



# **Management of Spent Fuel Pool Neutron Absorbing Material Degradation**

Emma Wong

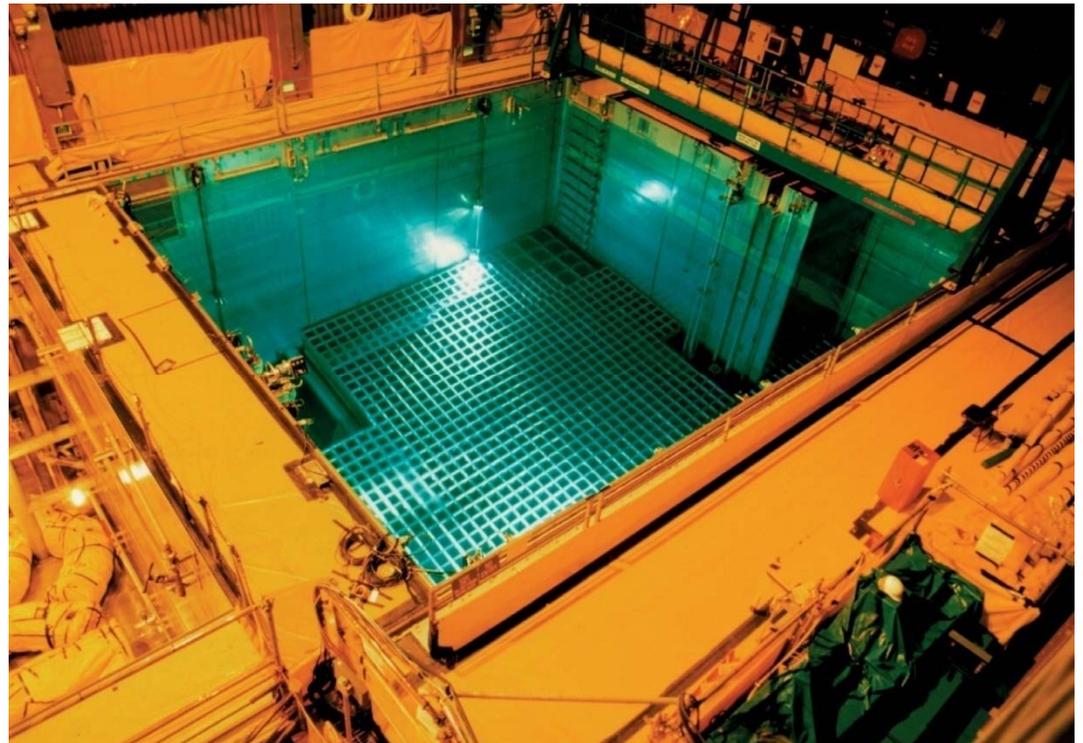
Nuclear Reactor Regulation/Division of Engineering

NEI Used Fuel Management Conference

May 9, 2013

# Overview

- Safety Significance
- Recent NRC Documents
- Topics of Interest
- Timeline
- Summary



Picture: Spent Fuel Pool



# Safety Significance

- Neutron absorbing materials have a direct impact on safety
- Prevent the occurrence of inadvertent criticality events in the SFP
  - Unidentified and unmitigated degradation poses a criticality and safety concern
  - Could challenge compliance with NRC subcriticality requirements: 10 CFR 50.68 and GDC 62
- NRC staff has identified this issue as potentially safety significant



## Recent NRC Documents

- IN 09-26, LR-ISG 2009-01, update to GALL (NUREG 1801 Rev 2), and IN 12-13
- Technical Letter Reports (TLRs) published
  - Database TLR: ML113550241 and ML121090500
  - TLR on Boraflex, RACKLIFE, and BADGER methodologies: ML12216A307
  - TLR on BADGER tool: ML12254A064
  - TLR on Phenolic Resins (expected May 2013)



# Topics of Interest

- Material properties and configuration
- Surveillance program methodologies
- Surveillance program frequencies
- Criticality analysis modeling of the material and degraded material
- Design basis event effects



# U.S.NRC Properties & Configuration

- Manufacturer and dates
- Material specifications
  - Materials of construction
  - Qualification testing
  - Current credit in analysis
- Configuration in the SFP
- Current condition of the material in the SFP
  - Areal density
  - Recorded degradation/deformation



**U.S.NRC**  
UNITED STATES NUCLEAR REGULATORY COMMISSION  
*Protecting People and the Environment*

# Surveillance Methodologies

- Basis of method to confirm that the material is performing its intended function
- Description of methods used
  - Procedures
  - Parameters
  - Monitoring and trending
  - Acceptance criteria



# U.S. NRC Surveillance Methodologies

- Visual inspection
- Coupon monitoring
  - Representative of the rack panel material in situ
  - Test methods/procedures and acceptance criteria
  - Re-insertion of coupons into SFP
  - Number of coupons remaining and frequency
- Predictive modeling methodology (RACKLIFE)
  - Inputs
  - Confirmatory testing
  - Calculation of areal density



# U.S. NRC Surveillance Methodologies

- In-situ testing methodology
  - Sample size and statistics
  - Calibration of instrument
    - Material selection, degraded materials, frequency
  - Cell geometry
  - Documentation
  - Qualification test report
  - BADGER
    - Plant specific procedures, standards, practices
    - Operating conditions, uncertainties, QA/QC, data analysis, interference factors, control points, head alignment



# Surveillance Frequencies

- Material degradation mechanisms and rate
- Confirmation of material properties during the surveillance interval
- Frequency modification
- Indicators of degradation between surveillances



# Criticality Aspects

- Modeling of the material
- Potential affect of degradation of the material on the criticality analysis of record
  - Loss of material – neutron absorbing capability
  - Deformation – blistering, bulging, pitting, warping
  - Gaps, cracks, shrinkage, densification
  - Voids
  - Structural integrity
  - Wear/mechanical damage
- Propagation of biases and uncertainties



# Design Basis Event

- Examples include: seismic, loss of cooling
- Effect on degradation mechanisms
- Effect on material configuration
- Limiting material and mechanical properties to maintain functionality
- Impact on surveillance intervals
- Criticality analysis impact



## Timeline

- Technical Specifications Task Force meeting – May 2, 2013
- NEI Used Fuel Management Conference - May 9, 2013
- Phenolic Resin TLR – Mid-2013
- Public Comment period on the potential generic communication - Mid-2013
- Public Meeting on the potential generic communication – 30 days after issuance for public comment



# Summary

- Additional public dialogue with industry
- Additional research underway
  - Materials
  - Surveillance methods and intervals
- Potential generic communication
  - May be used to gather plant-specific information
  - Determine if any additional NRC actions necessary
- Regulatory guidance, as necessary
- Other generic communications, as necessary



# **Management of Spent Fuel Pool Neutron Absorbing Material Degradation**

Emma Wong

Nuclear Reactor Regulation/Division of Engineering

NEI Used Fuel Management Conference

May 9, 2013