

MRP-227 Revision 1

Proposed Revisions to PWR Reactor Internals Inspection and Evaluation Guidelines

June 4, 2015



MRP-227 is an Integrated Strategy for Monitoring Aging Degradation Mechanisms

- Irradiation Embrittlement (IE)
- Irradiation Assisted Stress Corrosion Cracking (IASCC)
- Void Swelling
- Stress Corrosion Cracking (SCC)
- Thermal Embrittlement of CASS Material (TE)
- Stress Relaxation (SR)
- Wear
- Fatigue

Basic Approach of Guidelines

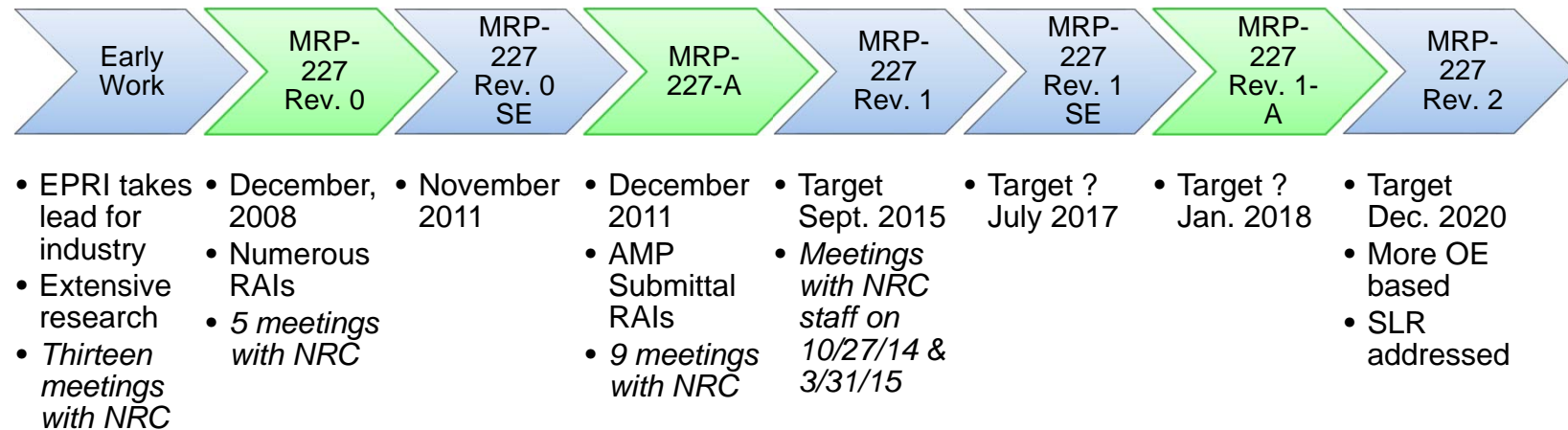
- Convey most requirements via simple tables
- Ensure guideline is generally applicable to all PWRs
- Needed and mandatory requirements applicable to all US PWRs through NEI 03-08 initiative
- Make the guideline a living document through reporting of results, review and update process
- Engineering evaluation of relevant conditions guided by companion document, WCAP-17096, developed by PWROG

Encouraging Inspection Results to Date

- 15 reactors inspected, others partly complete, as of Dec.2014
- Results show reactor internals remain structurally sound progressing into period of extended operation (PEO), beyond 40 calendar years
- In general, only minor issues identified to date, and these have been predicted and/or anticipated:
 - Guide cards wear rates are high for some reactors
 - Baffle bolt indications not as numerous as in international reactors, but there are two cases of anomalous results
- In contrast to BWRs, no indications at all of SSC or Irradiation Assisted SSC of stainless steels
 - Even for highly irradiated welds
- Inspections require special tooling and are costly (both \$ and dose)
 - Regulatory requirements have increased scope for utility owners

Development and Evolution of MRP-227

... *MRP-227 continues as a living document*



- Four major stakeholders influenced development under NEI 03-08
 - Owners, NRC, EPRI, NSSS Vendors
- Extensive interaction among stakeholders during development
- Implementation began in 2009 and continues each outage season
- Results of inspections are consistent with expectations
- MRP-227 Revision 1 will be available in late 2015
- Need for SER to be determined based on staff request of topical report

Benefits of MRP-227 Rev. 1

- Maintaining guidance current with lessons learned and research developments
- Enhancing nomenclature and detail of internal component sketches
- Adding specificity to coverage requirements/acceptability of limitations
- Incorporating latest WCAP requirements for guide card wear
- Addressing lower support clevis/snubber bolting/pin/wear concern and Operating Experience
- Incorporate generic acceptance guidance
- Addressing NRC SE A/LAIs
- Adding technical bases and associated exam scope specificity for Westinghouse and Combustion Engineering core barrel welds

Proposed Revisions to Westinghouse and Combustion Engineering Inspection Guidelines



Objectives for Revisions to Inspection Guidelines for Westinghouse and CE Internals

- Clarify Component Identifications
 - Nomenclature
 - Illustrations
- Rationalize Primary/Expansion Relationships
 - Focused core barrel inspections
 - Components added in SE
 - Eliminate linkages to Westinghouse CRGT Flange Weld
- Address and/or Eliminate A/LAIs
 - Applicability of guideline
 - Review of CASS susceptibility (Integrated weld/CASS program)
- Update CRGT Guide Card Inspection
- Incorporate OE and Lessons Learned

Westinghouse NSSS Core Barrel Weld Objectives for MRP-227 R1

1. Define standard nomenclature for welds in Westinghouse core barrel.
2. Eliminate inspection requirement for core barrel outlet nozzle welds.
3. Modify SCC linkage for core barrel welds with neutron fluences below IASCC threshold.
 - Propose upper flange weld as “Primary” inspection for SCC
 - Add inspections of other low fluence welds to “Expansion” list
4. Modify IASCC linkage for core barrel welds above the IASCC threshold
 - Propose lower girth weld as “Primary” inspection for IASCC
 - Add inspections of other high fluence welds to “Expansion” list
5. Establish weld specific coverage requirements.

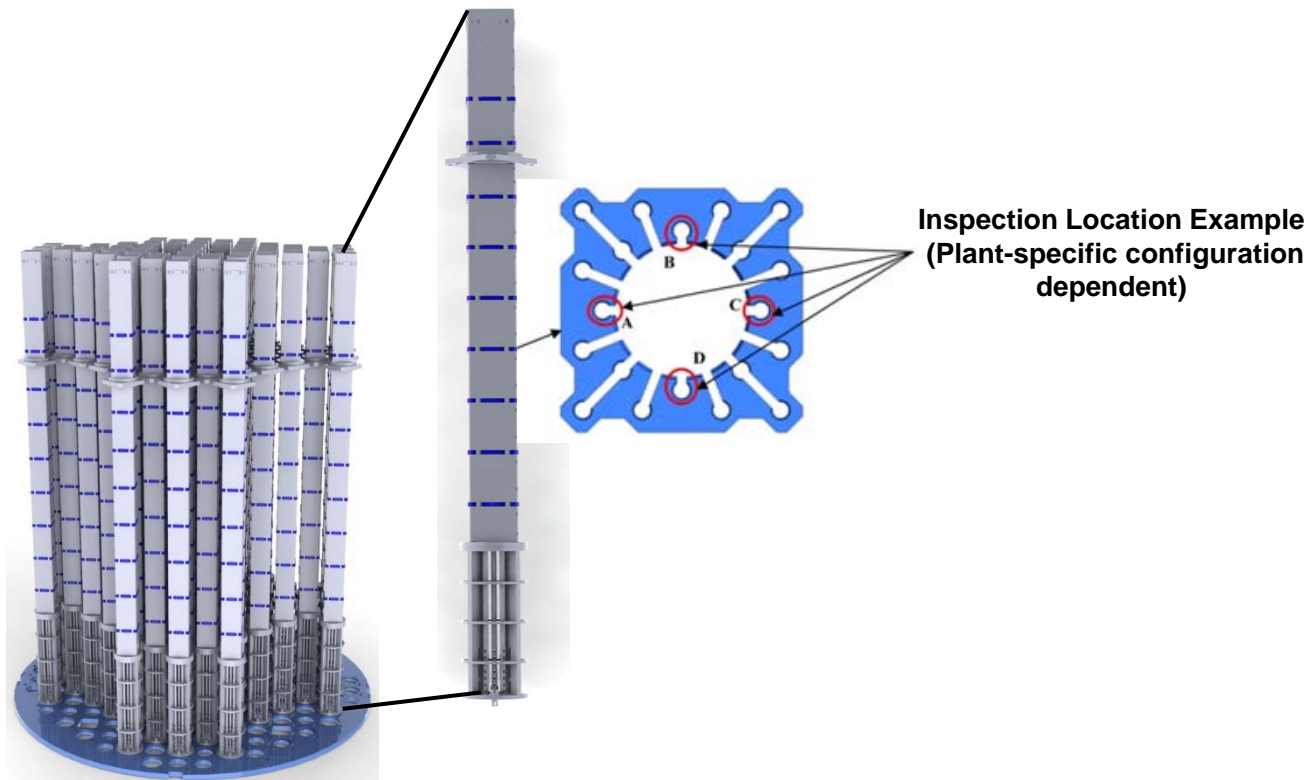
Combustion Engineering Core Support Barrel Weld Objectives for MRP-227 R1

1. Define standard nomenclature for welds in CE core support barrel.
2. Re-establish SCC monitoring based on inspection of key welds in core support barrel
3. Eliminate Expansion requirement to inspect Type 304 upper flange surface for SCC
4. Establish requirements for IASCC monitoring based on inspection of key locations in core support barrel
5. Establish weld specific coverage requirements

Westinghouse Guide Card Wear OE Implementation in MRP-227 R1



Control Rod Guide Tube Assembly Guide plates (cards)



Interim Guidance on Guide Card Wear MRP 2014-006

- Utilities must modify their CRGT examination plans to adhere to the requirements of WCAP-17451-P Revision 1 (and MRP-2014-006) or prepare a deviation under the NEI 03-08 protocol.
- The MRP-227 R1 table entry summarizes the guidance.

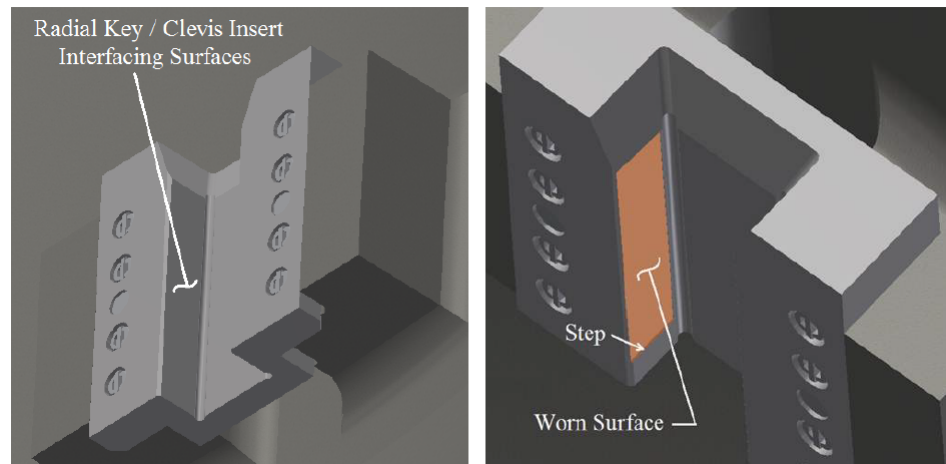
Item	Applicability	Effect (Mechanism)	Expansion Link (Note 1)	Examination Method/Frequency (Note 1)	Examination Coverage
Control Rod Guide Tube Assembly Guide plates (cards)	All plants	Loss of Material (Wear)	None	Per the requirements of WCAP-17451-P, including subsequent examinations (note 7)	Examination coverage per the requirements of WCAP-17451-P Revision 1 (Note 7) See Figure 4-20
Notes to Table 4-3: 1. Examination acceptance criteria and expansion criteria for the Westinghouse components are in Table 5-3. 7. <i>In WCAP-17451-P Revision 1 the baseline examination schedule has been adjusted for various CRGT designs, the extent of individual CRGT examination modified, and flexible subsequent examination regimens correlating to initial baseline sample size, accuracy of wear estimation and examination results.</i>					

Clevis Insert Bolt OE Implementation in MRP-227 R1



Clevis Insert Bolt Operating Experience

- Addressing OE as required by industry standard
- Westinghouse Technical Bulletin TB-14-5
 - Failure of the bolts would not result in a loss of safety function
 - Significant number of redundancies prevent the loss of the intended safety function
 - Concerns related to bolt failures are commercial
- MRP-227 R1 will add descriptive note to Existing examination, to refer to the Technical Bulletin



MRP-227 Revision 1 B&W Primary and Expansion Component Item Table Updates



B&W Plants Primary and Expansion Component Items

- Updates to Primary and Expansion component items tables made to incorporate modified information contained in MRP-231 Rev. 3
 - MRP-231 Rev. 3 incorporates updates to MRP-189 Rev. 2
 - Updates of screening parameters
 - Updates of component items and welds resulting from completion of records searches performed for all B&W units
 - Generic listing of B&W design component items maintained
 - Where applicable, unit-specific differences identified
 - Some unit-specific differences remain that are outside of MRP-227 listings
- New or revised figures included

B&W Plants Primary, Expansion, and Examination Acceptance and Expansion Criteria Tables

■ Summary:

- Updates completed to B&W-design basis documents (MRP-189 and MRP-231) completed since MRP-227-A issuance resulting from:
 - Completion of unit-specific record searches
 - Completion of Applicant/Licensee Action Items (e.g., A/LAI 2 and 4)
 - New analyses performed in PWROG or unit-specific programs
 - Editorial (e.g., clarifications)
- These efforts result in minor changes and additions to Primary, Expansion, and Examination Acceptance and Expansion Criteria table row listings (MRP-227 Tables 4-1, 4-4, and 5-1)



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