Westinghouse Owner Group Meeting on the PWR Reactor Vessel ISI Interval Extension Program with the U.S. Nuclear Regulatory Commission

September 2003

Agenda

- Project Objectives
- Background Information
- FAVOR Flaw Input
- Pilot Plant Input and Results
- Proposed Regulatory Process
- Project Plan

WOG Representatives

- *Dennis Weakland - First Energy Nuclear Operating Company and WOG Materials Subcommittee Chairman, W Pilot Plant*
- Bob Hardies – Calvert Cliffs, WOG Materials Subcommittee Co-Chair
- Kevin Hall – Entergy, CE Utility Technical Sponsor
- Michael Acker – Palisades, CE Pilot Plant
- Greg Gerzen – Exelon, WOG Materials Subcommittee Co-Chair
- Mo Dingler – Wolf Creek Nuclear Plant, Non-Pilot Plant Lead
- Cheryl Boggess - Westinghouse RI-RVI Project Manager
- Steve Lurie - Westinghouse WOG Projects
- RI-RVI Project Technical Leads
  - Bruce Bishop, Probabilistic Fracture Mechanics Analysis
  - Owen Hedden, ASME Code Case and White Paper
  - Chris Hoffmann, Deterministic Fracture Mechanics Analysis

Project Objectives

- Develop a methodology to determine acceptability of a 20 year RPV ISI interval
- Verify methodology with ASME Code Case and supporting White Paper
- Apply methodology to pilot plants in conjunction with the NRC Program on PTS Risk Re-evaluation.
- Develop software tool for flaw input.
- NRC review and SER of the topical report.

Background Information

- BWR VIP-05 Methodology
  - Eliminated future inspections on all RPV circumferential welds except at intersections with axial welds
  - NRC approved via SE dated 7/28/98
  - Process expanded to PWR
- ASME Code Case N-691
  - Diverse interests review methodology, reach consensus
  - Approved at Main Committee
  - Code Case revisited pending pilot studies and NRC review
- PWR Evaluation Focus
  - Less frequent vs. eliminating examinations

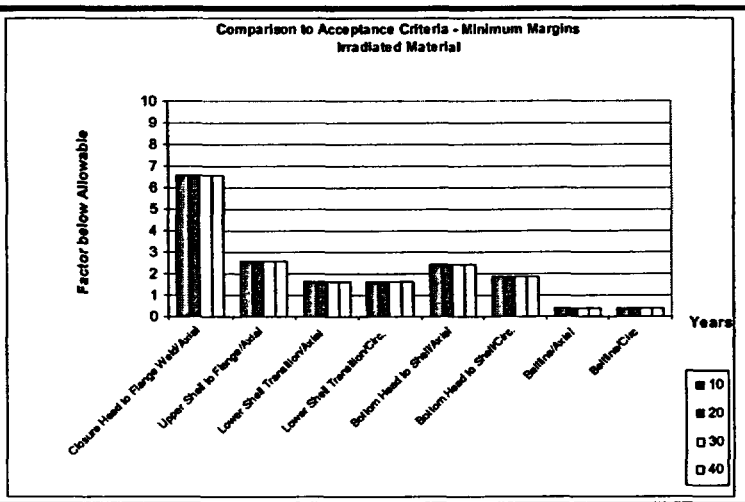
Background Information

- Pilot Plants

Reactor Supplier	PTS	WOG RI-RVI Program
Combustion Engineering	Palisades Calvert Cliffs	Palisades (Pilot)
Westinghouse	Beaver Valley Unit 1	Beaver Valley Unit 1 (Pilot)
Babcock & Wilcox	Oconee	Oconee (feasibility only)

- Deterministic study identified Beltline welds as critical locations

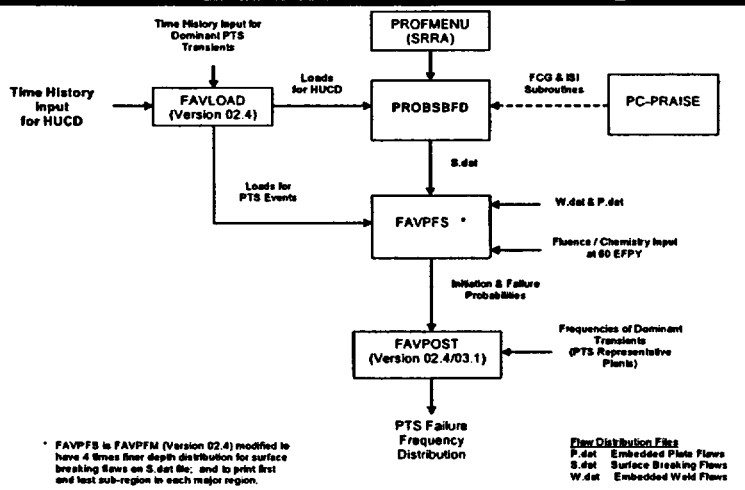
Background Information



FAVOR
Flaw Input for Pilot Plant Studies

- Surface Breaking Flaws
  - PNNL Computer Code from NRC PTS Study
  - Single pass cladding assumed vs Multi pass
  - Flaw extends completely through cladding
- Fatigue Crack Growth
  - pc-PRAISE subroutine and uncertainties
  - 1000 Monte-Carlo simulations consistent with NRC approved piping RI-ISI methodology
  - Four aspect ratios considered in evaluations
- In-Service Inspection Effects
  - A detected flaw is repaired, probability of having a surface breaking flaw is then reduced
  - Independent and cumulative effects of inspection are considered
  - Approach is consistent with pc-PRAISE and NRC approved piping RI-ISI methodology

Computer Tool Process Flowchart for Pilot Plant Surface Flaw Input



Use of FAVOR in Pilot Plant Studies

- PTS information used directly
  - FAVOR source code
  - Data input files for PTS
- FAVOR flaw input modified to support Pilot Plant Studies
- Modifications are consistent with NRC approved methodology
  - pc-PRAISE
  - Piping RI-ISI

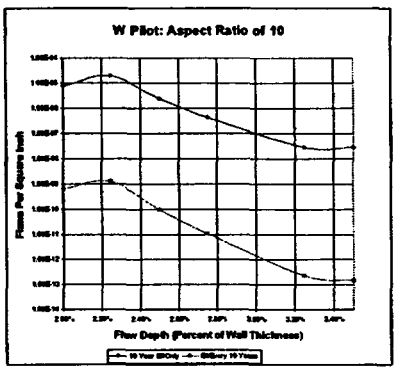
NRC PTS Risk Study Using FAVOR Version 02.4 vs. Version 03.1

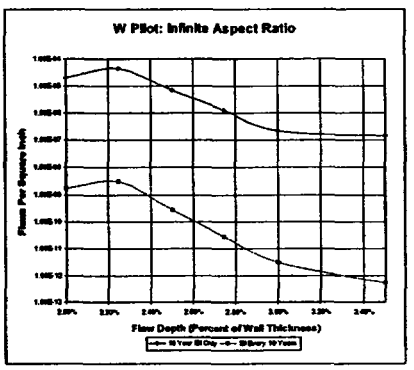
- NRC recently issued FAVOR 03.1
  - Corrects 02.4 error - increased initiation frequency
  - Improved upper shelf model - reduced failure frequency
  - Net effect between 02.4/03.1 - small change in failure frequency
- Dominant PTS Transients for Failure Frequency
  - 4 Transients added for W Pilot
  - No change in CE Pilot
  - BW under evaluation
- Overall impact on PTS Risk is insignificant

Pilot Plant Input

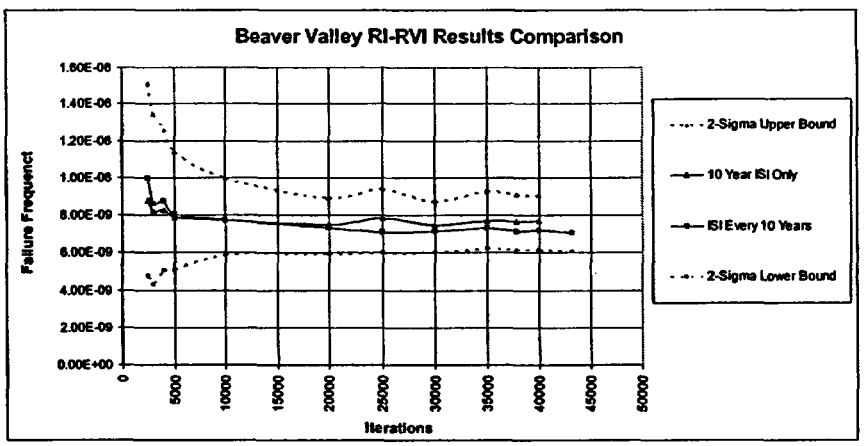
- Transients
  - NRC PTS Study
    - Input used directly
    - 8 to 12 dominant for W
    - 12 dominant for CE
  - Bounding Design Basis Normal/Upset Transients
    - HU/CD for 80 Calendar Years
    - Frequency (7/yr W, 12/yr CE)
- POD Curve from Beltline PDI at EPRI NDE Center
  - Only ISI after 10 years
  - Cumulative effect of ISI every 10 years
- Frequency of Failure (TWF) calculated at 60 EFPY

W Pilot Plant Surface Breaking Flaw Sizes and Densities

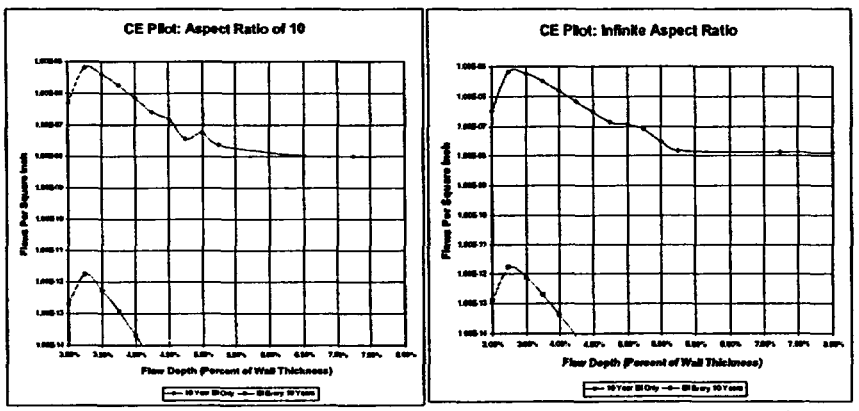




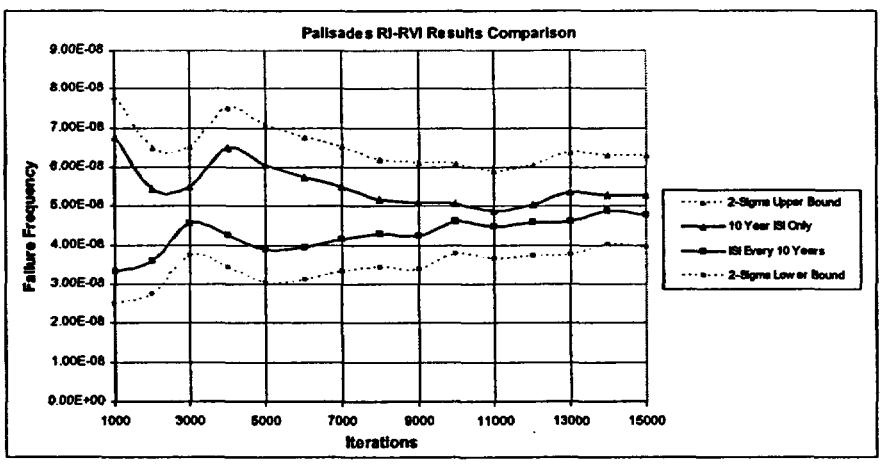
W Pilot Results Favor 02.4



CE Pilot Plant Surface Breaking Flaw Sizes and Densities



CE Pilot Results Favor 02.4



Pilot Results Favor 03.1

- Currently under evaluation
- Preliminary results indicate close correspondence with Favor Version 02.4 results
- FAVOR 03.1 results will be included in WCAP submitted for NRC review

Pilot Plant Risk Evaluation Criteria and Results

- Methodology
  - Regulatory Guide 1.174
    - Change in core-damage frequency (CDF) < 1 x 10-6 per reactor year
    - Change in large early release frequency (LERF) < 1 x 10-7 per reactor year
  - Proposed additional
    - Vessel Failure Frequency is directly related to CDF and LERF
    - Change in vessel failure frequency < 1 x 10-7 per reactor year
- Basis
  - Maximum difference between 2-Sigma Upper Bound and 2-Sigma Lower Bound vessel failure frequency values generated in probabilistic analysis
  - 10 Year Inspection within first 10 years only vs. Current requirement of Inspecting every 10 Years
  - 80 year operating life for fatigue transients
  - 60 EFPY vessel embrittlement
- Results
  - CE Pilot Change in Reactor Vessel Failure Frequency per reactor year ≤2.68E-8
  - W Pilot Change in Reactor Vessel Failure Frequency per reactor year ≤3.44E-9

WOG RPV ISI Interval Extension Results Summary

- Pilot Plant Results for Change in CDF and LERF
  - CE Pilot ≤2.68E-8 per reactor year
  - W Pilot ≤3.44E-9 per reactor year
- LERF Impact
  - Change in LERF insignificant based on Regulatory Guide 1.174
- CDF Impact
  - Change in CDF insignificant based on Regulatory Guide 1.174
- Defense in Depth
  - No credit for potential plant mitigation of through wall reactor vessel failure
  - Change in LERF is very small even for assumed conditional LER probability of one
  - A margin of safety maintained through continued 100% inspection every 20 years

Conclusion

Conservatively calculated CE and W Pilot Plant results based on current requirements of one inspection every 10 years versus one inspection in first 10 years and no further inspections through license renewal are within Regulatory Guidance for insignificant CDF and LERF changes.

Proposed Regulatory Process

- Future: Cite NRC approved ASME Code Case
- Interim Implementation (pending NRC Code Case Approval):
  - Methodology - WCAP Pilot Plant Topical
  - Plant Specific - Template Results Summary
  - Relief Request

Project Plan

- Complete Pilot Plant WCAP Report
- October 2003 Submit WCAP Report to NRC
- October 2003 Initiate Non-Pilot Lead Plant Evaluations
- January 2004
  - Submit Non-Pilot Lead Plant Template Results Summary
  - Relief Request
- September 2004
  - NRC SE
  - Pilot Plant Relief Request