



**FPL**

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NRC-FPL Meeting  
Turkey Point  
License Amendment Request  
Spent Fuel Pool Boraflex Remedy  
(Metamic Inserts and Storage Rules)

October 19, 2005

# FPL Fuel Storage Organization

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- Fuel Storage Projects
  - Carl Bible – Manager
  - Glenn Adams – Project Licensing
  - Yuan Kao – Project Engineer
  - Pete Sharp – Project Engineer, nuclear criticality
  - Carl O'Farrill - Supervisor, Nuclear Fuels
- Plant Staff
  - Paul Czaya - Turkey Point licensing
  - Bob Tomonto - Reactor Engineering

# Spent Fuel Storage Status

Loss of Full Core Reserve (LOFCR)

	LOFCR Date	ISFSI	
		Start Const	First Load
PSL Unit 1	2008	2006	2007
PSL Unit 2	2010	2006	2009
PTN Unit 3	2010	2007	2009
PTN Unit 4	2012	2007	2010
Seabrook	2009	2006	2008

# Turkey Point Boraflex Remedy

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- Meeting Objectives
  - Brief NRC Staff on license amendment request
    - Facilitate review
    - Preliminary Staff comments
    - Reduce RAIs, rules of engagement
    - Address current SFP Boraflex status
  - Staff concurrence on review schedule

# Turkey Point Background

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- Gamma-induced Boraflex degradation
  - Potential loss of reactivity hold-down
- 2nd Areal density (BADGER) test in 2004
  - Racks continue to meet design basis reqmts
  - Administrative controls to manage dose on high duty racks
- Next BADGER test in 2007
- New Cask Area Racks (Boral) not affected

# Project Objectives

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- Maintain spent fuel pool storage capacity
- Eliminate reliance on Boraflex
  - Ensure rack reactivity margin
  - Eliminate Boraflex surveillance testing
- Minimize fuel moves
  - Westinghouse fuel assembly top nozzle issue
- Flexibility in reactivity management
  - Variety of storage patterns, inserts

# Project Scope

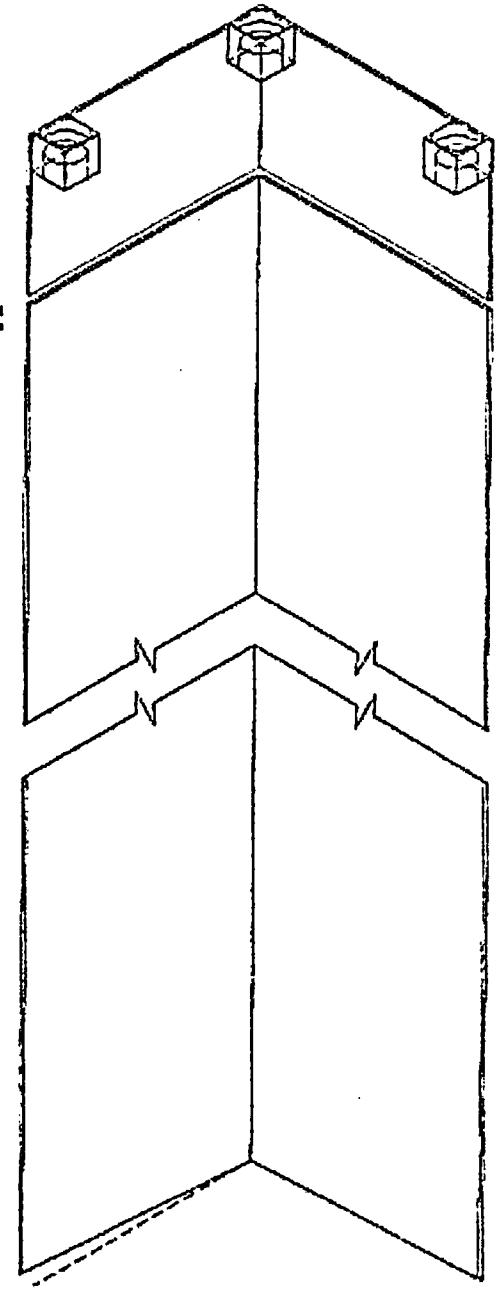
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- License Amendment Request
  - New rack loading patterns
    - disperses high-reactivity fuel
  - Metamic inserts (neutron absorber)
  - TS Program to evaluate other configurations
- Fuel movement campaign
  - Several hundred fuel moves per pool
  - Approximately 500 Metamic inserts per pool

# Metamic Inserts

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- Metamic panels
  - formed or welded
  - chevron shape
- Aluminum head
- Full length
- 24 lbs each
- Inserted around fuel





# Metamic Inserts

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- Supplier Holtec
  - Metamic LLC
- Quality Assurance
- Mill oxidized finish



# Fuel Loading Patterns

FIGURE 5.5-2

## ALLOWABLE REGION II STORAGE PATTERNS

I

### DEFINITION<sup>1,4</sup>

#### Region II 2x2 Array II-A

Category II-1 assembly in three of every four cells:  
One of every four cells is empty (water-filled).

### ILLUSTRATION<sup>1,2,3,4</sup>

II-1	II-1
II-1	E

#### Region II 2x2 Array II-B

Category II-2 assembly in every cell: Two of every four cells contain a Metamic insert (or full length RCCA in the assembly).

II-2	II-2
II-2	II-2

II-2	II-2
II-2	II-2

II-2	II-2
II-2	II-2

#### Region II 2x2 Array II-C

Checkerboard pattern of Category II-3 and II-5 assemblies:  
One of every four cells contains a Metamic insert (or full length RCCA in the assembly). Metamic inserts (or RCCAs) may be in either II-3 or II-5 cells.

II-3	II-5
II-5	II-3

II-5	II-3
II-3	II-5

#### Region II 2x2 Array II-D

Category II-4 assembly in every cell: One of every four cells contains a Metamic insert (or full length RCCA in the assembly).

II-4	II-4
II-4	II-4

# Schedule Objectives

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- Timely restoration of SFP reactivity margin
  - Currently meets reqmts, but degrading
- Preclude next Boraflex test (2007)
  - If possible
- Continue to meet storage requirements
  - Not affecting full core reserve at this time

# Schedule

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Submit LAR	Early 2006
RAI (if needed)	8 mos after submittal
Amendment	12 mos after submittal
Implementation	During 2007 *

\* Date negotiable. Interim configurations comply with old and new TS.

# LAR Preparation

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- Modeled after St. Lucie Boraflex Remedy
  - Unit 1 amendment 193 (9/23/2004)
- Applied other precedent
- RAI historical review
- Holtec – QA vendor
- NSHC compliant with RIS 2001-22

# LAR Structure

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- Wraparound Evaluation by FPL
  - Roadmap of evaluation, analysis
  - Information to supplement Holtec Report
    - FPL (non-Holtec) evaluations
    - Specific discussion of precedent
    - Specific discussion of related RAIs
- Holtec Report
- NSHC, EIC, TS Markup, Bases

# Applicable Precedent

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- Administrative controls - loading patterns
  - St. Lucie Unit 1, Unit 2
- Use of Metamic in Spent Fuel Pools
  - Topical Evaluation 6/17/2003
- Use of rack inserts in Spent Fuel Pools
  - ANO submittal review

# Affected Tech Specs

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- LCO – Refueling Boron Concentration
- LCO – Spent Fuel Storage
  - Establish new fuel loading reqmts per TS 5.5
  - Relocate max fuel enrichment to TS 5.5
  - Remove applicability of TS 3.0.3
- Design Features – Fuel Storage Criticality
  - Describe new fuel loading patterns
  - Describe use of rack and fuel inserts
  - Alternative loading patterns per NRC methodology



# Physical Changes Evaluated

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- More complex loading patterns
- Significant fuel movement campaign
- Metamic inserts reduce water inventory
- Metamic inserts reduce local convective flow
- Metamic inserts change seismic response
- Metamic potential for adverse chem reaction
- Metamic insertion may damage fuel
- Metamic surveillance requirements

# Structural Evaluation

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- Metamic inserts into racks
  - contribute  $< 0.1\%$  of gross wt on slab
- Whole Pool Multi-Rack WPMR Analysis
  - (DYNARACK)
- Previously-NRC-accepted method

# Thermal-Hydraulic Evaluation

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- Bulk THA - displaced water within margins
- Local THA
  - Metamic insert blocks two side flow channels
  - Computational Fluid Dynamics analysis
  - Local water temp peak is 206°F (<241°F sat.)
  - Peak clad temp is 250°F (>241°F sat.)
    - insufficient heat flux for DNB

# Criticality

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- Experienced vendor (Holtec International)
- Acceptance criteria per 10 CFR 50.68(b)
  - Soluble boron credit for  $K_{eff}$  0.95 is 560 ppm or less
- Previously-accepted codes, uncertainty methods
  - Explicit 3D analysis of fuel/rack geometry (MCNP4a)
  - Fuel burnup isotopics calculated (CASMO-4)

# Criticality Review

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- Loading patterns, correlation table
- Previous RAls incorporated:
  - Criticality criterion 10 CFR 50.68(b)
  - Sample Keff calculation
  - Quality controls on fuel, materials
  - Verification of calculated burnup
  - Integrity of RCCAs for neutron absorption
  - Configuration control on inserts
  - Unit differences
  - Managing new fuel types
- Boron Dilution Event (bounded)

# Materials - Metamic Guidance

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- Metamic Surveillance Program
- Inspect inservice inserts, not coupons
- B-10 composition, distribution assured by QA/QC
- Simulation of scratches (monitor actual scratches)
- Frequency (start within 48 mos. of service)
- Tests (visual)
- Mill oxidized finish, not anodized
- Cleaning technique – glass beading
- Limitation of 31 wt percent boron carbide

# Proposed Rules of Engagement

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- FPL extensive use of precedent
- FPL consideration of previous RAIs
- FPL points of contact for Staff questions
  - Example – Metamic insert tolerance
- One RAI within 8 months
  - LIC-101 threshold for formal questions

# Summary

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- Summary
  - Comprehensive analyses per guidance
  - Previously-approved methods, precedent
  - One-year review schedule
  - Potential for future TS Program for fuel storage
  - Proposed rules of engagement
- Questions / Followup Items