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Boiling Water Reactor Vessel & Internals Project (BWRVIP)

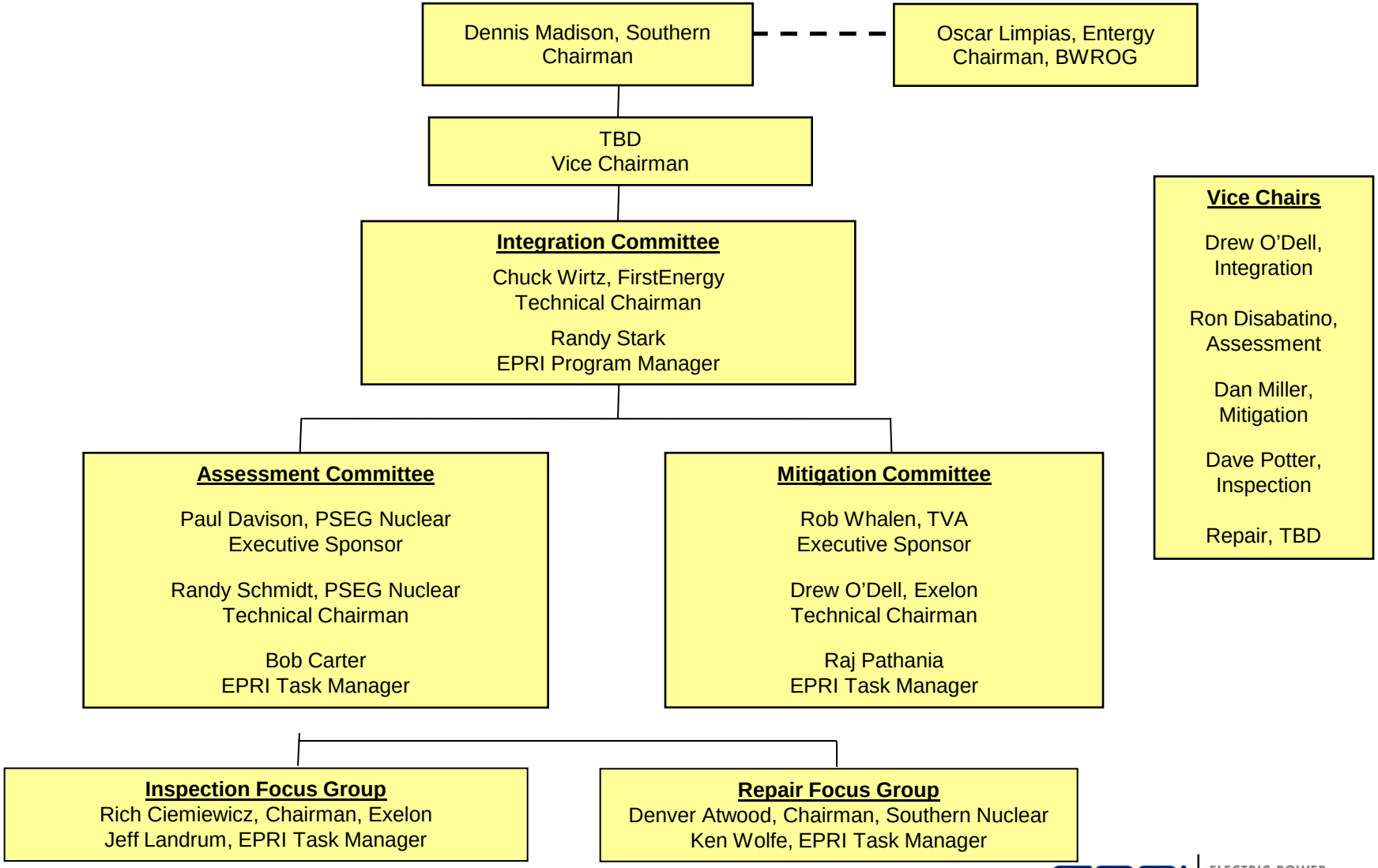
Dennis Madison, Southern Company
BWRVIP Executive Chairman

Industry/NRC Executive Meeting on Materials Program
July 31, 2012

Presentation Outline

- BWRVIP Organization
- Technical Committee Responsibilities
- Ongoing Research Activities
- Topical Report Reviews

BWRVIP Organization



Technical Committee Responsibilities

Assessment --	What needs to be inspected, when it needs to be inspected, inspection options, how to disposition observed degradation
Inspection --	How to inspect, what equipment and techniques are available, what are the associated uncertainties
Repair/replace --	What repair/replacement techniques are available and what are the associated requirements that must be met
Mitigation --	How can SCC degradation be prevented or reduced

Ongoing Research Activities

- Optimization of BWR internals inspection guidelines
- Impacts of irradiation on BWR materials
- Continuous improvements in BWR water chemistry
- Jet pump flow-induced vibration test facility
- Improved NDE methods for BWR internals

Optimization of Reactor Internals Inspection Guidelines

Optimize inspection programs based on:

- Latest field inspection data and fleet operating experience
- Evaluation of credit for benefits of HWC / NMCA
- Current NDE capabilities

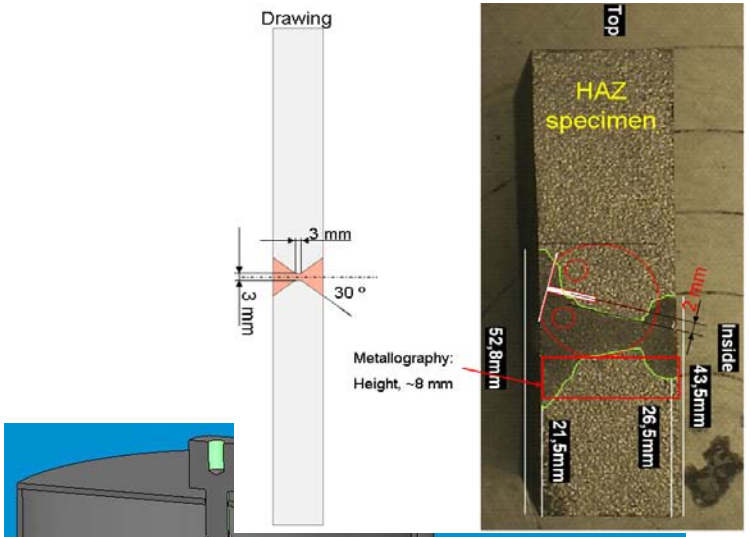
Key inputs include:

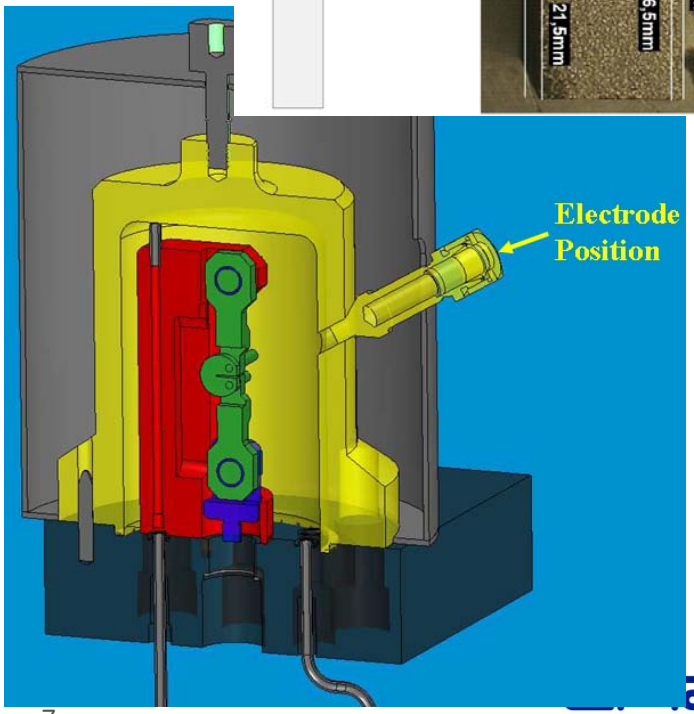
- Inspection database and survey results
- Crack growth studies
- Application of fracture mechanics

#	I&E Guideline	Bin
1	Core Spray (BWRVIP-18R1)	High
2	Jet Pump (BWRVIP-41R2)	
3	Shroud (BWRVIP-76)	
4	Shroud Support (BWRVIP-38)	
5	CRD Guide Tubes (BWRVIP47-A)	
6	Vessel ID Brackets (BWRVIP-48-A)	Medium
7	Top Guide Rims / Pins (BWRVIP26-A)	
8	SLC / Core DP Piping (BWRVIP-27-A)	
9	LPCI Coupling (BWRVIP-42-A)	
10	Access Hole Cover (BWRVIP-180)	
11	Jet Pump Beam (BWRVIP-138 R1)	
12	Top Guide Grid Beam (BWRVIP-183)	Low
13	Core Plate Bolts (BWRVIP-25)	
14	Steam Dryer (BWRVIP-139-A)	
15	Bottom Head Drain Piping (BWRVIP-205)	

Impacts of Irradiation on BWR Materials

- Austenitic stainless steels in BWR core structures can experience significant fracture toughness reductions and increased crack growth rates at elevated fluence levels
- As plants age and fluence levels increase, plants must understand the impacts so they can proactively address the issue
- EPRI has initiated a multi-year research project to study the impacts of irradiation to materials in a BWR environment





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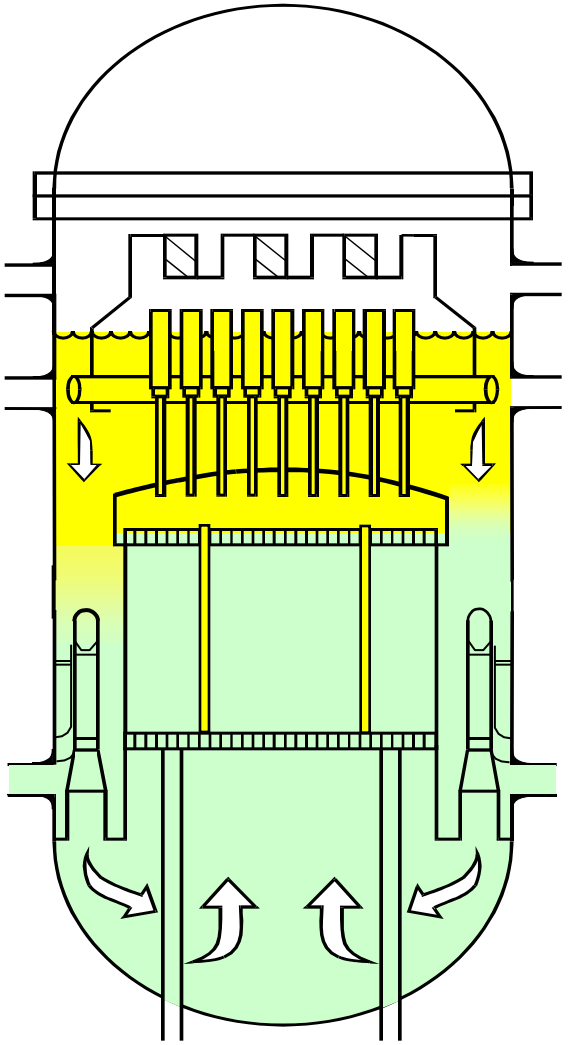
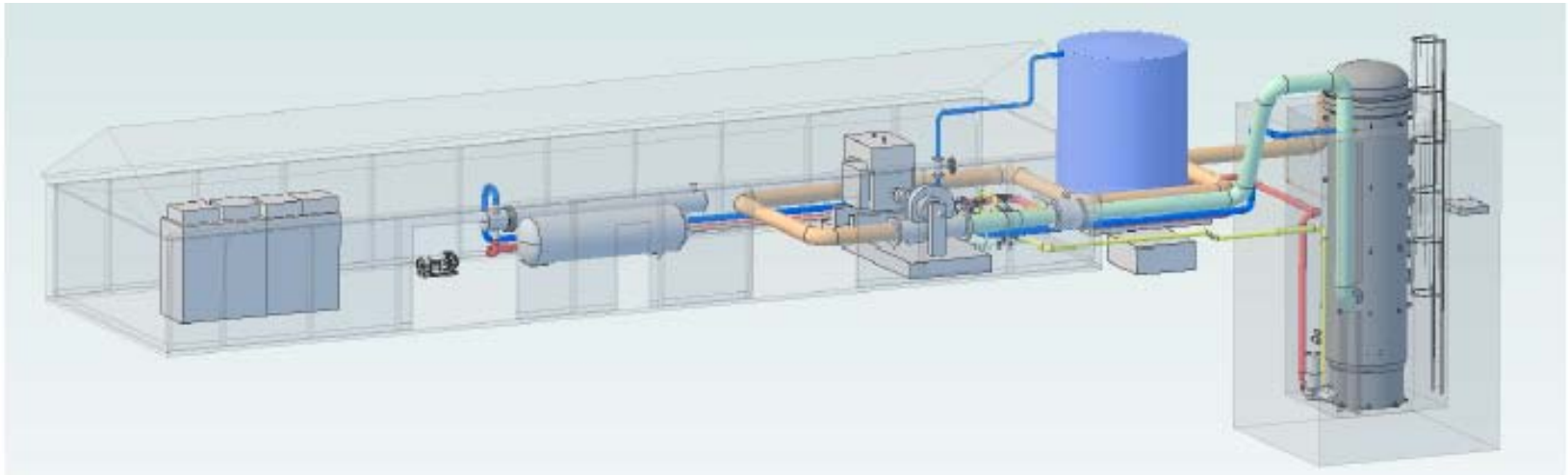
Continuous Improvements in Water Chemistry

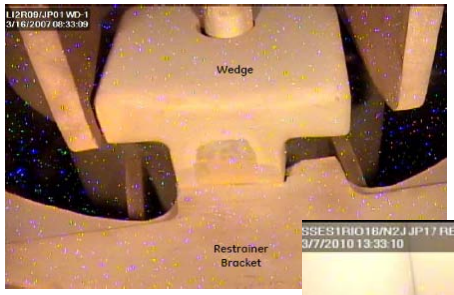
- BWRVIP has demonstrated effective mitigation solutions such as Noble Metal Chemical Application and Online NobleChem
- Water Chemistry Guidelines are updated every 4 years and have significantly improved water chemistry in all U.S. BWRs
- BWRVIP continues to evaluate additional mitigation options (e.g., Titanium Oxide) and improved mitigation solutions (e.g., Early Hydrogen Injection)
- Mitigation Performance Indicators (MPI) have been developed for all U.S. BWRs and some International BWRs which allow plants to easily measure water chemistry performance
- U.S. NRC has now approved BWRVIP-62, which allows for inspection relief for plants with effective mitigation
- BWRVIP-62, Rev 1 has been submitted to NRC



BWR Jet Pump Full Scale Test Facility

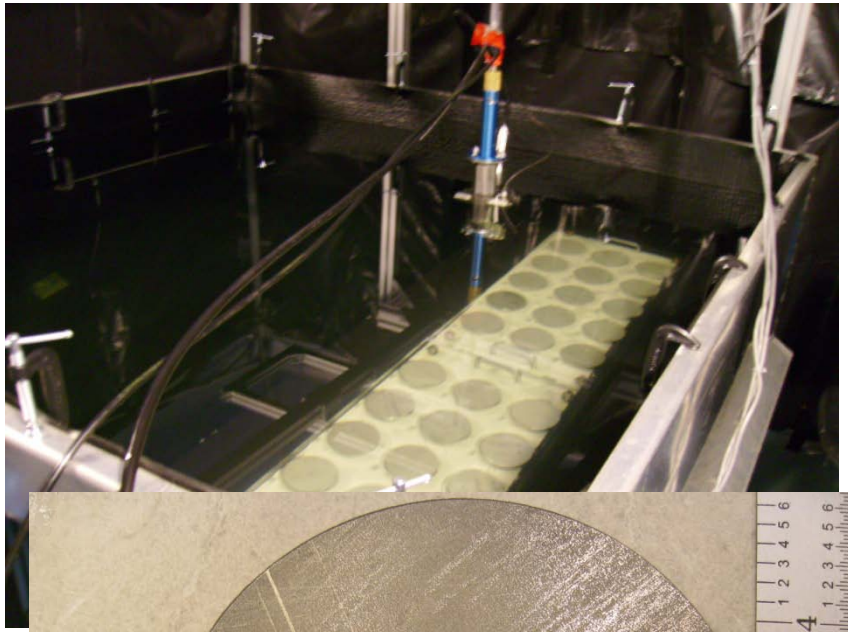


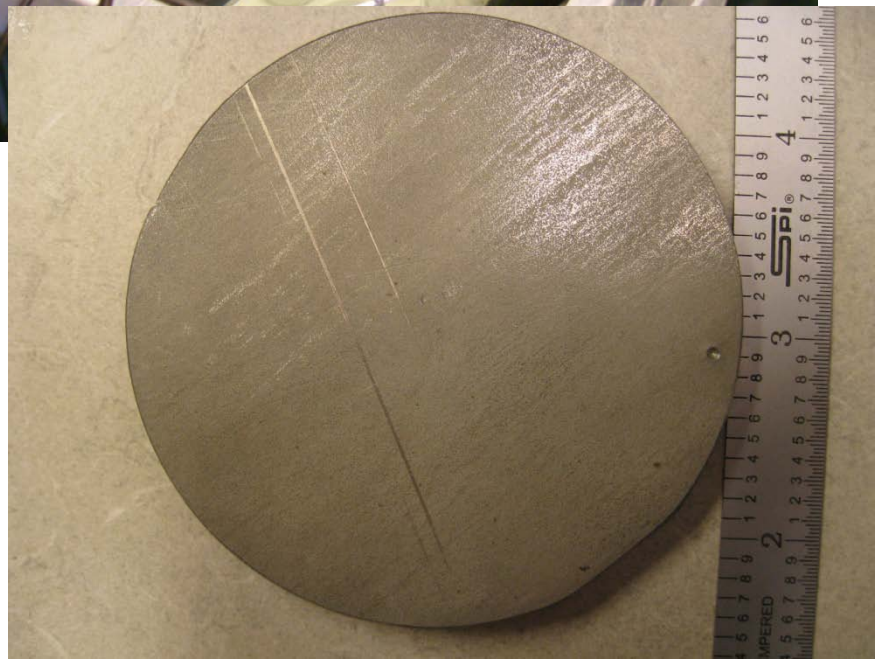
- Increasing Operating Experience showing FIV degradation
- Root causes not fully understood or predictable
- Current repair solutions not universally successful
- BWR/5 full scale facility construction and testing completed
- Initial vendor mitigation hardware testing has started



Improved NDE Methods for BWR Internals

- In-vessel remote visual inspections (IVVI) account for the majority of in-service reactor vessel examinations performed in boiling water reactors (BWR)
- Even though the technique results in the detection of numerous flaws and wear conditions annually, it's reliability and detection capabilities are not well documented
- EPRI is working with PNNL, USNRC and the industry to better understand the capabilities of remote visual techniques currently deployed





Topical Report Reviews

Recent Safety Evaluations or Approvals of "-A" Reports

- BWRVIP-86, Revision 1, Integrated Surveillance Program (Final-10/20/11)
- BWRVIP-183, Top Guide I&E Guidelines (Draft-12/13/11)
- Nondestructive Examination Uncertainty (Final-12/23/11)
- BWRVIP-18, Revision 1, Core Spray Inspection & Evaluation Guidelines (Final-01/30/12)
- BWRVIP-62-A, Technical Basis for HWC Inspection Relief (02/16/12)
- BWRVIP-138, Revision 1, Jet Pump Beam Inspection & Evaluation Guidelines (Final-05/14/12)

Safety Evaluations Expected in the Near Term

- BWRVIP-194, Steam Dryer Evaluation Methodology (Draft)
- BWRVIP-76, Rev 1, Core Shroud I&E Guidelines (Draft - Not Expecting RAI because Rev 1 was basically incorporation of NRC SE)

Topical Report Reviews

Recent Submittals for Review and Approval

- BWRVIP-241, Probabilistic Fracture Mechanics Evaluation of BWR Nozzle-to-Vessel Shell Welds and Nozzle Blend Radii (04/26/11)
- BWRVIP-76, Revision 1, Core Shroud Inspection and Evaluation Guidelines (06/30/11)
- BWRVIP-100, Revision 1, Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds (02/07/12)
- BWRVIP-62, Revision 1, Technical Basis for HWC Inspection Relief, Including OLNC (03/07/12)
- BWRVIP-18, Revision 2, Optimized Core Spray I&E Guidelines (05/09/2012)

Recent Submittal for Information Only

- BWRVIP-03, Revision 14, RPV and Internals Examination Guidelines (06/05/2012)

Near Term Submittals

- BWRVIP-84, Revision 2, Guidelines For Selection and Use of Materials for Repairs to BWR Internal Components

BWRVIP Key Contact Information

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