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## **2021 Materials Programs Technical Information Exchange PWROG Materials Committee Update**

Scott Boggs – PWROG MSC Chair (NextEra)



## **PWR Owners Group MSC Agenda**

- **PWROG MSC Key Focus Areas with NRC Interaction in 2021**
- **PWROG MSC NEI 03-08 Guidance Documents**
- **2020/2021 PWROG MSC NEI 03-08 Deviations**
- **Other Key PWROG MSC Programs in 2020/2021**
- **2021/2022 PWROG MSC Meeting Dates**
- **MSC PWROG Core/Planning Team Organization and Key Contacts**



## PWROG MSC Key Focus Areas with NRC Interaction in 2021<sup>(1/3)</sup>

### Transitioning RV Integrity to Direct Fracture Toughness

- The purpose of this ongoing program is to develop an acceptable method for any licensee to use irradiated fracture toughness data to improve or demonstrate margin in P-T curves **(more detailed update to be provided in another presentation)**
  - Concept presented to NRC in March 2016
  - Pre-submittal meeting held in October 2020 (OG-20-239)
  - Topical Report PWROG-18068-NP, Revision 0, “Use of Direct Fracture Toughness for Evaluation of RPV Integrity” submitted for review and approval in July 2021 under OG-21-144



## **PWROG MSC Key Focus Areas with NRC Interaction in 2021<sup>(2/3)</sup>**

### **WCAP-17096-NP-A Interim Guidance and Document Update**

- The purpose of this ongoing program is to update WCAP-17096-NP to be consistent with MRP-227, Rev. 1, include recent interim guidance and operating experience as appropriate. The TR also emphasizes the intended goal is to develop methodologies that will remain applicable to initial and subsequent license renewal.
  - WCAP-17096-NP, Revision 3, “Reactor Internals Acceptance Criteria Methodology and Data Requirements,” was submitted to the NRC in July 2019 under OG-19-164
  - The TR was accepted for the accelerated review process and a fee waiver was granted
  - NRC provided 14 RAIs for PWROG to address in October 2020
    - Teleconference held with NRC in November 2020 to discuss draft RAIs (OG-20-288)
    - Responses to RAIs 1-12 and 14 provided to the NRC in April 2021 under OG-21-81
    - Draft response to RAI 13 provided to the NRC in May 2021. NRC has requested additional dialogue on this response
    - PWROG MSC working with EPRI on BWRVIP-100 Non-Conservatism. This issue is affecting the review of WCAP-17096-NP.



## PWROG MSC Key Focus Areas with NRC Interaction in 2021<sup>(3/3)</sup>

### SLR Activities

- PWROG-19047-P/NP, Revision 0, “North Anna Units 1 and 2 Reactor Vessels Low Upper-Shelf Fracture Toughness Equivalent Margin Analysis”
  - The purpose of this topical report (TR) is to document the equivalent margins analysis (EMA) for the North Anna Units 1 and 2 reactor vessel (RV) inlet and outlet nozzle Rotterdam welds, nozzle forgings and nozzle belt forgings (a.k.a., upper shell forgings)
  - Topical Report was issued to the NRC for review and approval in May 2020 under OG-20-167
  - RAIs received in November 2020 and responses provided in December 2020 under OG-20-284
  - Draft SE received in May 2021 and final received in July 2021, PWROG working on issuing the “Approved” version by the end of August 2021



## PWROG MSC NEI 03-08 Guidance Documents – Mandatory & Needed (1/3)

Doc Number	Rev	Document Title	Date	Implementation Level	Comments
Documents Incorporated Within (i.e., issued prior to the initiative) or Under the Materials Initiative (i.e., issued since the initiative)					
WCAP-12639-P	0	Westinghouse Owners Group Pressurizer Surge Line Thermal Stratification Generic Detailed Analysis Program MUHP-1091 Summary Report	Jun 2008	Mandatory	OG-08-203, 4/8/2003
WCAP-17451-P	2	Guidance: Reactor Internals Guide Tube Wear-Westinghouse Domestic Fleet Operational Projections (WCAP-17451-P, Revision 2)	November 2018	Needed	OG-18-276, 11/9/2018
WCAP-14950	0	Mitigation and Evaluation of Pressurizer Insurge/Outsurge Transients	Jun 2008	Needed	OG-08-203, 4/8/2003
51-5003700-01	1	CRDM Life Extension Action Plan	Jan 2006	Needed	OG-10-119, 3/29/2010
WCAP-16180-NP	0	Operability Assessment for Combustion Engineering Plants with Hypothetical Circumferential Flaw Indications in Pressurizer Heater Sleeves	Dec 2003	Mandatory	WOG-03-643, 12/23/2003
WCAP-15988-NP	2	Generic Guidance for an Effective Boric Acid Inspection Program for Pressurized Water Reactors	Dec 2013	Mandatory	OG-12-247, 6/20/12
WCAP-16423-NP	0	Standard Process and Methods for Calculating RCS Leak Rate for Pressurized Water Reactors	Dec 2008	Needed	OG-08-400, 11/19/2008



## PWROG MSC NEI 03-08 Guidance Documents – Mandatory & Needed (2/3)

Doc Number	Rev	Document Title	Date	Implementation Level	Comments
<b>Documents Incorporated Within (i.e., issued prior to the initiative) or Under the Materials Initiative (i.e., issued since the initiative)</b>					
WCAP-16465-NP	0	Standard RCS Leakage Action Levels and Response Guidelines for Pressurized Water Reactors	Dec 2008	Needed	OG-08-400, 11/19/2008
WCAP-16913-P	1	Operability Assessment and Plant Applicability Evaluation for Pressurizer Heater Sleeve Leakage in Westinghouse Designed Pressurizers	Jan 2010	Needed	OG-09-140, 4/6/2009
51-5030027-01	1	Evaluation of RV Internals Bolting for the B&WOG (Note the "needed recommendations" for inspection of the high- strength bolt location is now superseded by MRP-227-A)	May 2005	Needed	OG-09-158, 4/17/2009
OG-12-330	0	Generic Guidance for Valves that have Seal Encapsulation Devices	Aug 2012	Needed	OG-12-330, 8/16/2012
PWROG-16003-P	2	Evaluation of Potential Thermal Sleeve Flange Wear	May 2019	Needed	OG-19-101, 05/13/2019, Non-Proprietary Appendix incorporates the MRP 2018-027 inspection guidance as "Needed"
OG-20-113	-	NEI 03-08 Needed and Good Practice Guidance: Thermal Sleeve Cross-Sectional Failure – Westinghouse Nuclear Safety Advisory Letter NSAL-20-1	July 2020	Needed	OG-20-113, 4/13/2020



## PWROG MSC NEI 03-08 Guidance Documents – Good Practice (3/3)

Doc Number	Document Title
Documents Incorporated Within (i.e., issued prior to the initiative) or Under the Materials Initiative (i.e., issued since the initiative)	
WCAP-16423-NP and WCAP-16465-NP	Recommendations for Implementation of Guidelines for PWROG RCS Leak Programs
OG-12-330	Generic Guidance for Valves that have Seal Encapsulation Devices
51-1257700-000	Investigation of Sulfur Intrusions at Plants of the B&WOG
51-5030027-01	Evaluation of RV Internals Bolting for the B&WOG
51-5003700-01	CRDM Life Extension Action Plan
51-5000239-01	Interim B&WOG Report on HPI/MU Nozzle Cracking
51-5000239-00	Interim B&WOG Report on HPI/MU Nozzle Cracking
51-5001199-00	Evaluation of Oxygen Levels on Pressurizer
PWROG-17067-NP	Resource Guide for Selecting Weld Locations for Inspection to Address ID-Initiated Stress Corrosion Cracking of Stainless Steel Piping
PWROG-17054-NP	Long-term Strategy for Identifying ODSCC of Stainless Steel Piping
OG-20-31	NEI 03-08 “Good Practice” Guidance: Westinghouse NSSS PWR Thermal Shield Degradation as per Westinghouse Technical Bulletin 19-5
OG-20-113	NEI 03-08 Needed and Good Practice Guidance: Thermal Sleeve Cross-Sectional Failure – Westinghouse Nuclear Safety Advisory Letter NSAL-20-1
OG-21-101	Guidance: Westinghouse NSSS PWR Thermal Shield Degradation – Westinghouse Technical Bulletin TB-19-5, Revision 1

### 2021 Materials Programs Technical Information Exchange – PWROG Overview





## 2020/2021 PWROG MSC Deviations

Doc Number	Rev	Document Title	Implementation Level	Comments
Documents Incorporated Within (i.e., issued prior to the initiative) or Under the Materials Initiative (i.e., issued since the initiative)				
PWROG-16003-P	2	Evaluation of Potential Thermal Sleeve Flange Wear	Needed	Luminant submitted to the PWROG a NEI 03-08 deviation to the "needed" guidance under PWROG topical report PWROG-16003-P, Revision 2, regarding deferral of the thermal sleeve flange wear measurements from Spring 2020 (2RF18) to Fall 2021 (2RF19) for Comanche Peak Unit 2. Deviation review documented under OG-20-260.
WCAP-17451-P	2	Guidance: Reactor Internals Guide Tube Wear- Westinghouse Domestic Fleet Operational Projections (WCAP-17451-P, Revision 2)	Needed	Exelon submitted to the PWROG a NEI 03-08 deviation to the "needed" guidance under PWROG topical report WCAP-17451-P, Revision 2 regarding deferral of reactor vessel guide card inspections from 2020 to 2023 for Byron Unit 1. Deviation review documented under OG-20-107.
OG-20-113		NEI 03-08 Needed and Good Practice Guidance: Thermal Sleeve Cross-Sectional Failure – Westinghouse Nuclear Safety Advisory Letter NSAL-20-1	Needed	Luminant submitted to the PWROG a NEI 03-08 deviation to the "needed" guidance issued under OG-20-113 regarding deferral of the thermal sleeve inspections or flange wear measurements from 1RF21 to 1RF22 for Comanche Peak Unit 1. Deviation review documented under OG-20-267.
WCAP-17451-P	2	Guidance: Reactor Internals Guide Tube Wear- Westinghouse Domestic Fleet Operational Projections (WCAP-17451-P, Revision 2)	Needed	SNOG submitted to the PWROG a NEI 03-08 deviation to the "needed" guidance under PWROG topical report WCAP-17451-P, Revision 2 regarding deferral of reactor vessel guide card inspections from Vogtle Unit 2 from VR21 to VR22. Deviation review documented under OG-20-242.

## Other Key PWROG MSC Programs in 2021<sup>(1/6)</sup>

### Scale and Impact of Uncertainty in Fluence Determinations for Reactor Vessel Internals

- The purpose of this ongoing program revision is to;
  - Use the sensitivity studies completed under revision 0 of the program for the fluence input parameters to determine the range of the fast neutron fluence on the reactor vessel internals and,
  - The uncertainties associated with the fast neutron fluence will then be used to determine the impact on the downstream screening on RVI components
  - Framatome and W draft reports issued for review and comment in late June of 2021. Working to issue final Framatome report. Additional work associated with W report, so a second draft report will be issued to the members in November 2021 for review and comment.
    - Draft PWROG-21011-P, Rev 0-A, "Scale and Impact of Uncertainty in Fluence Determinations for Reactor Vessel Internals - Westinghouse and Combustion Engineering NSSS Plants Fast Neutron Fluence Analytical Uncertainty Analysis"
    - Draft PWROG-21016-P, Rev 0, "Scale and Impact of Uncertainty in Fluence Determinations for Reactor Vessel Internals – Framatome Summary Report"



## Other Key PWROG MSC Programs in 2021<sup>(2/6)</sup>

### Harvesting, Transport, and Laboratory Testing of Degraded Thermal Shield Flexures

- The purpose of this ongoing program revision is to;
  - For the fracture surface of the flexure(s) removed from Salem 1 to be examined to provide insight into the potential cause of the failure(s)
  - Collaborative effort with the EPRI MRP
  - Failed flexures are currently at the hot cell facility in Churchill. Scheduled work includes;
    - Fractography
    - Metallography
    - Documentation

### Thermal Shield Flexure Susceptibility Study

- The purpose of this ongoing program revision is to;
  - Assess the relative risk between different TS flexure designs (i.e. 2-loop, 3-loop, and 4-loop) under generic (unit) loadings (Task 1 work approved at this time)
  - Draft PWROG-21015-P, Revision 0-A, "Thermal Shield Flexure Susceptibility Study" issued to the members for review and comment in mid July 2021



# Other Key PWROG MSC Programs in 2021<sup>(3/6)</sup>

## Management of Thermal Sleeve and Driveline Related Degradation and Interactions

- The purpose of this ongoing program revision is to;
  - To support the operation of a Thermal Sleeve and Driveline Degradation Focus Group. This Focus Group will coordinate industry activities relative to the following:
    - Understanding technical issues associated with recent thermal sleeve and drive line inspections and operating experiences
    - Coordinate an agreed upon industry approach to resolving these issues
  - Deliverables issued to date:
    - PWROG-20046-NP, Rev 0, "Review of Framatome-Designed CRDM Thermal Sleeve Information for Applicability to Cracking Operating Experience" under OG-21-31
    - PWROG-20047-NP, Rev 0, "Results from the Examination of Four Cracked Thermal Sleeves from Kori Units 3 and 4 Nuclear Power Plants" under OG-21-43
    - PWROG-21010-P, Revision 0, "Evaluation of Fractured Thermal Sleeve Remnant Wedging Scenario" under OG-21-145
  - A playbook that helps utility program owners understand how all of the thermal sleeve and driveline issues and documents tie together and how to navigate managing these issues is scheduled to be sent to the members for review in August 2021
  - Additional work recently approved to revise NSAL-20-1 and the associated guidance in OG-20-113 to re-consider recommendations and to relax the re-inspection requirement consistent with the determination of no safety significance associated with this degradation



# Other Key PWROG MSC Programs in 2021<sup>(4/6)</sup>

## Acceptance Criteria and Inspection Plan Guidance for Latch Assembly Visual Inspections

- The purpose of this ongoing program revision is to;
  - To develop generic inspection guidance, provide risk-based acceptance criteria and decision trees for the internal inspection of Westinghouse Style Control Rod Drive Mechanism (CRDM) Latch Assemblies.
    - The tools created as part of this project will help plants perform internal CRDM inspections, flag for potential future issues and have the knowledge to draw initial conclusions from video reviews on their own
  - Draft PWROG-21020-P, Revision 0-A, "CRDM Latch Assembly Wear - Risk Factors" to be issued to the members for review and comment by mid August 2021
  - Additional work planned to issue;
    - A draft inspection plan and acceptance criteria
    - A decision tree and mitigation options
    - NEI 03-08 guidance



## Other Key PWROG MSC Programs in 2020<sup>(5/6)</sup>

### Clevis Insert / Radial Key Wear Assessment

- The purpose of the work completed under revision 0 was to perform a technical assessment of lower radial key (LRK)/clevis insert wear in the industry
  - The work provided an assessment of the current state of wear in the lower radial support systems (LRSS) of operating nuclear power plants, and identified specific trends that allowed for the grouping or ranking of plants based on susceptibility
  - PWROG-19003-P/NP, Revision 0 “Clevis Insert/Radial Key Wear Assessment”, was issued to the PWROG in November 2019 under OG-19-209
- Under revision 1 of the program, the work documented in PWROG-19003-P was used to perform a generic safety assessment, with the intent of establishing a technical basis for safe operation with wear-related degradation of clevis inserts and radial keys
  - PWROG-19003-P/NP, Revision 1 “Clevis Insert/Radial Key Wear Assessment”, was issued to the PWROG in May 2021 under OG-21-103 (**more detailed update to be provided in another presentation**)



## Other Key PWROG MSC Programs in 2020<sup>(6/6)</sup>

### Reactor Internals Guide Card Wear - Westinghouse Domestic Fleet Operational Projections Update to Incorporate Operating Experience from Inspections Assessment

- The purpose of this ongoing program is two-fold;
  - Revise the guidance contained in WCAP-17451-P, latest revision by considering the OE from several guide card wear measurement (GCWM) inspections performed to date
  - To support EPRI with the benchmarking evaluation of WCAP-17451-P, Rev. 2 against the Japanese guide card wear evaluation approach documented in JANSI-VIP-27, Fourth Edition
- WCAP-17451-P, Revision 2, “Reactor Internals Guide Tube Wear - Westinghouse Domestic Fleet - Operational Projections” submitted under OG-19-197 to the NRC for information only to support PWROG-17096-P, Revision 3, “Reactor Internals Acceptance Criteria Methodology and Data Requirements”. Minor comments received from the NRC.
- Next update to WCAp-14571 planned for 2022
- Work to support the benchmarking kicked off with the EPRI MRP in July 2021



# MSC PWROG Core/Planning Team Organization and Key Contacts

*Materials Committee*  
*Scott Boggs, FPL/NextEra (Chair)*  
*Open (Vice Chair)*

*Reactor Internals Industry Planning Team*  
*Heather Malikowski, Exelon*

*Reactor Vessel Integrity Core Team*  
*Chris Koehler, Xcel Energy*

*Pressure Boundary Core Team*  
*Open*

*Jim Molkenthin*  
*PWROG PMO*  
  
*Ray Stewart*  
*Framatome*





## 2021/2022 PWROG MSC Meeting Dates

- August 16-19, 2021 PWROG Joint PWROG Meetings (hybrid)
- December 13-16, 2021 PWROG Joint PWROG Meetings (hybrid)
- April 25-28, 2022 PWROG Joint PWROG Meetings (hybrid)
- August 2022, TBD
- December 2022, TBD



## Questions?

**The Materials Committee is established to provide a forum for the identification and resolution of materials issues including their development, modification and implementation to enhance the safe, efficient operation of PWR plants.**