

# Industry Baffle-Former Bolt Focus Group NRC Update

**Tim Wells**  
BFB FG Chairman

**Brian Burgos**  
BFB FG EPRI Project Lead

**Next Steps**

7/19/16



# Upcoming Planned Refueling Outages

- Upcoming Refueling Outages will help to inform us further on fleet trends
- Additional OE from upcoming domestic refueling outages will add to our knowledge base
  - Fall 2016: 3 planned MRP-227 UT inspections (2 of 3 are Tier 1a plants)
  - Spring 2017: 3 planned MRP-227 UT inspections (all Tier 1a plants) and 1 VT-3 inspection (Tier 1b plant)
  - Fall 2017: 3 planned MRP-227 UT inspections (1 of 3 is a Tier 1a plant)
  - Spring 2018: 1 planned UT re-inspection (Tier 1a plant)
- Additional International OE is expected
- Out year planning will be important for inspection tooling preparation and for potential use of replacement equipment.

# Extent of Condition / Interim Guidance / NRC Interfacing

## (Focus Area #1)

- Primary objectives in the short term:
  - Developed an OE database and analyze for trends to identify potential relationships between known failures and plant design/operating conditions
    - This will be a significant input in developing Interim Guidance
  - Issue initial NEI 03-08 Interim Guidance to MRP-227/228 in the Fall 2016 timeframe
    - Potential update to Interim Guidance in 2017 based on OE from Fall 2016 and Spring 2017 refueling outages and other focus group activities
  - Confirm refueling outage schedules for the next 2 years to feed into Focus Area #3 (Repair / Replacement needs)
    - This is needed to develop planning for both UT and replacement tooling and inventory assessment of typical BFB designs
  - Support interfacing between regulatory authorities and industry groups

# Extent of Condition / Interim Guidance / NRC Interfacing (Focus Area #1)

- Many combinations of data are being assessed
  - Are there plant parameters that indicate susceptibility?
  - Are there combinations of parameters that indicate trends?
  - Are there design parameters that indicate trends?
- Trending of data continues and will support the development of Interim Guidance
- Development of the Industry BFB OE database is ongoing and will provide a means to capture and assess results of future inspections

# Plant/Fleet Operating Experience Assessment

## *(Focus Area #2)*

- Primary focus is on the development of the Westinghouse NSAL and the AREVA Customer Service Bulletin
  - NSAL issued 7/5/16
  - AREVA CSB issued 7/14/16
- Assisted in the development of an operating experience assessment
- Will continue to review OE

## Repair / Replacement (*Focus Area #3*)

- Recent OE at IP2 and Salem 1 identified issues related to replacement tooling availability
  - Delays in BFB replacement tooling were experienced due to limited availability of equipment
- Key input for this focus area is the development of the outage schedule for the next 2 years along with scheduled inspections (volumetric or visual)
- Fall 2016 refueling outage support:
  - Contingency plan recommendations are being developed to assist plants

## Repair / Replacement (*Focus Area #3*)

- Ongoing evaluations are underway for vendor capital and/or PWROG tooling investment
  - What is the appropriate amount of tooling needed
  - How do the outages overlap in Spring 2017
  - Are modifications or changes needed to the existing equipment for production or reliability
- Material availability assessment completed
  - Both vendors have bolting material to fabricate roughly 1,500 BFBs
  - Items under consideration
    - Are increased machining rates required to potential provide sufficient bolts in a timely manner if required
    - Is a common bolt design possible to allow for faster machining rates

## Inspection / NDE (*Focus Area #4*)

- Current methods are identifying defects
- Review bolting UT results for lessons learned relevant to the protocol
- Provide input to Focus Area #5 on recommended NDE examinations of bolts received from IP2 and Salem 1
  - Recommended PT prior to Destructive Examination
- Evaluate the ability to correlate UT signals with measured crack size from destructive examination
  - May be impractical with multiple bolt designs and varying vendor UT techniques
  - Internal hex head bolts and locking devices are particularly difficult to UT



# Irradiated Testing Support (*Focus Area #5*)

## Short-Term Testing (2016)

- Work to support Indian Point and Salem root cause and operability analyses

## Intermediate-Term Testing (2016)

- Testing with fleet-wide applicability resulting from the OE

## Long-Term Testing (2017+)

- Evaluation of IASCC susceptibility of BFB materials with respect to dose and time

- IP2 has shipped 32 bolts to the Westinghouse Hot Cell Facility (received 6/29/16)
- Shipment of Salem bolts (6+) to follow
- Ginna bolts (6) to be shipped in August 2016

# Irradiated Testing Support (*Focus Area #5*)

## Proposed Short-Term Testing (2016)

| Activity   | Notes  |
|--|--|
| Bolt Receiving & Transportation into Hot Cell  | 32 bolts (IP2), 6 bolts (S1)                         |
| Bolt Fracture Surface Examination <ul style="list-style-type: none"><li>• Optical microscopy, SEM</li><li>• Identify fracture modes (IASCC, fatigue, creep)</li><li>• Correlate with opposite fracture surface to assess potential relative motion or rotation</li></ul> | Work supports root cause analyses                    |
| Remaining Property Testing <ul style="list-style-type: none"><li>• Room temperature pull tests of bolts determined by NDE to have cracking</li></ul>   |  |
| Alloy Chemistry Confirmation   |  |
| Radionuclide Analysis (dpa)  | Can be conducted on same sample as alloy chemistry   |
| Technical Report   |  |
| Clean-up & Return of Materials to Site   | All material to be returned to utility after testing |

# Irradiated Testing Support (*Focus Area #5*)

## Focus Area #5 Action Items:

- Develop testing plan by the end of July based on clear test objectives and outcomes
- Prioritize needed information to optimize funding
- Coordinate funding sources such as utility, PWROG, MRP, and DOE

## Aging Management Assessment (*Focus Area #6*)

- Focus Area #6 is taking a long term approach toward understanding the mechanisms and adjusting the guidance of MRP-227 as required; for example:
  - Review previous aging management assessments and compare to recent OE
  - What materials/structural models best replicate observed OE and what do they predict for the future
- Identify any requirements that would modify the interim guidance issued by Focus Area 1

## Aging Management Assessment (*Focus Area #6*)

- Recommend any updates for future MRP-227 revisions
- Evaluation of repair/replacement modifications
  - Account for these within MRP-227
  - Relative effectiveness of options over the long term
- Recommend adjustments to WCAP-17096 methodology as appropriate

## Near Term Industry BFB FG Actions to be completed

- Assessment of Fall 2016 and Spring 2017 outage seasons for developing a contingency plan for tooling and BFB material needs
- Develop NEI 03-08 Interim Guidance taking into account trending of BFB OE database and recent OE
- Finalize integrated irradiated testing plan which will feed into Focus Areas 1, 2, 4, and 6



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