NRC / WOG / MRP Meeting

Reactor Vessel Internals Issues

April 18, 2000

Meeting Objectives

- Provide update status on WOG BBB program
- Provide update status on MRP ITG on Reactor Vessel Internals
- Requesting schedule for review completion of the Reactor Vessel Internals GTR

NRC / WOG / MRP Meeting
Reactor Vessel Internals Issues
April 18, 2000

Meeting Agenda

9:00	Objective / Background	Roger Newton, WEPCo
9:10	WOG Baffle Barrel Bolting Program Status Lead Plant Results	Tim Herrmann, AmerenUE
10:00	PWR MRP Reactor Internals ITG/JoBB	
	ITG Program and Status	Roger Newton, WEPCO
	JoBB	Larry Nelson, EPRI
11:00	WOG Generic Technical Report, Aging Mgmt of RV Internals, RAIs and Responses	Roger Newton, WEPCo
11:50	Summary	Roger Newton, WEPCo
12:00	Adjourn	

NRC / WOG / MRP Meeting
Reactor Vessel Internals Issues
April 18, 2000

Background

- WOG aging management report on RV Internals (WCAP-14577) submitted to NRC in September 1997
- RAI's on the report issued June 1999
- Formal WOG responses issued November 1999
- Significant RAI interest in WOG and MRP activities regarding RV Internals
- Many RAI responses defer to outcomes from these programs

WOG Baffle Barrel Bolting (B^3) Program Status

April 18, 2000

Tim Herrmann, AmerenUE
Chairman
WOG Materials Subcommittee

WOG B^3 Program - Presentation Outline

- **Objectives**

- **Program Update since March 25, 1999 WOG/NRC Meeting**
- **Plant Bolt Inspection Results**
- **Plant Bolt Replacement Results**
- **Hot Cell Testing Status**
- **WOG Program Strategy and Direction**

WOG B^3 Program - Objectives

- **Maintain safety for WOG plants**
- **Proactively manage the program with a systematic approach**
  - Assess technical and safety issues
  - Minimize regulatory risk
  - Minimize cost to WOG plants
  - Establish integrated long term plan

B^3 Program Events Since March 25, 1999 WOG/NRC Meeting on Baffle Bolts

- Rochester Gas & Electric completed a limited bolt replacement at Ginna
- Southern Nuclear successfully completed baffle bolt inspection and replacement at Farley Unit #2.
- Hot cell testing of Removed Bolts Continuing
- WOG moved BBB work to the Materials Subcommittee
  - Acceptable baffle barrel bolting analyses for plant groupings continuing
    - Fuel sensitivity work completed
- Risk Informed WCAP Issued
- WOG/MRP/NRC Meeting held on March 22, 2000
  - Review of WOG and MRP funded work on Farley and Point Beach Bolts
  - Review of WOG funded work on Ginna bolts
  - MRP/JoBB Testing Summary
  - Visit to the Westinghouse STC hot cell facility

WOG Baffle Bolt UT Inspection Domestic Plant Data

Plant	Date Inspected	Number of Effective Full Power Hours	Baffle Bolt Material	# of Bolts Inspected (% of Total)	# of UT Indications (% of Total Inspected)	Non-Functional Bolts (% of Bolts Verified to be Non-functional)
Farley Unit 1	12/98	144,000	316 CW SS	1086 (99.8)	0 (0.0%)	0 (0.0%)
Point Beach Unit 2	1/99	182,000	347 Annealed SS	728 (100.0)	55 (7.6%)	9 (1.2%)
Ginna	4/99	195,000	347 Annealed SS	639 (87.8)	59 (9.2%)	5 (0.8%)
Farley Unit 2	11/99	134,000	316 CW SS	1088 (100.0)	0 (0.0%)	0 (0.0%)

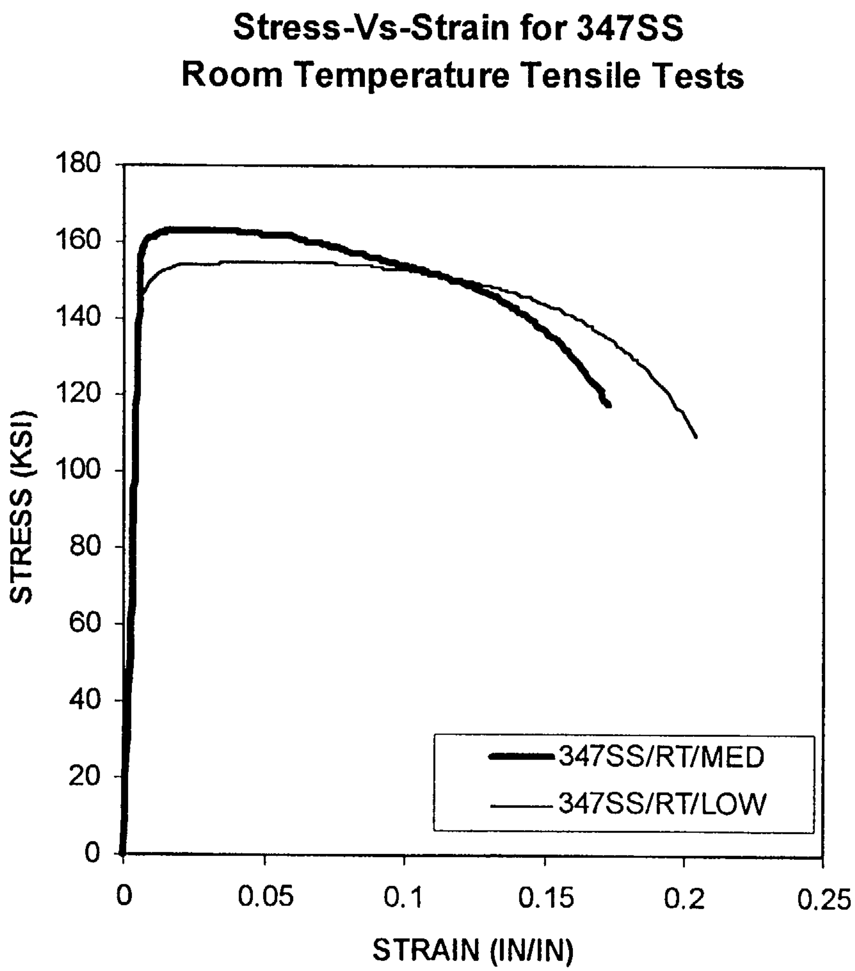
WOG Baffle Bolt Replacement
Domestic Plant Data

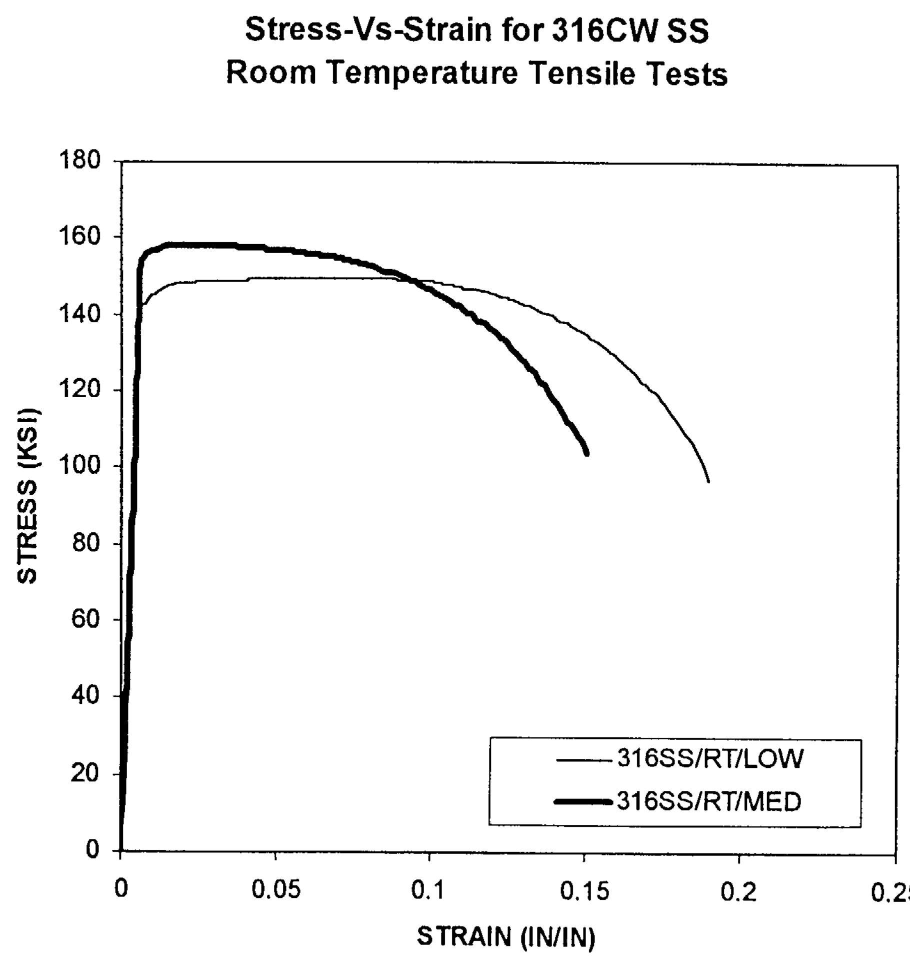
Plant	Date of Bolt Replace ment	Initial Pattern	Modified Pattern	Actual # of Removed Bolts	Actual # of Replaced Bolts	Comments
Farley Unit 1	12/98	384	277	277	276	Final pattern acceptable per Westinghouse NRC approved methodology
Point Beach Unit 2	1/99	280	176	176	175	Final pattern acceptable per Westinghouse NRC approved methodology
Ginna	4/99	-	-	56	56	Limited replacement
Farley Unit 2	12/99	264	204	204	203	Final pattern acceptable per Westinghouse NRC approved methodology.

WOG Baffle Bolt Mechanical Testing of Removed Bolts
Domestic Plant Data

Plant	Date of Bolt Mechanical Testing	Location of Testing	# of Removed Bolts Tested
Farley Unit 1	12/98	On-Site	211
Point Beach Unit 2	1/99	On-Site	146
Ginna	2/00	At W STC	12

Stress-Strain Curves at Room Temperature





Material Tested

Material Type	# Whole Bolts	# Bolt Heads
Strain Hardened 316 SS with 304SS Lock Bars*	6	0
Annealed 347SS with 304 SS Lock Washers*	24	8

* Each bolt head and whole bolt had either a lock bar or lock washer.

Investigation of Bolting Materials, Lock Bars and Lock Washers of Three PWR Plants

Analysis	Status
Fractography	In Progress.
UT Examination	Inspection Completed. Analysis of results in progress.
Fluorescent Dye Penetrant Inspection	Inspection completed. Results Submitted in Interim Report.
Tensile Tests	Testing completed. Interim report submitted.
SSRT Testing	Testing Completed. Analysis of results in progress.
Crack Growth Testing	Testing in Progress.
Fracture Toughness Testing	Testing to begin in July.
Pull Bolt Heads	Bolt Head Pulling Completed. Analysis of Results in Progress.
Chemistry & Constituents of Deposits on Fracture Faces (X-ray)	In Progress.
Gamma Spectroscopy	Measurements Completed. Analysis of Results in Progress.
Metallography	In Progress.
Microhardness/ Hardness Testing	In Progress.
ASTM A262 Practice A test for Sensitization	Testing Completed. Analysis of Results in Progress.
TEM - Microstructure, Grain Boundary Chemistry, Voids	In Progress.
Chemical Analysis of Cracked and Uncracked Bolt Materials, Lock Bar and Lock Washer Materials	In Progress.

Summary of Test Results Covered at March 22nd Meeting

- PT, Metallography, Fractography, Tensile Testing, SSRT Testing for IASCC. (In progress IASCC growth, Toughness, TEM)
- Findings to Date
  - Bolts with suspect UT indications have no defects
  - Tensile Strength is increased (YS, UTS)
  - Elongation is decreased but failures are ductile.
  - SSRT testing indicates IASCC susceptibility (Test is aggressive)
  - Metallography and Fractography are normal

Schedule for the Determination of Acceptable Baffle Barrel Bolting Distribution

- 1998 Case 1: Two Loop Downflow Generic Base Case
  - Case 2: Three Loop 17 x 17 Downflow Generic Base Case
  - Case 3: Three Loop Converted Upflow Case
  - Case 4: Four Loop 17 x 17 Downflow Generic Base Case
- 1999 Case 1: Three Loop Downflow Configuration 2 Case
  - Case 2: Fuel type sensitivity evaluation for the 2 loop group (Two Westinghouse plus One Siemens fuel product)
  - Case 3: Four Loop15x15 Fuel Downflow Case
- 2000 Case 1: Three Loop15 x 15 Downflow Case
  - Case 2: Four Loop 15 x 15 Converted Upflow Case
  - Case 3: Four Loop 17 x 17 Converted Upflow Case
  - Case 4: Four Loop High Seismic Case
  - Case 5: Three Loop Standard Upflow Case
  - Case 6: Four Loop Standard Upflow Case

Acceptable Bolting Analysis Assuming The Extension of LBB to Smaller Lines

- Extent of LBB application determined by individual plant groups
- Some Down flow plant groupings are extending LBB to smaller lines to reduce the number and distribution of intact and functional bolts required.
  - For such distributions, normal operation bolt stresses are relatively higher for downflow plants than converted upflow plants. These normal/upset condition bolt stresses have to be considered as well as the faulted condition stresses.
- Consistent with RI 10CFR54 LBLOCA Redefinition Methodology

Utilization of Irradiated Bolt Material Properties

- Initial yield and ultimate strength for Type 347 annealed SS significantly less than Type 316 CW SS
- Irradiated properties for both materials are comparable
- Analysis of replacement bolts utilizes type 316 CW virgin material properties as limiting assumption
- Analysis of downflow plants with Type 347 bolts which are considering only inspection may utilize irradiated 347 material properties

WOG Baffle Bolt Program Summary

- Two WOG lead plants completed their bolt inspection, replacement and on-site testing programs
- One WOG plant performed a bolt inspection and limited replacement program
- One additional WOG plant completed their bolt inspection and replacement program
- Bolt degradation less than anticipated based on European experience and confined only to 347 SS annealed material baffle bolts
- Integration of WOG baffle barrel bolting program tasks with MRP/ITG program completed

WOG Baffle Bolt Program Summary (Continued)

- Four international Westinghouse plants are planning bolt inspections and possible replacements in May/June 2000, January 2001 and September 2002
- No further inspections and/or replacements are planned for the domestic Westinghouse PWR plants within their current licensing basis
- Will continue to participate and support PWR industry reactor internals aging management programs

- **Conclusion**
  - **It is appropriate to treat baffle bolt degradation as a potential aging management issue for License Renewal**

PWR Materials Reliability Program

MRP Reactor Internals ITG / JoBB Update

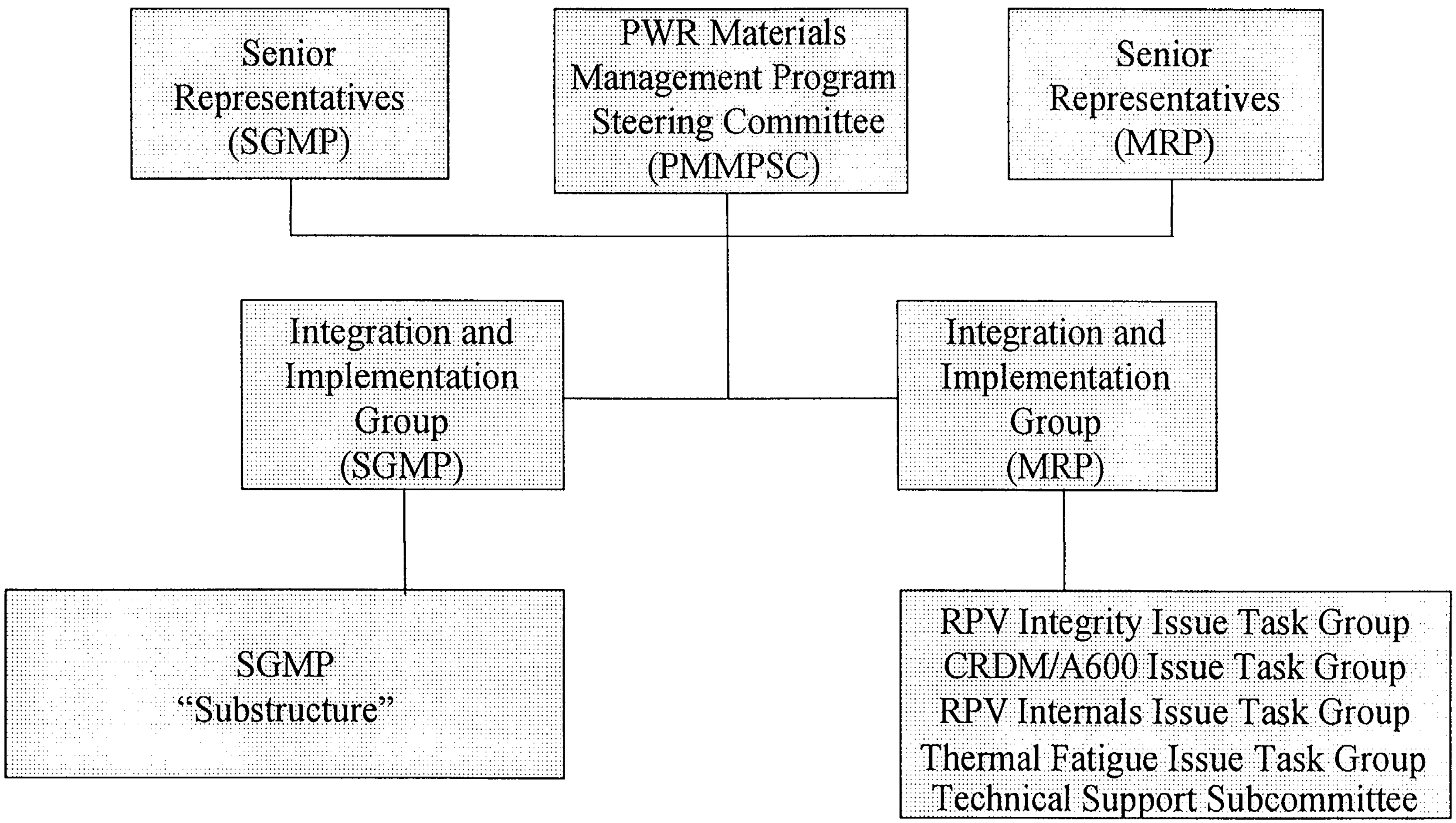
RI ITG - Roger Newton (WEPCO)

JoBB - Larry Nelson (EPRI)

Presented at NRC/WOG/MRP Meeting

April 18, 2000

PWR MRP Structure

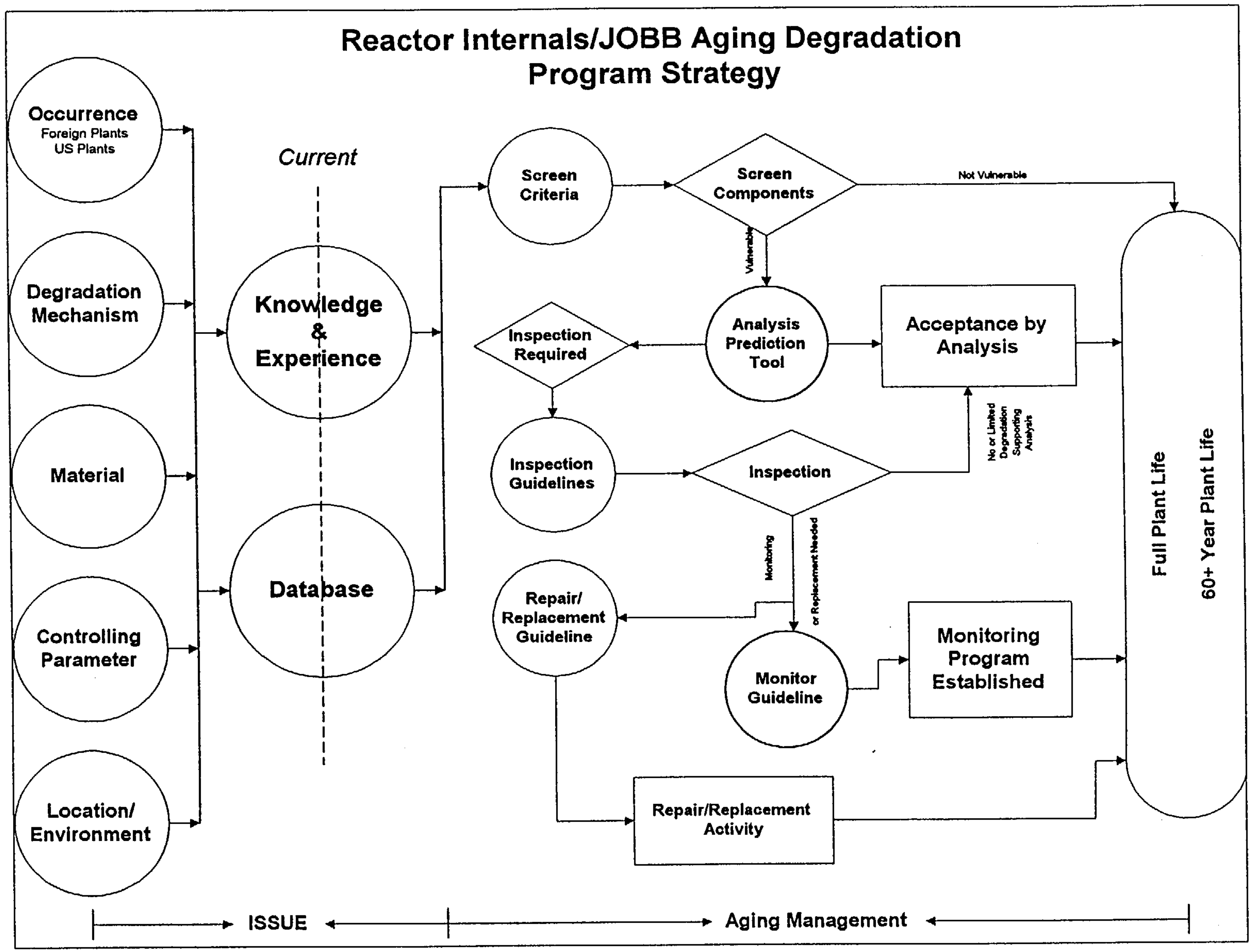


RPV Internals/JOBB ITG Mission/Vision

- Proactively manage reactor internals aging issues
- No reactive regulation or forced shutdowns due to degradation of reactor internals
- Operate reactor internal components for operating life of plant
- Focal point for Industry communication with NRC for aging of PWR reactor internals components

RPV Internals/JOBB ITG Strategy

- Establish overall technically correct program to assure plant operability and safety
- For reactor internal components:
  - Understand the long-term degradation mechanisms
  - Aging effects assessment
  - Identify gaps in technology
  - Define safe operating limits
  - Evaluate need for additional aging management programs
  - Develop cost effective inspection, mitigation and replacement strategies as appropriate


Reactor Internals/JOBB Aging Degradation
Program Strategy
Occurrence
Foreign Plants
US Plants
Degradation Mechanism
Material
Controlling Parameter
Location/ Environment
Current
Knowledge & Experience
Database
Screen Criteria
Screen Components
Not Vulnerable
Vulnerable
Analysis Prediction Tool
Inspection Required
Acceptance by Analysis
Inspection Guidelines
Inspection
No or Limited Degradation Supporting Analysis
Monitoring
or Replacement Needed
Repair/ Replacement Guideline
Monitor Guideline
Monitoring Program Established
Repair/Replacement Activity
Full Plant Life
60+ Year Plant Life
ISSUE
Aging Management

Reactor Internals/JOBB ITG
Key Deliverable Areas

- **Assessment/consequence determination for reactor internal components**
- **Resolution of potential issues** (such as swelling, stress relaxation, stress corrosion cracking and irradiation embrittlement as appropriate)
- **Worldwide inspection and R&D results**
  - Existing R&D programs are in place and planned to evaluate the effects of irradiation on the material mechanical and corrosion properties.
  - Tools are being developed for modeling French plant results

RPV Internals/JOBB ITG Tasks

Task No.	Title
3.2	Hot Cell Material Testing of Baffle/Former Bolts Removed from Two Lead Plants
3.3	Determination of Bolt Operating Parameters of Extracted Bolts
3.4	Determination of the Occurrence and the Magnitude of Irradiation Induced Swelling ans Stress Relaxation of Reactor Internals Bolting in PWRs
3.5	Characterization and Evaluation of European and US Baffle/Former Bolt Manufacture, Operation, and Performance/Failures
3.6	SCC of High Strength Reactor Vessel Internals Bolting in PWR's
3.7	Evaluation of Material Properties of Reactor Internals Bolting in PWR's
3.8	Evaluation of the Effects of Irradiation on the IASCC and Mechanical Properties of Core Shroud Materials (SA 316, SA 304, CW 304, and 308 welds)
3.10	Development of Visual Inspection Requirements for Core Internal's Materials Subject to Aging Degradation
3.13	Support for the International IASCC Program, Phase 2
3.15	JOBB Tasks

Task 3.2: Hot Cell Material Testing of Extracted Baffle / Former Bolts from Two Westinghouse Lead Plants

- **Goal**
  - Determine mechanical and corrosion (IASCC) properties of bolts removed from Point Beach (Type 347) and Farley (Type 316CW).
  - Fully characterize the materials (microstructure, fluence, etc.).
- **Description**
  - A small number of the B/F bolts removed from the Westinghouse lead plants (Task W.1) will be shipped to the Westinghouse laboratories for additional study of the effect of irradiation on the properties of the materials.
- **Schedule:**
  - Project Initiation 1st Quarter 1999
  - Project Completion 4th Quarter 2001

Task 3.3: Determination of Bolt Operating Parameters for Bolts Extracted from Westinghouse Plants

- **Goal**
  - Determine the operating characteristics (temperatures, fluence, etc.) for the bolts extracted from the Westinghouse lead plants (Task W.1).
- **Description**
  - Coolant temperature, coolant flow, neutron flux distribution, gamma heating, and other information that may characterize the bolts will be used to estimate the operating temperatures and fluence levels (dose) for the baffle/former bolts.
- **Schedule:**
  - Project Initiation 1st Quarter 2000
  - Project Completion 2nd Quarter 2001

Task 3.4: Evaluation of Irradiation Induced Swelling and Stress Relaxation in PWRs

- **Goal**
  - Evaluate the extent of void swelling and stress relaxation that could occur in PWR core internals.
- **Description**
  - Evaluate the available data pertinent to PWR highly irradiated core internals components.
  - Prepare a technical basis report for plant application and assessment.
- **Schedule:**
  - Project Initiation 4th Quarter 1999
  - Project Completion 2nd Quarter 2002

Task 3.5: Characterization of European & US Baffle/Former Bolt Manufacture, Operation, and Performance/Failures

- **Goal**
  - Understand the differences and similarities between US and European bolt performance.
  - Identify operational similarities and key operating parameters.
- **Description**
  - Evaluate the available, relevant information from European PWRs.
  - Compare available information on the neutron doses, stresses, temperatures, major power transients, material compositions and mechanical properties between US and European plants.
- **Schedule:**
  - Project Initiation — 1st Quarter 2000
  - Project Completion — 2nd Quarter 2002

Task 3.6: Determination of SCC Extent of High Strength Reactor Vessel Internals Bolting in PWRs

- **Goal**
  - Determine the extent of SCC cracking and stress relaxation of reactor vessel internals Alloy X-750 and A286 bolting materials.
- **Description**
  - Cracking of Alloy X-750 and A286 internals bolting is of concern for the B&W plants. A capsule with X-750 and A286 bolts was placed in the Davis-Besse reactor for irradiation. The bolts will be evaluated for cracking and stress relaxation.
- **Schedule:**
  - Project Initiation 4th Quarter 1999
  - Project Completion 3rd Quarter 2002

Task 3.7: Material Properties of Reactor Internals Bolting in PWRs

- **Goal**
  - Determine irradiation effect and fracture toughness to assess the structural integrity of the RV internals.
  - Develop criteria to identify, rank & manage susceptible locations.
- **Description**
  - Evaluation of the available fracture toughness data.
  - Estimation of toughness at maximum neutron fluence locations.
  - Determination of potential for embrittlement to cause failure of internal items under design loadings.
- **Schedule:**
  - Project Initiation 2nd Quarter 2000
  - Project Completion 2nd Quarter 2002

Task 3.8: Evaluation of the Effects of Irradiation on the IASCC and Mechanical Properties of Core Shroud Materials

- **Goal**
  - Determine the effects of irradiation on the IASCC resistance, the fracture toughness, and the tensile properties of the materials utilized in the fabrication of the core shroud (baffle plate/former).
- **Description**
  - Type 316SA, Type 304SA, Type 304CW, and Type 308 weld metal materials will be irradiated in BOR 60. The tests on materials with fluences up to 4 to 5×10^{22} n/cm^2 will be of primary interest. Type 308 weld metal will be extended to doses greater than 40 dpa.
- **Schedule:**
  - Project Initiation 4th Quarter 1999
  - Project Completion 3rd Quarter 2002

Task 3.10: Development of Visual Inspection Requirements for Core Internal's Materials Subject to Aging Degradation.

- **Goal**
  - Develop a modified rational for a cost effective, visual inspection of the internals.
- **Description**
  - Evaluate visual inspection requirements for materials and components that are considered to be potentially aging-degradation susceptible.
- **Schedule:**
  - Project Initiation TBD
  - Project Completion TBD

Task 3.13: Support for the International IASCC Program, Phase 2

- **Goal**
  - Obtain swelling, mechanical and corrosion data from high fluence thimble tube from a PWR and correlate the data with existing lower fluence and fast reactor data.
  - Obtain information on alternate material IASCC susceptibility.
  - Obtain microstructural data to support IASCC mitigation efforts.
- **Description**
  - The International IASCC program consisting of six international co-sponsors focuses on examinations of existing and improved structural alloys after irradiation in PWR and test reactors.
- **Schedule:**
  - Project Initiation 1st Quarter 2000
  - Project Completion 3rd Quarter 2002

RPV Internals/JOBB ITG Conclusions

- Reactor internals work is in the early stages of a multi-year program
- RPV Internals/JOBB ITG will integrate industry reactor internals efforts both in the U.S. and in other countries

Overview of EDF/JOBB Internals Program

1. Plant operating experience
2. Performance limits of current and possible replacement materials

EDF/JOBB Internals Program

Performance Limits of Existing and New Materials

Goal 1: Evaluate the effects of irradiation on the mechanical properties of the materials

Goal 2: Evaluate the effects of irradiation on in-service cracking in a PWR environment

Goal 3: Develop a replacement material

EDF/JOBB Internals Program

Mechanical Properties of Irradiated 304/308/316 Materials

Material	Tensile samples	Toughness	Creep	Under-irrad. corrosion	Post-irrad. corrosion	Fatigue
SA-304L	Phenix EBR-II Bor-60 Osiris SM-2	Phenix EBR-II Bor-60	Phenix EBR-II Bor-60 Osiris	Osiris	Phenix Bor-60 Osiris SM-2	EBR-II
CW-316	Phenix EBR-II Bor-60 Osiris SM-2		Phenix Bor-60 Osiris	Osiris	Phenix Bor-60 Osiris SM-2	
308 (Welds)	Bor-60	Bor-60			Bor60	

EDF/JOBB Internals Program

U.S. materials added:

- Type 347
- Type 304 SA
- Type 308 welds
- Type 316 SA
- Type 316 CW I
- Type 316 CW II

EDF/JOBB Internals Program

Description of the New Materials Being Tested

Material	Experiment	Comment
Optimized 316	Boris 2 and 3	Grain size Purity Chemical composition Single crystal
321/347	Boris 2 and 3	
316-Ti	Boris 2, 3 & 4	Materials developed by CEA Optimization of chemical composition Optimization of thermo-mechanical treatments
316-Nb	Boris 3	
316-Zr/Hf	Boris 2	Positive size effect atoms
304-Zr/Hf	Boris 2	Positive size effect atoms
Uranus	Boris 2	High Si material
"N9"	Boris 2 & 3	25% Ni, 12% Cr
690-800 alloy	Boris 3	
Nitronic 50	Boris 3	Mn effect
NMF 18	Boris 3	Mn effect

EDF/JOBB Internals Program

	1996	1997	1998	1999	2000	2001	2002
EBR-II irradiation	——xxxxx	xxxxxxxx	xxxxxxxx				
Bor-60 irradiation							
20 dpa	- - - -	- - - -xxxx	x				
40 dpa		- - - -	xxxxxxxx	xx			
60 dpa		- - - -	- - - - - - -	- - - xxxxx	xxxxxxxx		
80 dpa	- - - -	- - - - - - -	- - - - - - -	- - - - - - -	- - - xxxxx	xxxxxxxx	
JoBB - 20 dpa			- - - -	- - - - xxx	xxxxxxxx		
JoBB - 40 dpa				- - - -	- - - -xxxx	xxxxxxxx	
SM-2 irradiation							
6 dpa	- - - -	- - - - xxxx	xxx				
15 dpa	- - - -	- - - - - - -	- - - - - - -	- xxxxxxx	xxxxx		
Osiris irradiation	- - - -	- - - - -	- - - - - - -	xxxxxx			
Phenix irradiation		- - -	- - - -	- - - -	- - - - - -	- - xxxxxxx	xxxxxxxx
Corrosion tests			+ + +	+++++++	+++++++	+++++++	+++++++

——: irradiation
xxxx: post-irradiation characterizations: mechanical testing, microstructural characterization
++++: corrosion testing

Westinghouse Owners Group
Life Cycle Management / License Renewal Program

WOG Responses to RAI's on Reactor Vessel Internals GTR, WCAP-14577

Roger Newton - WEPCo

Chairman, WOG LCM/LR Program

Presented at NRC/WOG/MRP Meeting
April 18, 2000

Meeting Objectives

- Provide update status on WOG BBB program
- Provide update status on MRP ITG on Reactor Vessel Internals
- **Requesting schedule for review completion of the Reactor Vessel Internals GTR**

Summary of WOG Responses to RAI's

RAI #1: Describe Industry Plans Regarding Aging Management of RV Internals

Response:

- PWR MRP described
- RV Internals ITG, JoBB identified
- Specific tasks (WOG and ITG) listed:
  - Hot cell material testing
  - Evaluation of IASCC, swelling, mechanical properties
  - White paper on swelling
- Final Aging Management approach under development

Summary of WOG Responses to RAI's

RAI #2: Describe Changes to GTR to Cover Technical Progress During Last 2 Years

Response:

- Description provided of baffle/former bolt inspections, testing results
- GTR changes identified for "Industry Experience"
  - Fasteners (baffle/former bolts)
  - Guide tube support pins

Summary of WOG Responses to RAI's

RAI #3 and RAI #4: Describe WOG Baffle Bolt Programs / Schedules; Based on Inspection Experience, Consider Volumetric Inspection

Response:

- WOG Methodology for number / distribution of intact bolts is approved and was used at Farley and Point Beach
- Actual number of non-functional bolts is small (1.2%)
- Two additional bolts at PBNP had small cracks (<2% area)
- Crack initiation rate low

(continued)

Summary of WOG Responses to RAI's

RAI #3 and RAI #4: Describe WOG Baffle Bolt Programs / Schedules; Based on Inspection Experience, Consider Volumetric Inspection

Response: (continued)

- No further inspections planned at any U.S. WOG plant during initial license period
- Baffle former bolt degradation is an aging management issue
- Industry Program results will identify need for, and extent of future inspection

Summary of WOG Responses to RAI's

RAI #5: Identify TLAAs, Clarify Fatigue Evaluations Provided in GTR

Response:

- Fatigue is the only TLAA identified in the GTR for RV internals
- A conservative screening evaluation (which increased fatigue cycles by 50%) of **ALL** WOG plants identified only 7 components which might require plant-specific fatigue evaluation
- Preferred approach is to demonstrate that fatigue effects for the renewal term are bounded by the fatigue effects anticipated for the original service period.

Summary of WOG Responses to RAI's

RAI #6: Provide a More Effective Aging Management Program for IASCC and Embrittlement (like Calvert Cliffs)

Response:

- Susceptibility assessments in progress
- Need for supplemental examinations to be determined
  - Augmented inspections and/or enhanced VT-1 for accessible components
  - Revised aging management program for baffle bolts to be developed based on results from industry programs
- Industry Program results will identify need for, and extent of future inspection

Summary of WOG Responses to RAI's

RAI #7 Provide a More Effective Program for CASS (like Calvert Cliffs)

Response:

- Threshold fluence level in stainless steel materials is much higher than the $1x10^{17}$ n/cm^2 used by the NRC
- Very little CASS in RV internals
  - Lower core support casting
    No embrittlement expected due to low fluence at 48 EFPY and low operating temperature
  - Mixing vane device in upper internals
    Does not perform an intended function
- Effects of thermal aging for CASS need not be considered

Summary of WOG Responses to RAI's

RAI #8: Address Void Swelling Effects, Provide Aging Management Program

Response:

- Swelling effects considered minimal
  - Low leakage core management
  - Offset by effects of creep
- There are no discernible effects attributable to swelling at this time
- Being evaluated by MRP and WOG
- White paper scheduled for 2001

Summary of WOG Responses to RAI's

RAI #9: Describe how RV Material Properties will meet CLB Limits on Stresses or Deformations under Neutron Irradiation Embrittlement Conditions

Response:

- Bolts used as example
- Testing shows considerable ductility
- Brittle failure unlikely
- Yield and ultimate strength found to be within the expected range for irradiated material
- Demonstrates continued acceptability for renewal term

Summary of WOG Responses to RAI's

RAI #10: Include Additional Intended Functions

Response:

- Intended Functions from Executive Summary Repeated in Section 2.2
- Table Added (Components vs. Intended Function)
- Table Modified (Components Requiring AMR)

Summary

- WOG and industry programs reviewed
- RAI responses summarized
- Request NRC schedule for review and approval of WCAP-14577 to allow utility reference in license renewal applications.