

# Industry Perspectives on the Importance of PFM Application in Regulatory Issue Resolution

Tim Wells  
Southern Nuclear  
Regulatory Information Conference  
March 9, 2016

2/1/16

---

---

---

---

---

---

---

---

## Overview

- ▶ Why apply PFM?
- ▶ How is PFM being used by Licensees?
- ▶ How does PFM use improve operation?
- ▶ How does PFM use improve regulatory oversight?
- ▶ How can we improve PFM regulatory outcomes?

2

---

---

---

---

---

---

---

---

## Why apply PFM?

- ▶ Deterministic and Probabilistic Fracture Mechanics Analyses are complementary - addressing different aspects of the same questions
  - ▶ Rich history of prescriptive deterministic design and evaluatory analysis methods with widely recognized acceptance criteria
    - ◊ Establish "safe" configurations through conservative assumptions and safety factors
    - ◊ Results include poorly characterized safety margins
  - ▶ Probabilistic methods involve more complex analyses and less prescriptive methodologies but can provide important insights into
    - ◊ Assessing the safety implications of implementing a change in examination scope, method or frequency
    - ◊ Design margin quantification (including selection of deterministic safety factors)
    - ◊ Design condition combinations with potentially adverse outcomes
- *"The NRC uses a risk-informed regulatory approach to identify and support additional requirements or regulatory actions, when needed. Risk information can also be used to reduce unnecessary requirements in purely deterministic approaches."*

\* <http://www.nrc.gov/about-nrc/regulatory/risk-informed-concept.html>

3

---

---

---

---

---

---

---

---

### How is PFM being used by Licensees?

- ▶ Single plant single event emergent issues
  - Flaw evaluations & associated reinspection intervals
- ▶ Single plant relief evaluations
  - 2-cycle reinspection for  $T_{\text{cold}}$  head with Primary Water Stress Corrosion Cracking (PWSCC)
- ▶ Generic issue resolution
  - Reactor Pressure Vessel (RPV) hydrogen flaking
  - Branch Technical Position (BTP) 5-3 uncertainty assessment
- ▶ Generic management plan development
  - PWSCC degradation management technical bases for RPV Upper & lower Head Penetrations and Dissimilar Metal Butt welds
- ▶ Generic Relief Assessments
  - PWR Owner's Group RPV weld reinspection optimization
  - BWR Vessel & Internals Project RPV circumferential weld inspection elimination

---

---

---

---

---

---

---

---

### How does PFM use improve operation?

- ▶ Decision-making:
  - Focus limited resources on the more safety-significant activities
- ▶ Scope and Schedule:
  - Distinguish activities that are "Important & Urgent" from just "Important"
  - Minimize emergent plant repair evolutions to those with safety significance
  - More effectively manage cost and radiation exposure by optimizing examination scope and/or frequency

---

---

---

---

---

---

---

---

### How does PFM use improve regulatory oversight?

- ▶ Decision-making:
  - Focus limited resources on the safety-significance of activities
  - Provides a framework for reaching robust "reasonable assurance" decisions
- ▶ Separate the forest from the trees
- *"For the NRC, a "risk-informed" approach offers the following benefits:*
  - ❖ Enable the NRC to consider a wide variety of accidents.
  - ❖ Give the NRC a way to prioritize those accidents based on public safety, operating experience, and/or engineering judgment.
  - ❖ Consider every reasonable method to prevent or mitigate an accident.
  - ❖ Highlight areas that are not thoroughly understood.
  - ❖ Test the sensitivity of analysis results to key assumptions."

---

---

---

---

---

---

---

---

## How can we improve PFM regulatory outcomes?

- ▶ Extract and apply lessons learned from development and implementation of risk-informed program areas (*Probabilistic Risk Assessment, Risk-Informed In-Service Inspection, etc.*)
- ▶ Agreed-upon standards for analysis and content of PFM submittals to
  - Establish mutual confidence between the licensee and regulator
  - Support consistent consideration and acceptance of PFM validity by NRC Staff
  - Ease review of and even streamline submittals
- ▶ Must understand each other's role and perspective
- ▶ Continued collaboration on such topical areas fosters better understanding on both sides (*e.g., Weld Residual Stress and Extremely Low Probability of Rupture (xLPR) cooperative research projects*)

7

---

---

---

---

---

---

---

---