



Regulatory/Enforcement Conference

Florida Power & Light Company Turkey Point Unit 3 Boraflex Degradation

April 14, 2010

List of Attendees

- Gene St. Pierre, Vice President, Fleet Support
- Michael Kiley, Vice President, Turkey Point
- Larry Nicholson, Director of Licensing
- Robert Tomonto, Licensing Manager, Turkey Point
- Carl O’Farrill, Nuclear Fuel Engineering Manager
- John Laffrey, Senior Licensing Engineer, Corporate
- William Blair, Senior Attorney



Agenda

- Introduction
- Opening Remarks
- Background
- Boraflex Management Program
- Discussion of Apparent Violations
- Closing Remarks



Purpose of Presentation

- Present background on Turkey Point Unit 3 Spent Fuel Pool and Boraflex Management Program
- Present FPL conclusions regarding the apparent violations associated with Boraflex degradation specifically identified in the Turkey Point Unit 3 Spent Fuel Pool



Opening Remarks

- Turkey Point 3 Spent Fuel Pool (SFP) has always been maintained in a safe configuration, with sufficient margin to criticality
 - The most reactive available fuel assembly could be safely placed in the most degraded cell, without credit for either soluble boron or interim compensatory measures, and Keff would still remain <1.0
- FPL's goal is to eliminate need for Boraflex in Turkey Point 3 SFP; removing any reliance on monitoring and interim compensatory measures
- Despite continuous efforts, numerous design and vendor production quality issues contributed to significant delays in implementation
- FPL is responsible for not implementing the Boraflex Remedy in a timely fashion
- FPL is now making progress to complete the Boraflex Remedy by Fall 2010



Background

- Boraflex degradation managed as operable/degraded non-conforming condition in accordance with GL 91-18/RIS 2005-20 guidance
 - Interim measures implemented to compensate for degradation prior to reaching design basis analysis assumption of 0.006 gms-B₁₀/cm²
 - Action taken at 0.0075 gm-B₁₀/cm²
- Final resolution includes use of Metamic inserts
 - Fabrication to specified tolerances found to be extremely difficult
 - Vendor production rate now acceptable: 80 inserts installed to date
- Fabrication issues delayed implementation of approved License Amendment 234



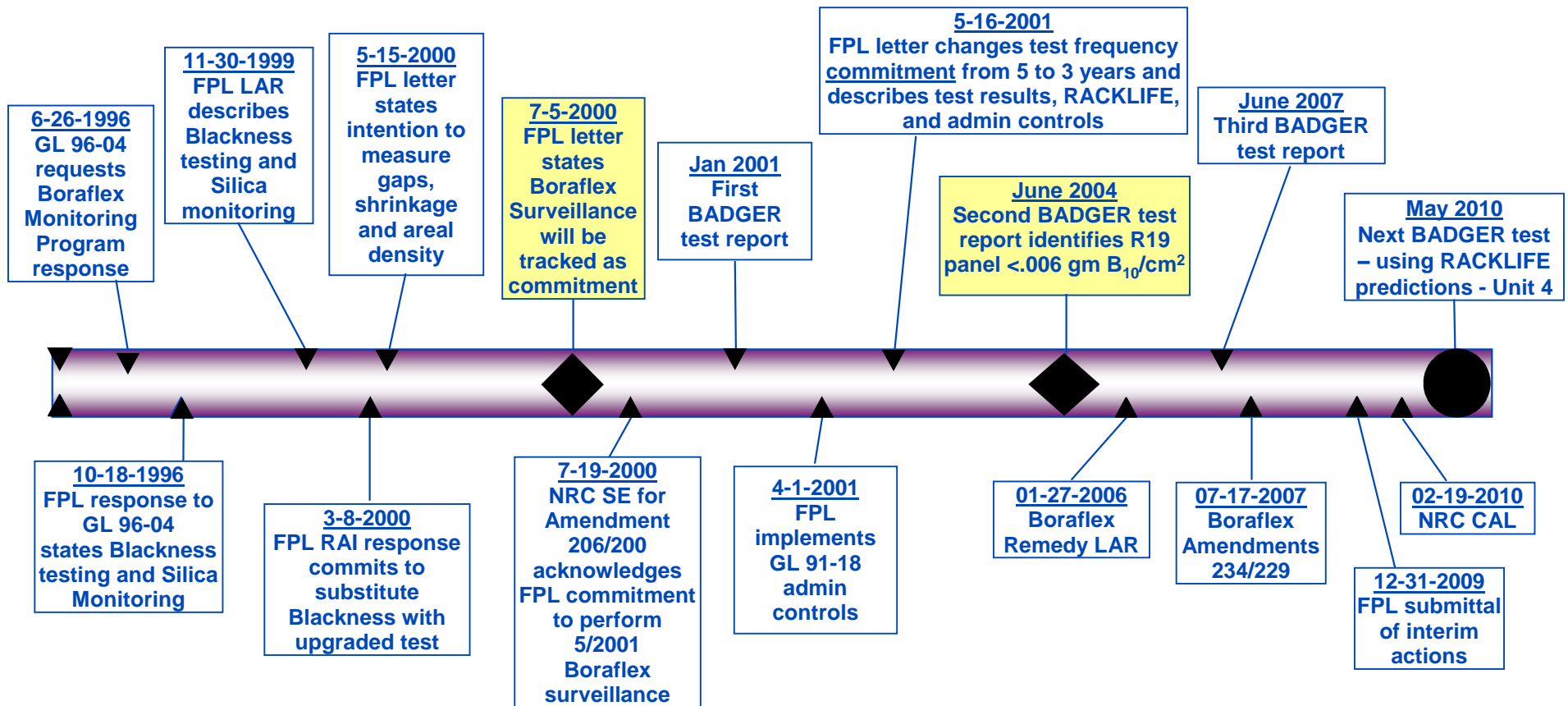
Background (cont'd)

- FPL December 31, 2009 submittal outlined interim actions
- NRC Confirmatory Action Letter (CAL) issued on February 19, 2010 to confirm acceptability of FPL interim actions
- Final Boraflex resolution for Unit 3 expected by Fall 2010
- We missed several opportunities over the years of this project to keep the NRC fully aware of the implementation issues and the condition of Unit 3's SFP. This lack of communication and information sharing on our part, we believe, is a significant contributor to the need for today's discussion



Timeline

Turkey Point Nuclear Plant Unit 3 SFP Boraflex Management Program



Background

- The Turkey Point Unit 3 SFP has two regions
 - Region I - designed to store higher reactivity fuel including fresh fuel
 - Region II - designed to store lower reactivity burned fuel
 - Both regions contain storage racks (placed in service in 1985) that use Boraflex neutron absorber to control reactivity
- Accumulated gamma dose and long term exposure to the wet pool environment cause the Boraflex panels to degrade
- The Region II racks have been subject to greater gamma dose due to the storage of burned fuel and have, therefore, experienced a greater amount of degradation



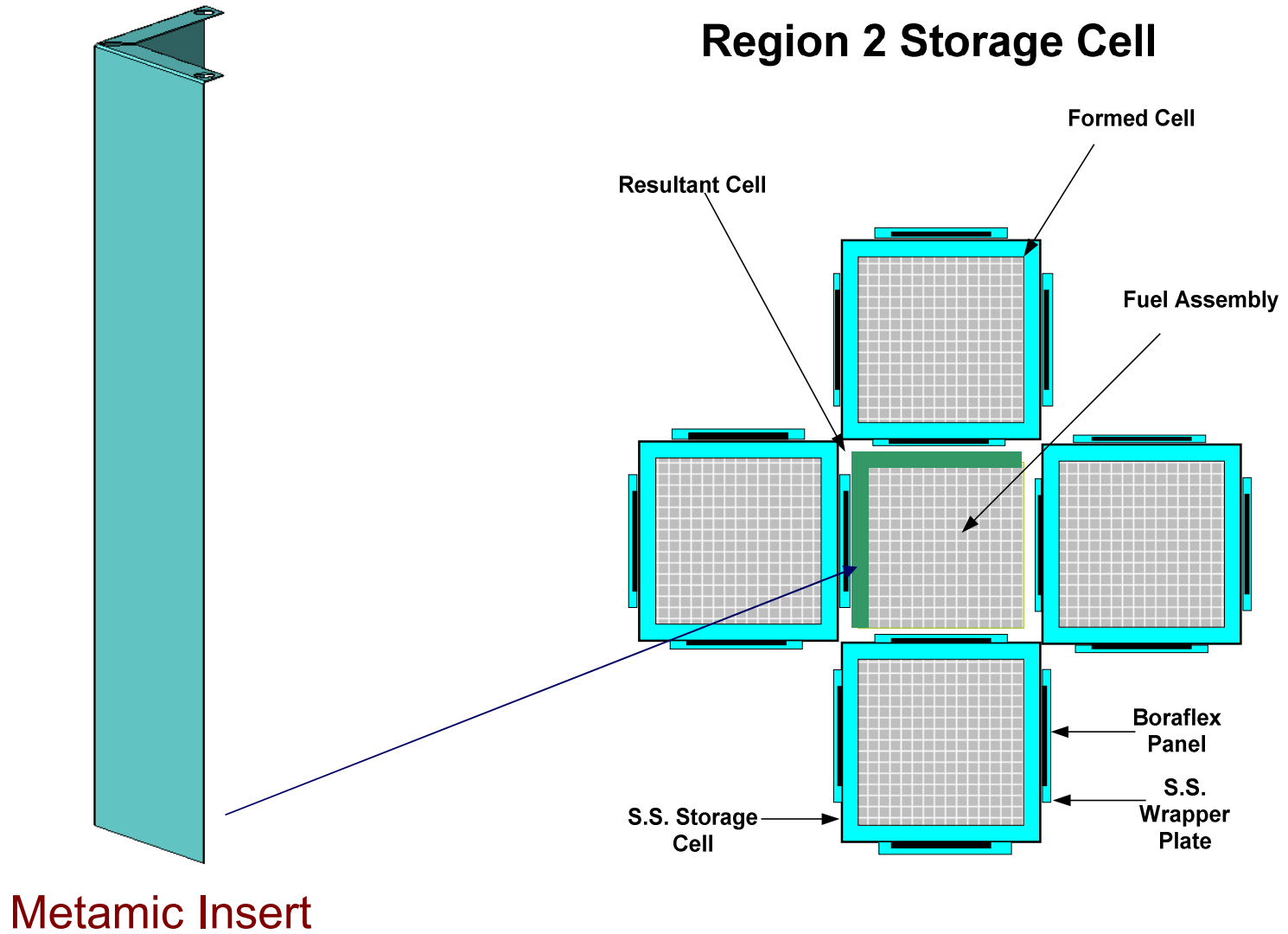
Background (cont'd)

Boraflex Licensing Basis Overview

- 10 CFR 50.68 establishes Keff requirements for SFP storage racks
- Technical Specification (TS) 5.5.1.1 specifies design requirements for the SFP racks, as detailed in UFSAR, to comply with 10 CFR 50.68 Keff requirements
- Associated Region II licensing basis analysis conservatively assumes a uniform minimal areal density to bound the effect of any actual Boraflex dissolution
 - Every panel in every cell assumed to be at the same dissolved B-10 areal density of $0.006 \text{ gms-B}_{10}/\text{cm}^2$



Background (cont'd)



Boraflex Management Program

- Purpose:
 - Manage Boraflex degradation to ensure the requirement for $K_{eff} < 1.0$ unborated is maintained in the SFP
- Objective:
 - To ensure implementation of compensatory measures before degradation exceeds licensing basis assumption of $0.006 \text{ gms-B}_{10}/\text{cm}^2$
 - Establishes administrative limit with an action threshold at $0.0075 \text{ gms-B}_{10}/\text{cm}^2$



Boraflex Management Program (cont'd)

- The program is based on monitoring and predicting the condition of the Boraflex panels using advanced techniques
 - Measuring and trending silica released to the SFP from the degrading panels
 - EPRI-RACKLIFE predictive code benchmarked to SFP silica and periodically updated to account for gamma dose from fuel repositioning on individual panels
 - EPRI-BADGER (Boron-10 Areal Density Gage for Evaluating Racks) in-situ areal density testing of a sample of panels in the SFP
- These three elements are endorsed by NUREG 1801, Rev. 1, “Generic Aging Lessons Learned” to manage the effects of aging on Boraflex
 - RACKLIFE has been used at 25 SFPs and BADGER testing at 14 SFPs throughout the industry (FPL implements full program; others implement partial program)



Boraflex Management Program (cont'd)

- Turkey Point Unit 3 RACKLIFE model update and analysis is performed at least once per operating cycle (every 18 months) or when significant fuel repositioning occurs
 - RACKLIFE model has been conservatively benchmarked to the Turkey Point Unit 3 SFP bulk silica concentration trend
 - RACKLIFE provides a predicted condition of each panel; used to determine when to take compensatory action for a storage cell
 - RACKLIFE used to determine the sample of panels to be measured covering a full range of service histories
 - BADGER used to validate RACKLIFE modeling



Boraflex Management Program (cont'd)

- BADGER testing at Turkey Point Unit 3 conducted in 2001, 2004, and 2007
 - 2001 results - used to determine administrative controls needed to meet TS 5.5.1.1
 - 2004 results - one panel below design bases analysis assumption of 0.006 gms-B₁₀/cm²
 - 2007 results – average panel at approximately 0.012 gms-B₁₀/cm² areal density

Boraflex Management Program (cont'd)

- BADGER testing has validated RACKLIFE predictions to be conservative on a storage cell basis
 - The impact on K_{eff} from dissolution of a single panel is affected by the areal density of the other panels in a storage cell and, therefore, the condition of all panels in a cell must be considered
 - RACKLIFE conservatively predicts the cumulative areal density of the four panels in a storage cell by 10.4% when compared to BADGER test results, with a 95% probability and 95% confidence (95/95 lower confidence limit)
- The conservative RACKLIFE model, combined with the conservative action threshold of $0.0075 \text{ gms-B}_{10}/\text{cm}^2$, provides significant margin to ensure action is taken to assure $K_{eff} < 1.0$ unborated is maintained

RACKLIFE predictions are conservative on a cell basis



Boraflex Management Program (cont'd)

- Since 2001, conservative actions taken to manage Boraflex degradation to ensure unborated $K_{eff} < 1.0$ include:
 - Established “checkerboard” storage rack module
 - Module configured to not require credit for Boraflex
 - Used to store recently discharged fuel assemblies
 - Helps to limit pool-wide Boraflex degradation
 - Mitigated storage cells that have any panel with areal density below administrative action threshold of $0.0075 \text{ gms-B}_{10}/\text{cm}^2$
 - No longer credit Boraflex in the cell
 - Remove cell from service, or
 - Insert RCCAs to compensate for Boraflex loss
- These actions did not require any increase in soluble boron to maintain $K_{eff} < 1.0$

Boraflex degradation effectively mitigated without crediting soluble boron



Boraflex Management Program (cont'd)

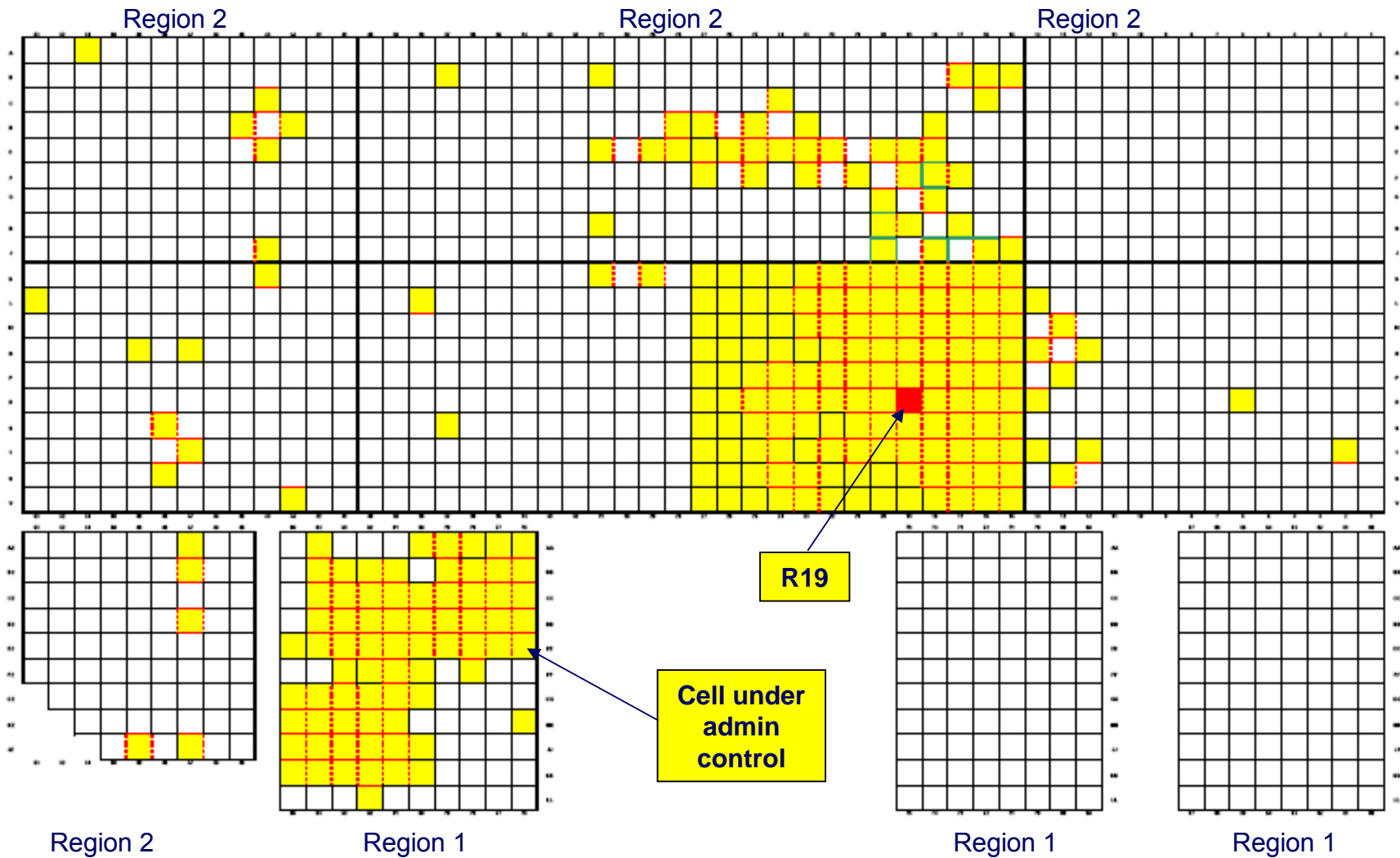
Unit 3 SFP Current Condition

- 258 of 1,404 Boraflex storage cells have been placed under administrative control as part of the Boraflex Management Program
- To date, one Region II storage cell panel (R19-east) measured (2004) with an areal density below 0.006 gms-B₁₀/cm² (i.e., .0056) while other panels in the cell measured well above 0.006 gms-B₁₀/cm²
 - The cell was already under administrative control since 2001, as part of the “checkerboard” storage rack module
- As of today, RACKLIFE indicates no additional panels have an areal density below the licensing basis assumption of 0.006 gms-B₁₀/cm²



Boraflex Management Program (cont'd)

Unit 3 Spent Fuel Pool Current Boraflex Degradation



Boraflex Management Program (cont'd)

Safety Significance of Boraflex Degradation

- No safety significance associated with the condition of the Unit 3 SFP
 - To date, only one panel in one cell has been determined to be below the licensing basis areal density input assumption, versus many that are above the assumed minimum areal density
 - The most reactive available fuel assembly could be safely placed in the most degraded cell, without credit for either soluble boron or interim compensatory measures, and K_{eff} would still remain <1.0



Boraflex Management Program (cont'd)

Safety Significance of Boraflex Degradation

- Boraflex Management Program has been effective in preventing any safety significance associated with Boraflex degradation
 - Designed to take actions prior to exceeding licensing assumption
 - Significant margin has been preserved by administratively controlled actions



Boraflex Management Program (cont'd)

Safety Significance of Boraflex Degradation

- Defense in depth with two effective, independent and diverse means of SFP reactivity control have been utilized
 - SFP racks with administrative control ensured $K_{eff} < 1.0$ unborated, and
 - Soluble boron to ensure $K_{eff} \leq 0.95$

Keff was always maintained within limits



(1) Failure to Comply with TS 5.5.1.1.a and 10 CFR 50.68(b)(4)

- Apparent violation:
 - Failure to comply with TS 5.5.1.1.a and 10 CFR 50.68(b)(4) requirements to assure that the effective neutron multiplication factor (Keff) would be maintained <1.0 for all cases in the Unit 3 spent fuel pool when flooded with unborated water
- Discussion:
 - FPL agrees with the apparent violation of TS 5.5.1.1.a
 - FPL considered compliance achieved by confirmation that the Boraflex surrounding each cell was sufficient to ensure acceptable Keff results
 - FPL did not apply NRC interpretation that compliance is dependent on each individual panel, without consideration for the condition of the remaining panels in a cell
 - Violation occurred in 2004 when the east panel in cell R19 was determined to be less than the required areal density
 - As a result, FPL did not submit a 10 CFR 50.73 report as a condition prohibited by TS



(1) Failure to Comply with TS 5.5.1.1.a and 10 CFR 50.68(b)(4) (cont'd)

- Discussion:
 - FPL respectfully disagrees that an apparent violation of 10 CFR 50.68(b)(4) occurred
 - 10 CFR 50.68(b)(4) establishes the Keff requirements for the SFP storage racks under certain specified conditions
 - Keff of the SFP storage racks was always maintained within the requirements under all the conditions specified in 10 CFR 50.68

Keff was always maintained within limits



(1) Failure to Comply with TS 5.5.1.1.a and 10 CFR 50.68(b)(4) (cont'd)

- Safety Significance:
 - There was no adverse impact on nuclear safety
 - $K_{eff} < 1.0$ unborated was maintained at all times
 - Only one panel in a single cell has been determined to date to fall below the areal density assumed in the licensing basis analysis
 - The typical panel remains well above the areal density limit assumed in the licensing basis analysis
 - There is inherent conservatism within the Boraflex Management Program to offset the uncertainties of panel measurement
 - No credit has been taken for soluble boron, thus preserving an independent, diverse and effective means of reactivity control

(2) Failure to Implement Effective Corrective Action Relative to SFP cells L38 and F19

- Apparent violation:
 - Failure to implement effective corrective actions for two specific cells that had degradation determined to be greater than that assumed in the criticality analysis
- Discussion:
 - FPL respectfully disagrees with the apparent violation as stated
 - SFP cells L38 and F19 were determined to have exceeded the FPL action threshold but not the density value assumed in the criticality analysis



(2) Failure to Implement Effective Corrective Action Relative to SFP cells L38 and F19 (cont'd)

- Circumstances for Cell L38:
 - BADGER testing in 2007 identified that the east panel of cell L38 was at 0.0071 gms-B₁₀/cm²
 - At that time, RACKLIFE was predicting this specific L38 panel to be above the action threshold
 - The Boraflex Management Program relied upon RACKLIFE results to take actions and did not explicitly require action based solely on BADGER results
 - The issue was entered into the corrective action program, after NRC identification, and storage cell L38 was placed under administrative control on November 13, 2009



(2) Failure to Implement Effective Corrective Action Relative to SFP cells L38 and F19 (cont'd)

- Circumstances for Cell L38:
 - Corrective actions:
 - Program has been revised to also take action, if needed, based on BADGER results
 - There are no other panels with BADGER results below the action limit that are not already under administrative control
 - Safety Significance
 - This event is of no safety significance
 - Analysis of the actual fuel stored in and around L38 demonstrates a $K_{eff} < 1.0$ unborated
 - Analysis assuming that the most reactive fuel available is stored in and around L38 also demonstrates a $K_{eff} < 1.0$ unborated



(2) Failure to Implement Effective Corrective Action Relative to SFP cells L38 and F19 (cont'd)

- Circumstances for Cell F19:
 - In January 2009, RACKLIFE projected the west and south panels of F19 to reach the action threshold in June and July of 2009
 - On September 1, 2009, during a routine RACKLIFE update, FPL discovered that cell F19 had not been placed under administrative control
 - Condition report generated, RCCA inserted into F19
 - Areal density of west and south panels determined to be at or above $0.0072 \text{ gms-B}_{10}/\text{cm}^2$ when placed under administrative control
 - Cause determined to be human error
 - No safety significance



(3) Failure to Report Condition Prohibited by TS

- Apparent violation:
 - Failure to make notification to the NRC in accordance with 10 CFR 50.73
- Discussion:
 - FPL agrees with the apparent violation
 - Report was not submitted as a direct result of not interpreting TS appropriately
 - FPL should have reported the condition of cell R19, discovered in 2004, as a condition prohibited by TS pursuant to 10 CFR 50.73(a)(2)(i)(B)
 - Time of discovery established on March 9, 2010, report being developed



(4) Failure to Update UFSAR

- Apparent violation:
 - Failure to update the UFSAR to reflect the interim monitoring program and associated compensatory measures being used since 2001
- Discussion:
 - FPL agrees that a violation of 10 CFR 50.71(e) occurred in that the compensatory measures taken between 2001 and present should have been described in the UFSAR
 - UFSAR was updated in 2002 to provide general description of Boraflex Surveillance Program
 - Boraflex monitoring aspect has been captured and tracked as a formal commitment
 - Compensatory measures have been considered as short-term interim measures under GL91-18/RIS2005-20
 - Given the duration, the UFSAR should have been updated to include the Boraflex Program details



(4) Failure to update UFSAR (cont'd)

- Actions taken:
 - FPL updated UFSAR Section 9.5 on March 1, 2010 to describe the Boraflex Management Program, including the monitoring and interim compensatory actions
- Significance:
 - FPL has continued to perform Boraflex surveillance testing as committed in License Amendment 206/200
 - FPL has managed the compensatory measures consistent with the guidance found in GL 91-18 as revised in RIS 2005-20



(5) Failure to Perform Adequate 50.59 Evaluation

- Apparent Violation
 - Failure to maintain a written evaluation which provided the bases for the determination that the change to the design of the spent fuel pool storage racks, without the use of Metamic inserts, did not require a license amendment
- Discussion:
 - FPL respectfully disagrees that a violation of 10 CFR 50.59 occurred
 - The inability to implement the license amendment that credited Metamic inserts does not constitute a proposed change, test or experiment within the context of 10 CFR 50.59



(5) Failure to Perform Adequate 50.59 Evaluation (cont'd)

- Discussion:
 - Existing licensing basis analysis was reviewed & approved via Amendment 206/200 dated 7/19/2000
 - RIS 2005-20 provides appropriate regulatory framework to evaluate effects of interim compensatory measures
 - Metamic inserts are currently being installed under 10 CFR 50.59 with no credit to offset Boraflex degradation
 - Situation very unique, no clear policy or precedent relative to the inability to implement an approved amendment



Closing Remarks

