to natural circulation
	0651	RCP 2B indicates zero speed
	0847	Enter Mode 4
	1005	Attempted to open SI-405 A
	1008	Attempted to open SI-405 B
	1020	E-plan "ALERT" declared
	1137	Opened SI-405 A
	1143	Opened SI-405 B
	1150	Exited E-Plan
	1242	Placed Shutdown Cooling Train A in service

Refuel 11 Events Summary

Jay Thayer

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Shutdown Issues Review Team

- Executive lead put in charge from EN-S headquarters
- 3 separate Root Cause Teams formed to address each event:
  - RCP 2B Anti Reverse Rotation Device Failure (Natural Circulation Cooldown)
  - SI-405 A & B Failure to Open
  - Voiding of Shutdown Cooling Suction Piping
- 1/2 of team members non-Waterford personnel
- Team included external industry expertise
- All RCA reports reviewed by EN-S Vice Presidents
- All RCA reports completed and approved by April 4, 2002
- Each team addressed
  - Root cause and contributing cause(s)
  - Safety significance
  - Corrective actions (short and long term)
  - Generic Implications

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RCP 2B Anti Reverse Rotation Device Failure

Event Description

- On March 23, 2002, during shutdown for RF11, Reactor Coolant Pump 2B rotated in reverse direction when secured. The Control Room crew entered the Reactor Coolant Pump Malfunction procedure and secured all Reactor Coolant Pumps. This stopped Reactor Coolant Pump 2B's reverse rotation. RCP 2B rotated in the reverse direction for approximately 1 hour and 35 minutes.

Root Cause

- The most likely cause associated with this failure is *sludge accumulation* in the ARRD assembly.

Voiding of Shutdown Cooling Suction Piping

Event Description

- On March 23, 2002, during shutdown for RF11, a portion of both trains of Shutdown Cooling (SDC) suction piping (between the inboard and outboard containment isolation valves SI-405A(B) & SI-407A(B)) was determined to be empty by performance of ultrasonic examinations. Immediate corrective actions involved the fill and vent of the SDC suction piping.

Root Cause

- The root cause of this event is *original design inadequate*.

SI-405 A & B Failure to Open

Event Description

- On March 23, 2002, during shutdown for RF11, SI-405A(B) did not open when attempting to put the Low Temperature Overpressure Protection (LTOP) relief valves in service delaying the initiation of shutdown cooling. The Plant declared an ALERT due to this event.

Root Cause

- The root cause of this event was determined to be *thermal binding*.

Root Cause Analyses

Craig Lambert

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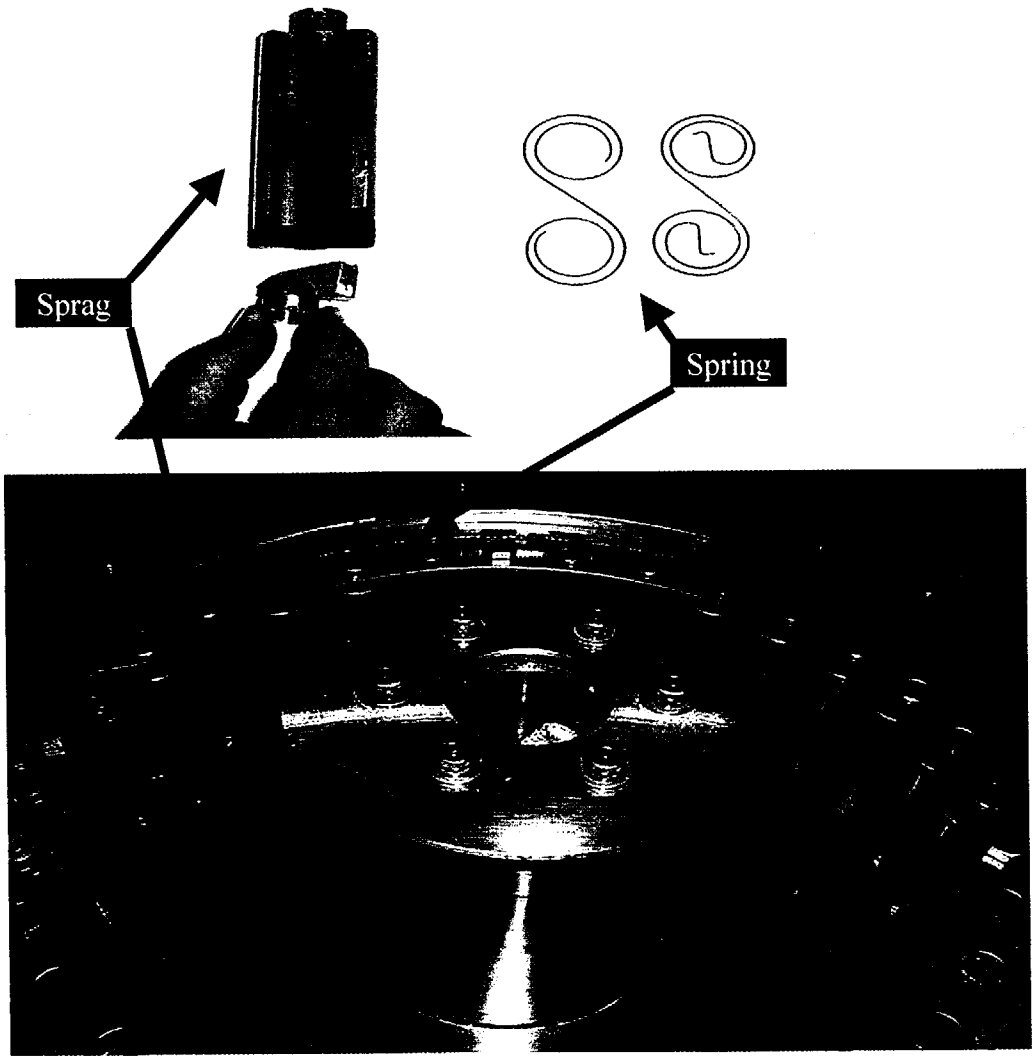
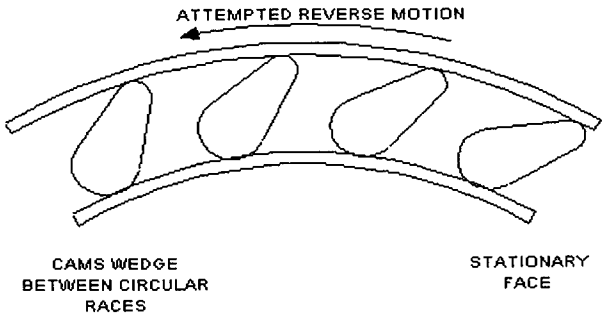
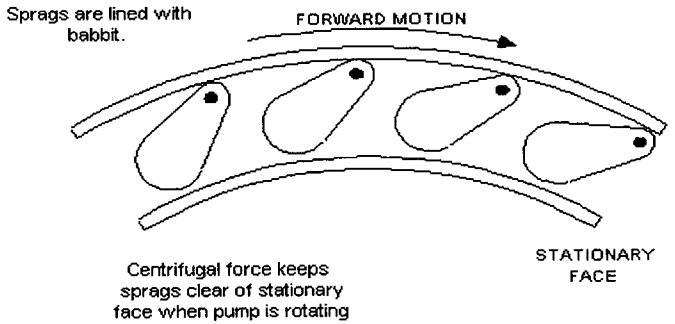
RCP 2B ARRD Failure







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RCP 2B ARRD Failure

Root Cause Analysis

- The most likely cause associated with this failure is sludge accumulation.
  - Induces erratic sprag operation
  - Springs are not able to overcome additional frictional forces to properly position the sprags

Main Contributing Cause

- No vendor recommendations exist for preventative maintenance.

RCP 2B ARRD Failure

Short-term Corrective Actions

- Guidance for monitoring secured RCP's during the shutdown and startup sequences issued
- Operations training on the indications of ARRD failure and entry requirements for RCP malfunction completed
- Replaced 2B ARRD and replaced all RCP 2B motor bearings
- Drained, cleaned reservoir, changed oil on all RCPs
- Backlash checked on all 4 RCPs
- RCP 2B pump and motor vibration monitored during startup
- Analyzed sludge found in RCP 2B ARRD
- ARRDs monitored during pump bumps

RCP 2B ARRD Failure

Long-term Corrective Actions

- Develop and implement a preventive maintenance program.
- Complete metallurgical evaluation of broken sprags and springs.
- Issue Operating Experience.
- Enhance indications available to operator.

RCP 2B ARRD Failure

Safety Significance

- ARRD failure mechanism has no impact on Reactor Coolant System integrity or any system or component needed for accident mitigation.

Voiding of Shutdown Cooling Suction Piping

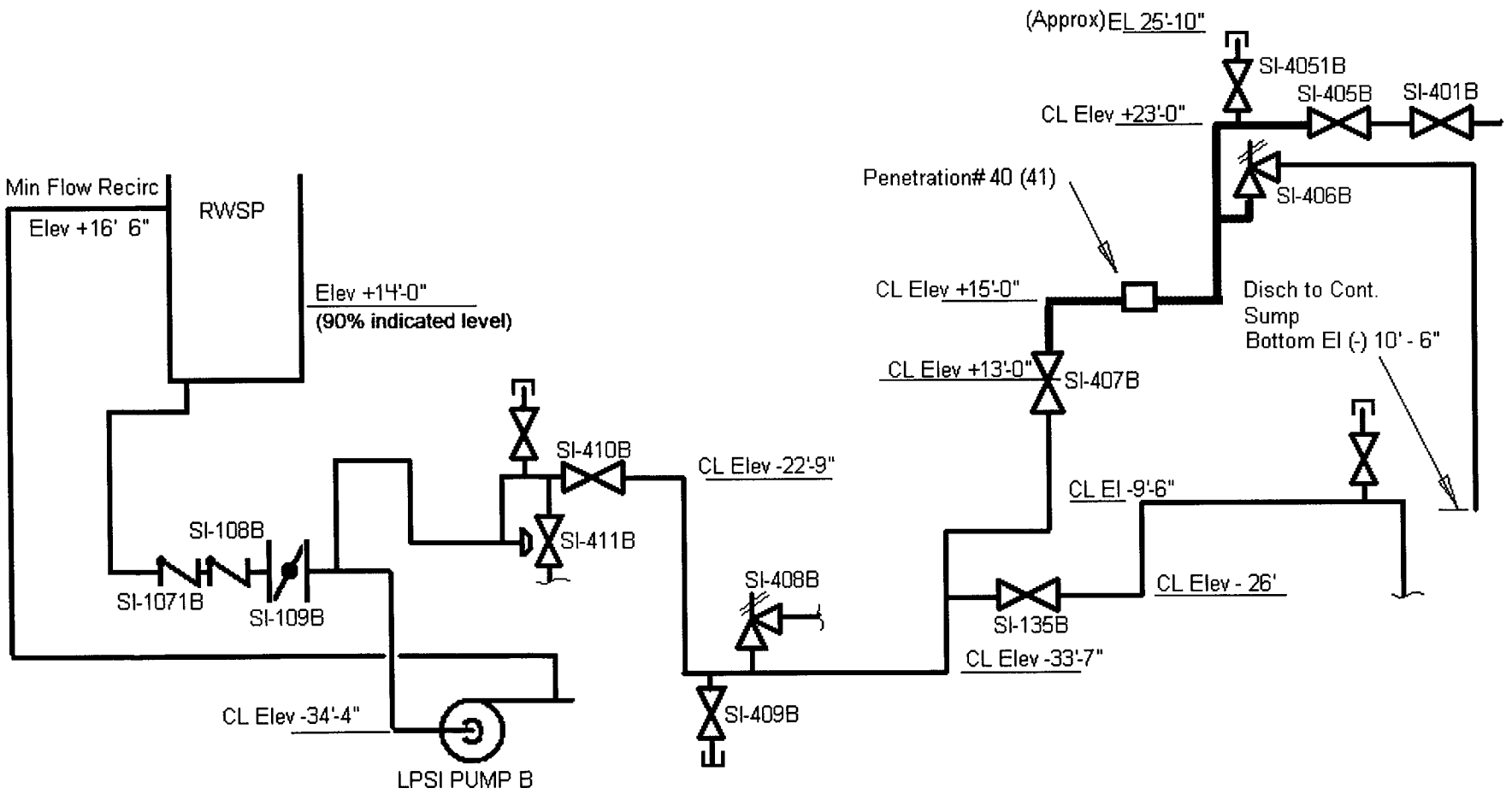
Root Cause Analysis

- Determined root cause of this event to be *Original Design Inadequate.*
  - SDC suction piping routed above hot leg and normal RWSP level

Main Contributing Cause

- *Causes of a Previous Event or Known Problem were not Determined*
  - The causes of a previous event were not adequately determined
  - The SDC suction piping voiding mechanism was not broadly understood
  - Significance of this configuration was not adequately determined

Shutdown Cooling Suction Piping



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Voiding of Shutdown Cooling Suction Piping

Short-term Corrective Actions

- Confirmed that air intrusion will not prevent SDC or LPSI systems from performing their safety function
- Confirmed no other safety system is inoperable due to air intrusion
- Confirmed that a water seal is present at other penetrations at the start of and 30 days post accident
- Confirmed that containment integrity is maintained
- Confirmed continued compliance with Technical Specifications

Voiding of Shutdown Cooling Suction Piping

Long-term Corrective Actions

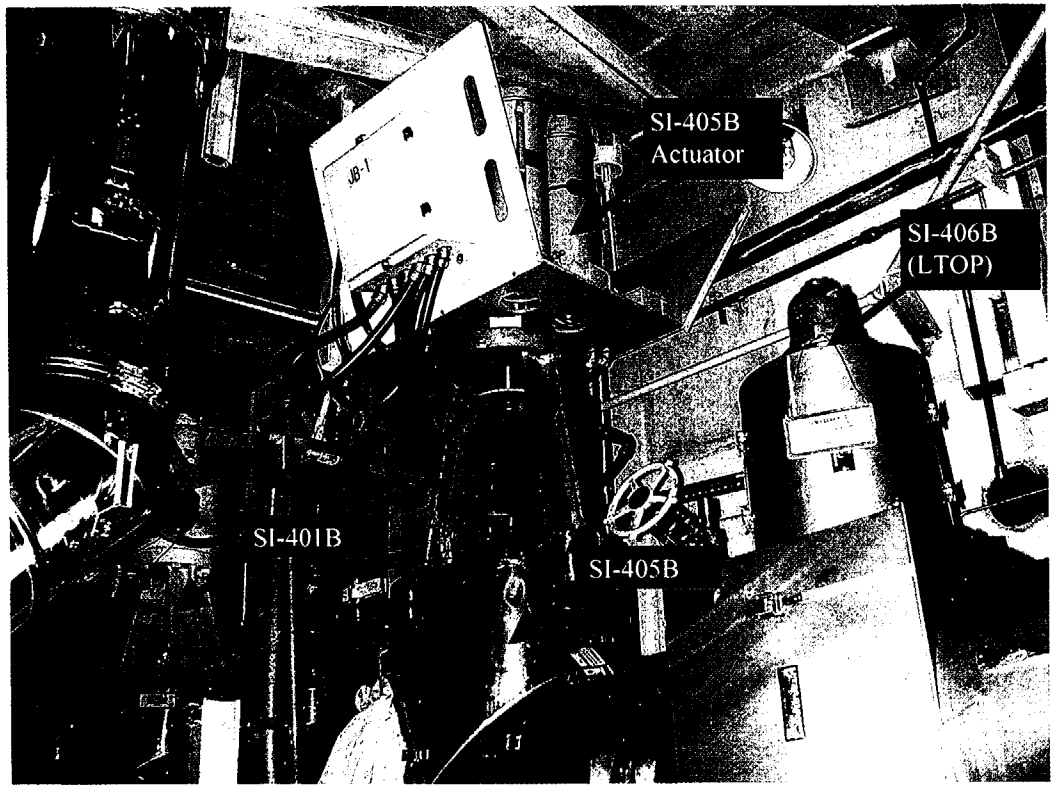
- Define options for resolving the air intrusion conditions
- Identify training needs related to containment design and testing and technical issue resolution
- Complete an organizational effectiveness assessment
- Perform periodic UT examinations to determine static leak rates

Voiding of Shutdown Cooling Suction Piping

Safety Significance

- Very low safety significance
- Containment Integrity is maintained
- Air pocket growth during LOCA will not affect LPSI injection
  - LPSI secured at Recirculation Actuation Signal (RAS)
  - Time to RAS < time to impact injection
- Air pocket too small to gas bind pump
  - Size limited to containment SI sump elevation
  - Air pocket compressed by RCS pressure
- Plant experience shows air pocket is swept through pump

SI-405 A & B Failure to Open



- ***14-inch flex wedge gate***
- ***hydraulic-pneumatic actuator***
- ***hydraulic pump opens the valve***
- ***stored nitrogen closes the valve***
- ***interlocks prevent opening while > 386 psia***
- ***second valve off of the RCS to align SDC (SI-401 is first)***

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SI-405 A & B Failure to Open

Root Cause Analysis

- The Root Cause of the event is determined to be thermal binding of SI-405 A & B
- Actuator set-up had little margin

Main Contributing Causes

- Vendor manual contained incorrect chart for charging nitrogen system
- GL 95-07 analysis did not consider event conditions

SI-405 A & B

Short-term Corrective Actions

- All circuits and instrument setpoints checked with no problems found
- Performed analysis to verify SI-405 A(B) susceptibility to thermal binding
- Evaluated data from normal hydraulic actuator PMs to validate there were no actuator problems
- Validated design parameters in the field for actuator capability and perform testing using AOV/MOV test equipment
- Increased the SI-405 A(B) open stroke actuator thrust
- Re-evaluated response to GL 95-07

SI-405 A & B Failure to Open

Long-term Corrective Actions

- Evaluate modification/replacement of SI-405 A(B) with respect to thermal binding design

- Evaluate implementing EPRI study recommendations for coping with thermal binding

SI-405 A & B

Safety Significance

- Very low safety significance
- Delayed SDC initiation
- Required additional SG steam release / feedwater inventory
- Accident conditions bounded by FSAR for 24 hour delay
  - Small (< 1 Rem) increase in offsite dose assuming actual SG leakrate
  - Feedwater inventory available

Risk Impact

- SGTR with failed SG isolation
- Instantaneous $\Delta CDF = 5.4 \times 10^{-8}$
- $\Delta CDP_{12\ hour} = 8 \times 10^{-11}$

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Operations Views

Randy Douet

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Operations Views

Plant Performance

- Equipment problems led to unnecessary burden on control room operators
  - Charging pump tripped
  - Pressurizer level control malfunction
  - RCP reverse rotation
  - SI-405 A & B delayed opening
- Plant and procedures responded well to natural circulation cooldown

Operations Views

Operations Performance

- Weak diagnosis of RCP 2B reverse rotation
- Missed opportunity on LPSI SDC line voiding impact on containment penetration
- Prompt conservative E-Plan entry amidst heavy activity load
- RF11 Operations human performance excellent
  - Human error rate for RF10 = 1.43
  - Human error rate for RF11 = 0.00

Emergency Plan Performance

Randy Douet

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Emergency Plan Performance

- Emergency Action Level - Inability to Achieve or Maintain Cold Shutdown
- Declared 15 minutes after valves declared Inoperable and Technical Specification entry
- Performance Indicators Met - 2 of 2
- Shift Manager promptly relieved of Emergency Plan duties - 17 Minutes
- Timely Emergency Facility Activation
  - 30 Minutes for TSC and OSC
  - EOF ready for activation in 52 minutes
- Offsite notifications timely and accurate
  - State and Locals - 6 Minutes; NRC - 18 Minutes

Emergency Plan Performance

Lessons Learned

- Event termination
  - Checklist to be revised by May 15, 2002
- ENS commitments/site boundary surveys
  - Communicated to emergency organization decision makers (action complete)
  - Status boards to be provided by May 15, 2002
- Emergency News Center staffing
  - Communicated to Emergency News Center Directors (action complete)

Reactor Vessel Head Inspection

Joe Venable

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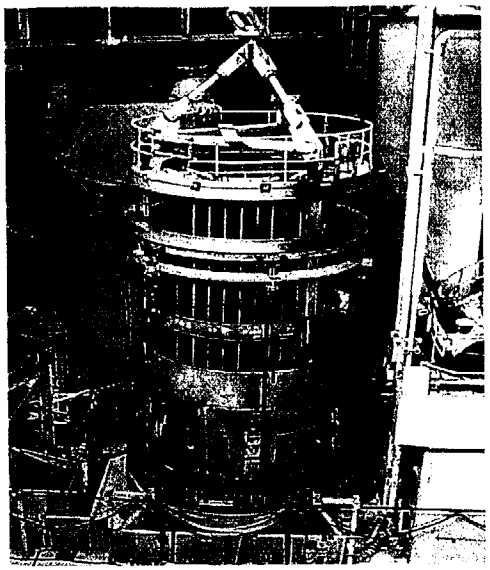
Reactor Vessel Head Inspection

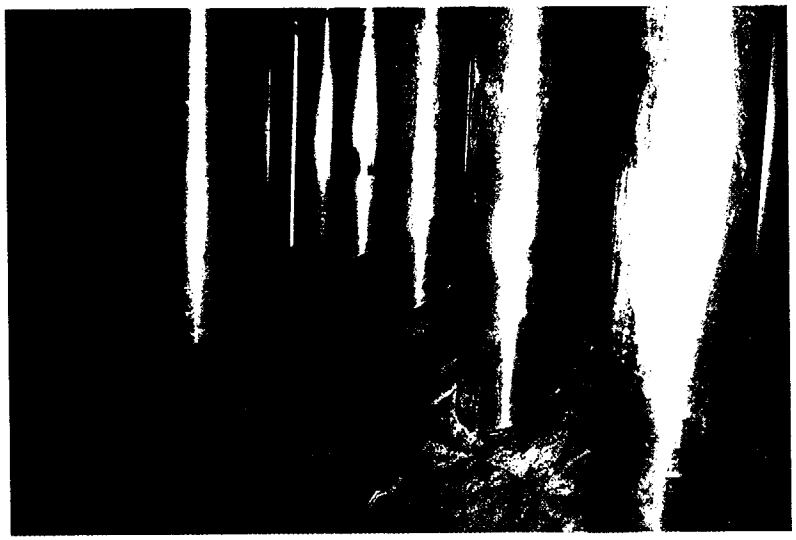
- Effective visual examination completed on 4/1/02
- No evidence of boric acid deposits
- 360° of all nozzles were inspected
- ~ 20% of the original reflective insulation was not removed due to the risk of damage to the CEDM's and vent line
- This section was raised to permit a borescope inspection of the bare metal
- A robotic crawler used to inspect the balance of the head
- NRC Sr. Resident and Regional Inspector were present during portions of insulation removal and inspection evolutions.
- Blanket insulation was installed in place of the removed reflective insulation
- Dose received on this activity which included headstand spacer and shielding modification, inspection and re-insulation was 8.5R

Waterford 3 Reactor Head Inspection Photos

Waterford 3 Reactor Head (stored on the refueling stand)



Old Insulation and "Donuts"



Head with Insulation Removed

New blanket Insulation

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Outage High Level Overview

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Outage High Level Overview

RF11 Safety Performance

- 0 critical safety function challenges
- 0 lost-time accidents
- 0 OSHA recordables (7 during RF10)
- 15 first aid cases (34 during RF10)
- Outage total dose = 102.5* Rem
  - no over-exposures
  - personnel contaminations down 35% from RF10

RF11 Duration

- 25 days, 22 hours, 15 minutes

* to be updated

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Outage High Level Overview

RF11 Major Activities/Results

- No RCS nozzle leakage identified during inspection
- No boric acid deposits / reactor head degradation identified
- No fuel reconstitution required
- Steam generator inspection - plugged a total of 36 tubes
- Major activities
  - Reactor head modification / permanent seal plate
  - Part Length CEA / 4-finger CEA elimination
  - Appendix K power uprate
  - Resolved remaining GL 96-06 penetrations
  - MS 401 A & B valve replacements
  - Replace Main Transformer A
  - Replace SI-142 A

Closing Remarks

Joe Venable

Entergy

MAY - 1 2002

Electronic distribution by RIV:
Regional Administrator **(EWM)**
DRP Director **(KEB)**
DRS Director **(ATH)**
Senior Resident Inspector **(TRF)**
Branch Chief, DRP/E **(WBJ)**
Senior Project Engineer, DRP/E **(GAP)**
Staff Chief, DRP/TSS **(PHH)**
RITS Coordinator **(NBH)**

R:_WAT\2002\WT 04-24-02 MS-DRP.wpd

RIV:SPE:DRP/E	C:DRP/E			
GMVasquez	WBJONES			
04/30/2002	04/30/2002			

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