Update on Code Case N-711-1

Gary Lofthus
Southern Nuclear

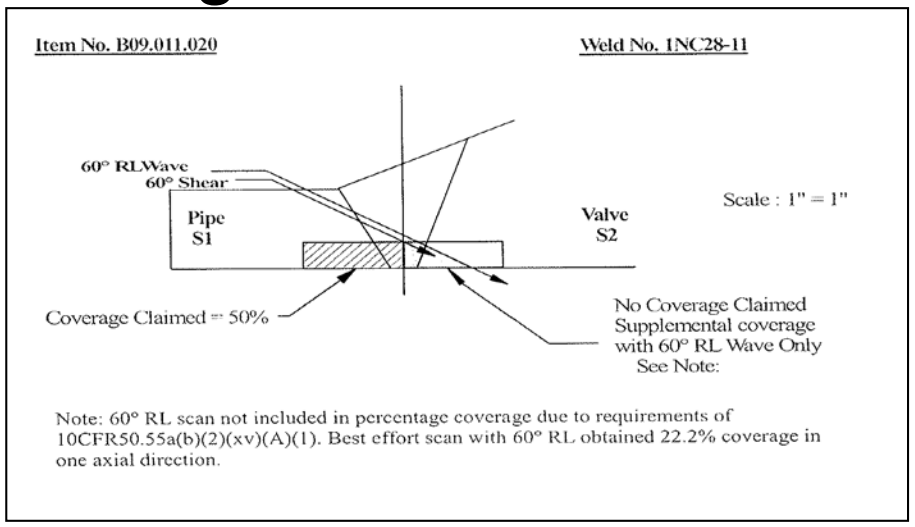
Doug Kull
Carl Latiolais
EPRI

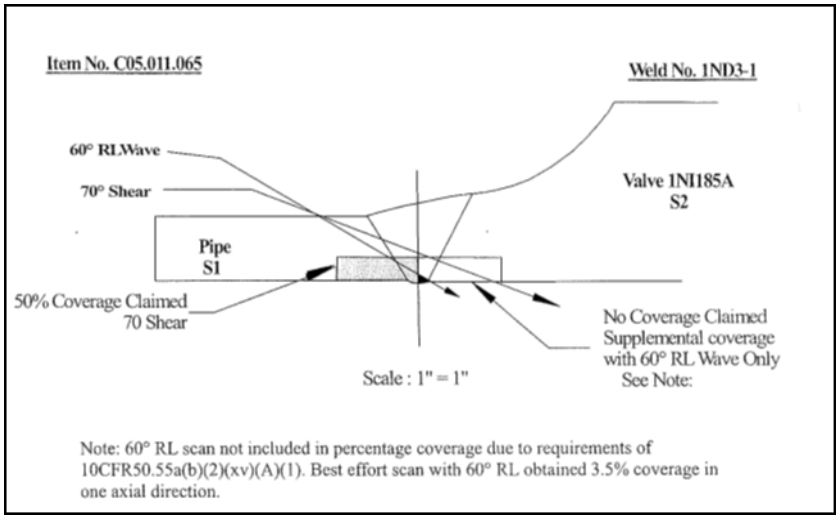
NRC / Industry
NDE Technical Information Exchange Meeting
Washington, DC
January 2019

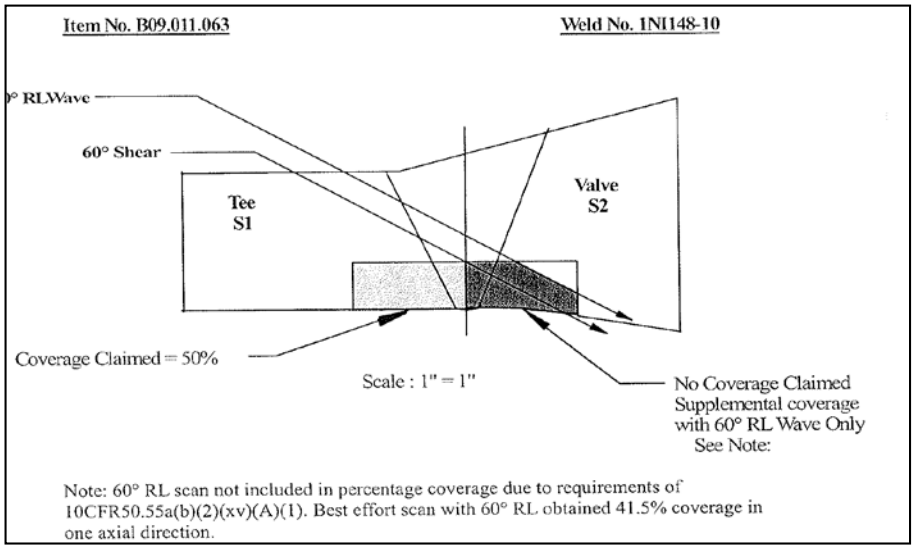
What is Code Case N-711-1?

- A method to reduce burden on the NRC and Industry by decreasing the number of relief requests related to missed examination coverage from single sided examinations
- Code Case N-711-1 is a Risk Based approach that focuses on the areas where service induced flaws are most likely to occur
- The process provides alternative examination coverage requirements for Category B-F, B-J, CF-2, and R-A piping welds

Examples of Typical Single Side Examintion Configurations







- Single sided examinations are most often caused by:
  - OD Mismatch
  - Component Geometry (e.g. nozzle boss or machined land)
  - Component Material Properties (e.g. CASS)
  - Diametric Shrinkage
  - Weld Crown Reinforcement

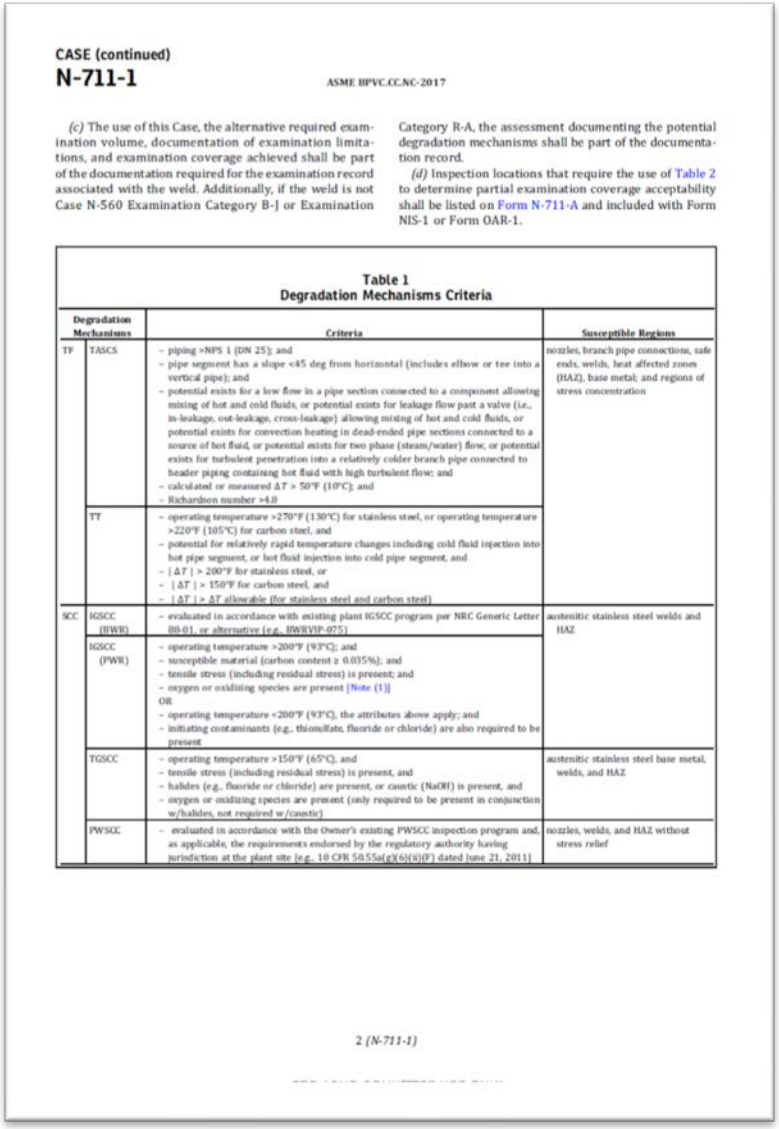
Challenges

- Most single sided examination piping welds are joined to a component that limits the examination coverage
  - Flange
  - Pump (Cast)
  - Valve (Cast)
- Components have larger outside diameter than pipe, thus causing a transition that cannot be removed
- Component geometry does not complete allow coverage of the examination volume
- Component material properties challenge the effectiveness of the examination (Cast)
- Welds have irregular surface conditions due to mismatch that cannot be improved to an level where effective examinations can be performed
- Most piping welds have diametric shrinkage that if removed would violate minimum wall requirements
  - More prevalent on thin piping welds
- In many cases removal of weld crown reinforcement would violate minimum wall thickness
  - Counterbore has reduced thickness of pipe

Code Case N-711-1 Process

Step 1 – Establish Probable Degradation Mechanisms

- The licensee determines the degradation mechanisms (DM) associated with the weld
  - For examination category R-A the degradation mechanism assessments from the risk-informed ISI examination requirements may be used
  - For the other examination categories, not in the risk program, an assessment must be performed to determine potential degradation mechanisms
    - Table 1 in Code Case N-711-1 provides the criteria for the DM assessment



CASE (continued)
N-711-1

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(c) The use of this Case, the alternative required examination volume, documentation of examination limitations, and examination coverage achieved shall be part of the documentation required for the examination record associated with the weld. Additionally, if the weld is not Case N-560 Examination Category B-J or Examination Category R-A, the assessment documenting the potential degradation mechanisms shall be part of the documentation record.

(d) Inspection locations that require the use of Table 2 to determine partial examination coverage acceptability shall be listed on Form N-711-A and included with Form NIS-1 or Form OAR-1.

Table 1
Degradation Mechanisms Criteria

Degradation Mechanisms		Criteria	Susceptible Regions
TF	TASCS	– piping >NPS 1 (DN 25); and – pipe segment has a slope <45 deg from horizontal (includes elbow or tee into a vertical pipe); and – potential exists for a low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or potential exists for leakage flow past a valve (i.e., in-leakage, out-leakage, cross-leakage) allowing mixing of hot and cold fluids, or potential exists for convection heating in dead-ended pipe sections connected to a source of hot fluid, or potential exists for two phase (steam/water) flow, or potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with high turbulent flow; and – calculated or measured $\Delta T > 50°F$ (10°C); and – Richardson number >4.0	nozzles, branch pipe connections, safe ends, welds, heat affected zones (HAZ), base metal; and regions of stress concentration
	TT	– operating temperature >270°F (130°C) for stainless steel, or operating temperature >220°F (105°C) for carbon steel, and – potential for relatively rapid temperature changes including cold fluid injection into hot pipe segment, or hot fluid injection into cold pipe segment, and – $\lvert \Delta T \rvert > 200°F$ for stainless steel, or – $\lvert \Delta T \rvert > 150°F$ for carbon steel, and – $\lvert \Delta T \rvert > \Delta T$ allowable (for stainless steel and carbon steel)	
SCC	IGSCC (BWR)	– evaluated in accordance with existing plant IGSCC program per NRC Generic Letter 88-01, or alternative [e.g., BWRVIP-075]	austenitic stainless steel welds and HAZ
	IGSCC (PWR)	– operating temperature >200°F (93°C); and – susceptible material (carbon content ≥ 0.035%); and – tensile stress (including residual stress) is present; and – oxygen or oxidizing species are present [Note (1)] OR – operating temperature <200°F (93°C), the attributes above apply; and – initiating contaminants (e.g., thiosulfate, fluoride or chloride) are also required to be present	
	TGSCC	– operating temperature >150°F (65°C), and – tensile stress (including residual stress) is present, and – halides (e.g., fluoride or chloride) are present, or caustic (NaOH) is present, and – oxygen or oxidizing species are present (only required to be present in conjunction w/halides, not required w/caustic)	austenitic stainless steel base metal, welds, and HAZ
	PWSCC	– evaluated in accordance with the Owner's existing PWSCC inspection program and, as applicable, the requirements endorsed by the regulatory authority having jurisdiction at the plant site [e.g., 10 CFR 50.55a(g)(6)(ii)(F) dated June 21, 2011]	nozzles, welds, and HAZ without stress relief

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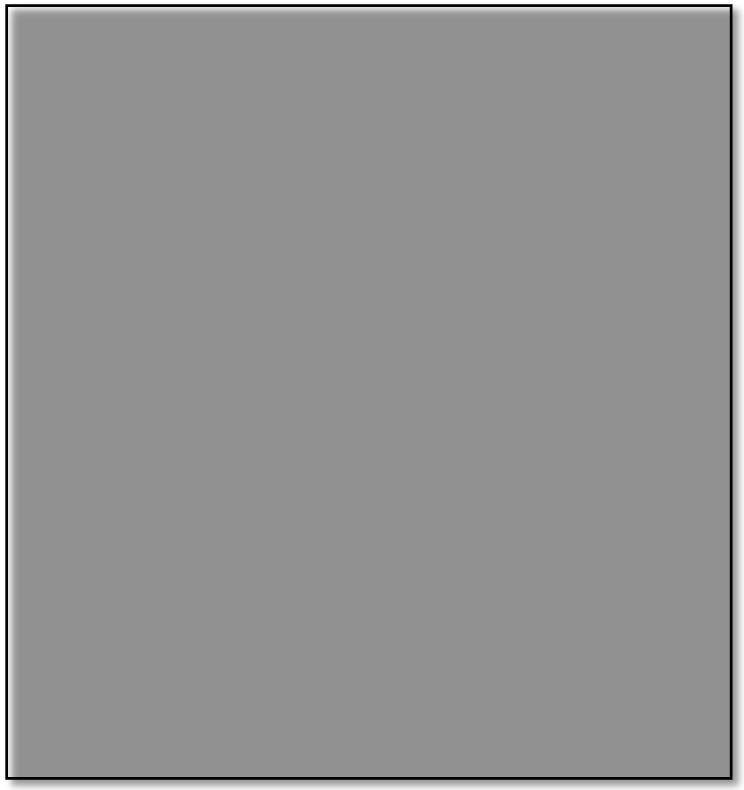
Code Case N-711-1 Process

Step 2 – Determine Volume of Primary Interest

- The licensee next must determine the volume of primary interest (VPI) using the postulated DM along with Table 2 from the Code Case



CASE (continued)
N-711-1

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Table 2
Partial Examination Coverage Evaluation Process

Degradation Mechanisms	Process Decision Point [Note (1)]	If Decision Point is "Yes"	If Decision Point is "No"	Risk Characterization [Note (2)], [Note (3)] Method A	Method B
FAC	Requirements governed by plant FAC program.	...	...	Region 1A Region 1B Region 2 Non RI-ISI Examination	Category 1 Category 3 Category 5 Non RI-ISI Examination
WH + other DM VF (assumed)	(a) Is water hammer or vibratory fatigue still applicable?	-correct design deficiency -re-risk-rank system without water hammer or vibratory fatigue	-re-risk-rank system without water hammer or vibratory fatigue		
	(b) Is the examination still required?	-partition by applicable degradation mechanism as shown below	-no further action required		
TASCS TT	(c) Is the inspection location on a horizontal run to a steam generator or BWR vessel, including feedwater nozzle?	-see decision point (d)	-see decision point (e)	Region 1A Region 1B Region 2 Non RI-ISI Examination	Category 2 Category 5 Non RI-ISI Examination
	(d) Was the weld, pipe side heat affected zone and pipe side counterbore transition region captured?	- document examination limitation and coverage achieved and verify examination performed to the examination requirements of B-F, B-J, C-F-1, C-F-2 or R-A, as applicable	-volume of primary interest not sufficiently examined -coverage requirement not met		
	(e) Is the inspection location a pipe component weld? Included pipe to pumps, valves, nozzles and branch connections.	-see decision point (f)	- see decision point (g) if the examination limitation is a counterbore issue - if the examination limitation is a weld or heat affected zone issue, then the volume of primary interest was not sufficiently examined and the coverage requirement was not met		
	(f) Was the weld, pipe side heat affected zone and pipe side counterbore transition region captured?	-document examination limitation and coverage achieve and verify examination performed to the examination requirements of B-F, B-J, C-F-1, C-F-2 or R-A, as applicable	- see decision point (h) if the examination limitation is a counterbore issue - if the examination limitation is a weld or heat affected zone issue, then the volume of primary interest was not sufficiently examined and the coverage requirement was not met		

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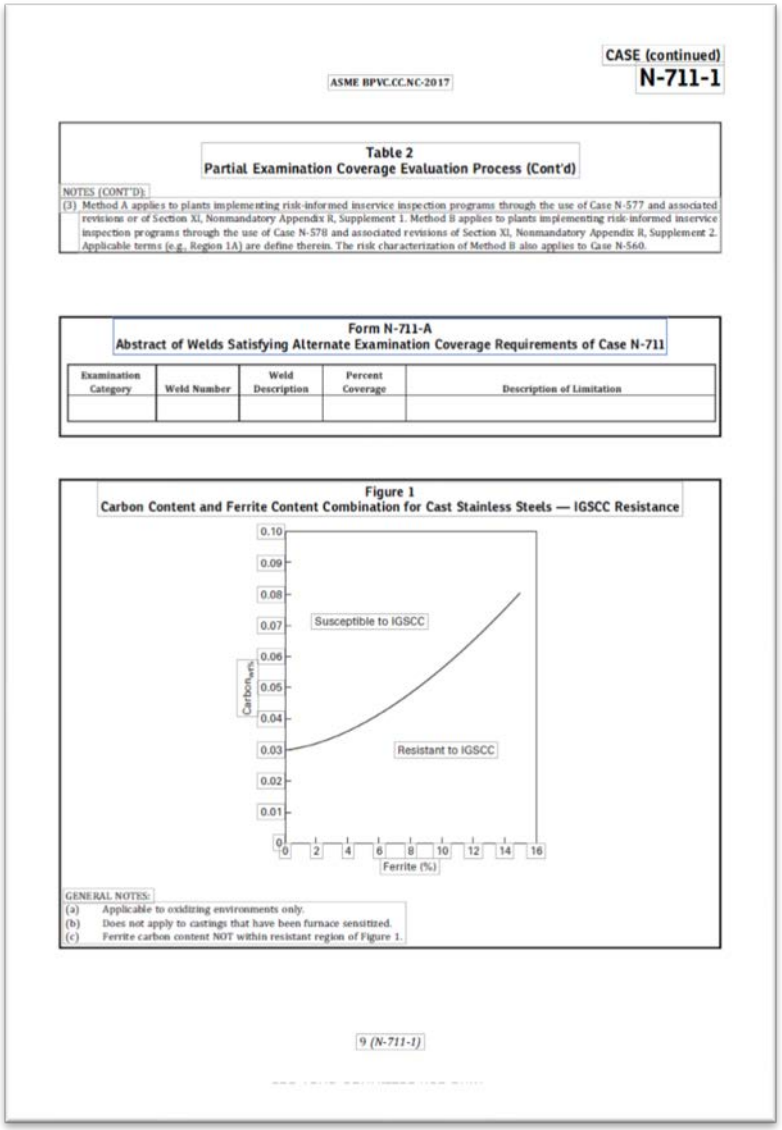
Code Case N-711-1 Process
Step 3 - Documentation

- Once the examination is complete, the licensee documents it by assembling an examination record which will contain the results along with any scan limitations and achieved examination coverage.
  - If the weld is not examination category B-J (CC N-560) or examination category R-A, the degradation mechanisms assessment will also be included in the examination record.
  - The inspection locations that require the use of Table 2 to determine partial examination coverage acceptability shall be listed on Form N-711-A and included with Form NIS-1 or Form OAR-1.



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CASE (continued)
N-711-1

Table 2
Partial Examination Coverage Evaluation Process (Cont'd)

NOTES (CONT'D):
(3) Method A applies to plants implementing risk-informed inservice inspection programs through the use of Case N-577 and associated revisions or of Section XI, Nonmandatory Appendix R, Supplement 1. Method B applies to plants implementing risk-informed inservice inspection programs through the use of Case N-578 and associated revisions of Section XI, Nonmandatory Appendix R, Supplement 2. Applicable terms (e.g., Region 1A) are define therein. The risk characterization of Method B also applies to Case N-560.

Form N-711-A
Abstract of Welds Satisfying Alternate Examination Coverage Requirements of Case N-711

Examination Category	Weld Number	Weld Description	Percent Coverage	Description of Limitation

Figure 1
Carbon Content and Ferrite Content Combination for Cast Stainless Steels — IGSCC Resistance

GENERAL NOTES:
(a) Applicable to oxidizing environments only.
(b) Does not apply to castings that have been furnace sensitized.
(c) Ferrite carbon content NOT within resistant region of Figure 1.

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Code Case N-711-1 Work Plans

- A multiyear project to publish the technical basis (2017) and develop a series of tools and training for the implementation of N-711-1 (2018 & 2019)
  - Convert the N-711-1 evaluation process into a step by step flowchart
  - Generate examples using missed coverage relief requests previously submitted by industry
    - Gain insights on what cases and how often using N-711-1 will eliminate the need for a relief request
  - Support training classes focused on teaching licensees how to navigate the process
  - Develop a software tool to automate and document the N-711-1 evaluation process as discussed above

Code Case N-711-1 Work Plans
(Continued)

- Working to qualify UT procedures to support New Plants (Vogtle 3 & 4)
  - Fabricate NDE specimens with flaws in the extremities of the applicable volume of primary interest
  - Evaluate existing generic NDE procedures to determine if they are capable of detecting and characterizing flaws in the new specimens
  - Conduct blind trials with the new specimens to expand existing procedures or qualify new procedures to include the applicable volumes of primary interest
  - Support Vogtle 3 & 4 with a Request for Alternative and any Requests for Additional Information

Performance Demonstration Activities for N-711-1

Status

- PD Support for Vogtle 3 & 4
  - **Fabricate NDE specimens – Complete**
    - The new specimens were designed based on configurations in the new plants that would benefit from the use of CC N-711-1
    - Drawings provided by Southern Nuclear and their vendor
    - Reviewed the drawings and designed a specimen set based on the these configurations and also based on gaps in the PDI inventory to also support future equipment additions
    - Specimens designed, fabricated, fingerprinted, and documented in accordance with the EPRI QA program

Performance Demonstration Activities for N-711-1

Status

- PD Support for Vogtle 3 & 4 (Continued)
  - **Evaluate NDE techniques and procedures – Complete**
    - Circumferential flaws could all be detected and length sized from the austenitic base material
    - Some axial flaws were detected when scanning from the austenitic base material
    - All axial flaws were detected when examinations were performed on top of the weld material
      - Conditioning is needed to facilitate scanning on top of the welds
        - Ground flush
        - Blended into the austenitic base material (smooth transition)
      - This method may work for new plants or replacement configurations but not for the existing as-welded or flat top crowns conditions
        - Minimum wall thickness restrictions (due to shrinkage or counterbore)
        - Dose and time associated with conditioning

Performance Demonstration Activities for N-711-1

Status

- PD Support for Vogtle 3 & 4 (Continued)
  - **Conduct Blind Trials – Complete**
    - A new plant specific procedure was developed based on the industry generic procedure that also included:
      - New RL search units were needed
      - New procedural guidance was needed to include the additional scan surface (atop the weld) and techniques
    - Blind testing was performed to qualify the new plant specific procedure
      - A total of 4 individuals participated in the blind testing (2 utility members and 2 NDE vendors)
      - The procedure has been qualified and the PDQS is available on EPRIq

Performance Demonstration Activities for N-711-1

Status

- PD Support for Vogtle 3 & 4
  - **Support Request for Alternative and RAIs – In Progress**
    - Vogtle 3 and 4 has submitted a “Request for Alternative” based on Code Case N-711-1 and EPRI will provide support as necessary

Industry Actions Going Forward

- While a process has been outlined for the new plants, a number of limitations prevent the industry from fully benefiting from Code Case N-711-1
  - NDE technology is not available to interrogate the weld root for the presence of small axial flaws from the adjacent base material
  - Some component configurations cannot be conditioned to an acceptable surface to allow scan access on top of the weld
    - Minimum wall thickness and counterbore requirements
  - Licensees unable to condition existing components due to dose and time constraints

Industry Actions Going Forward (Continued)

- A revision of Code Case N-711-1 is needed to address the above concerns and may incorporate the following solutions:
  - Develop technical basis to adjust the VPI for certain damage mechanisms to exclude the weld for axial flaws
  - For weld where axial flaws are unlikely the revision will modify the required coverage to:
    - Essentially 100% (≥ 90%) coverage of VPI for axial flaws
    - 100% (no tolerance) coverage of VPI for circumferential flaws
  - Scanning shall be performed from all accessible surfaces (i.e., weld crowns if ground flush)

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Carbon Fiber Reinforced Polymer NDE Research Update

Kevin Hacker
Dominion Energy

Steve Kenefick
EPRI

NRC / Industry
NDE Technical Information Exchange Meeting
Washington, DC
January 2019

Work Concluded in 2016

- Carbon fiber reinforced polymer (CFRP) assessment was performed using ultrasonic techniques for thickness measurements through coatings
- Ultrasonic assessment results
  - CFRP highly attenuative to higher frequencies
  - Two techniques exhibited limited capabilities of measuring wall thickness
    - Low frequency and large diameter transducers at high amplification
  - EMAT was not successful due to electrical conductivity of the carbon fibers and excessive lift off due to CFRP thickness
  - Techniques were **not** optimized for CFRP
- Results are published in EPRI report:
  - *Ultrasonic Pipe Wall Thickness Measurement of Coated Buried Pipe Phase II* (3002008067) 2016

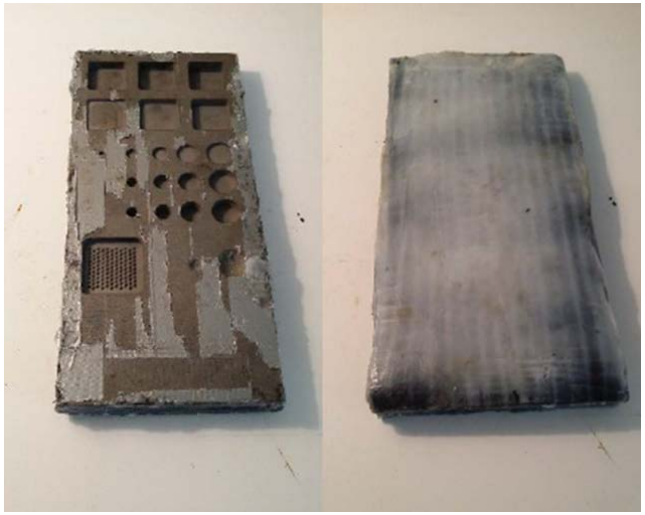
2018 Work – Dynamic Response Spectroscopy (DRS)

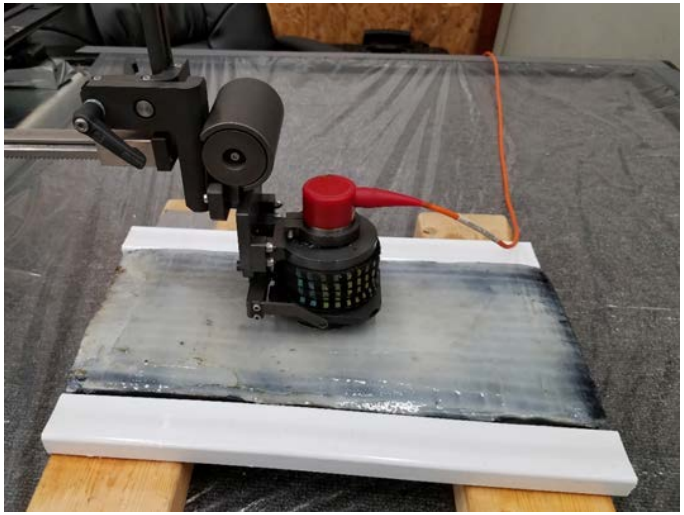
- Dynamic Response Spectroscopy (DRS) technology
  - Relatively new technology
  - EPRI has been engaged with technology through Pipeline Research Council International (PRCI) research in prior years
- Basis of technology
  - Lower frequency (<1Mhz) transducer used to transmit ultrasonic energy through CFRP (probe selection depends on CRFP thickness)
  - Ultrasonic energy excites the steel causing it to vibrate at its natural frequencies
  - Transducer collects returning energy
  - Signal processing algorithms extracts frequency content which is used to generate wall thickness
  - Data used to generate C-scan wall thickness views

Note, this is a contact technique.

2018 Work – DRS Assessment on CFRP

- PRCI conducted a round robin assessment of various NDE technologies on pipeline industry wraps
  - DRS showed potential
  - Wrap technology is different
- EPRI then conducted an assessment on a small EPRI CFRP specimen
  - CFRP representative of that used in the nuclear-industry
  - DRS successfully penetrated CFRP
  - Small configuration of specimen and square nature of the reflectors not conducive.
    - Features not representative of field conditions



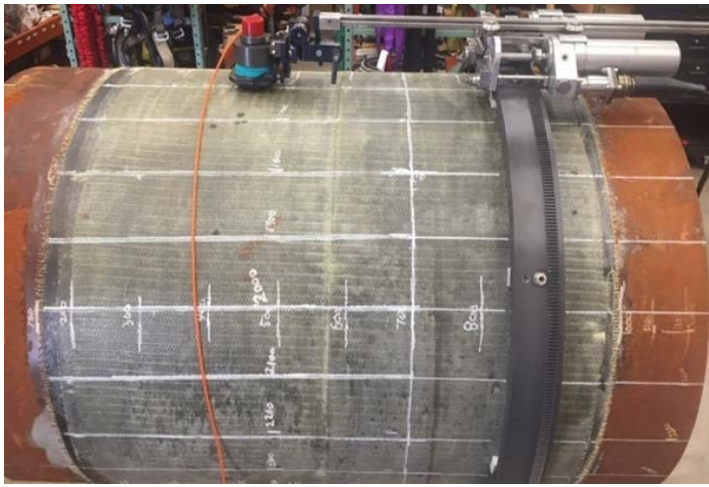


2018 Work – DRS Assessment on CFRP

- A mock-up was constructed to assess the technology on actual corrosion
  - Field removed carbon steel pipe with heavy internal corrosion
  - ~3-ft long x 30-in diameter x 0.375-in thick pipe
  - Morphology and dimensions of the corrosion vary significantly
  - Wrapped with multi-layers of CFRP
    - Two thicknesses of CFRP
  - Wrapped externally to assess detection and characterization capabilities of opposite side corrosion

2018 Work – DRS Assessment on CFRP

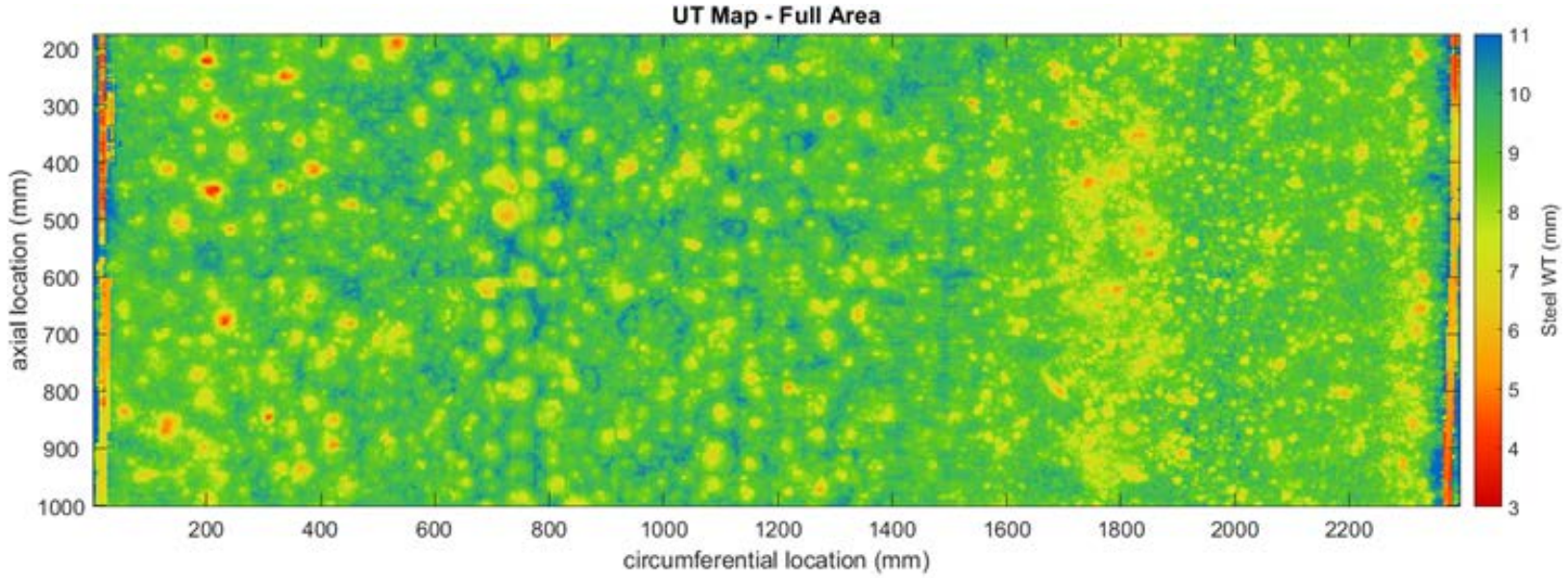
- High resolution ultrasonic data was collected prior to wrapping the mock-up
  - 10 MHz dual element 0-degree contact probe using an encoded scanner
  - Increments: 1-mm (0.039-inch) axial and 4-mm (0.157-inch) circumferential
- After mock-up was wrapped, DRS data was collected using an encoded scanner at the same increments
- Fine increments were used to allow comparison of ultrasonic and DRS data. Such increments would not be used in field applications.

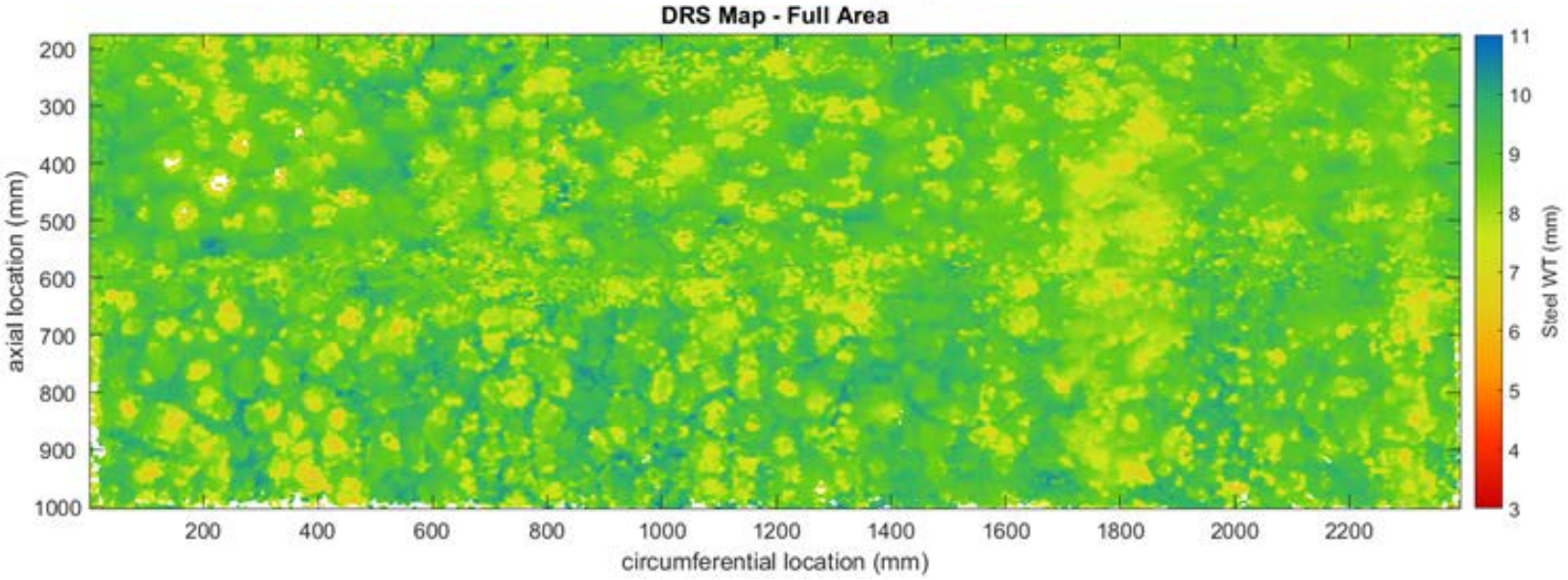


2018 Work – DRS Assessment on CFRP Results

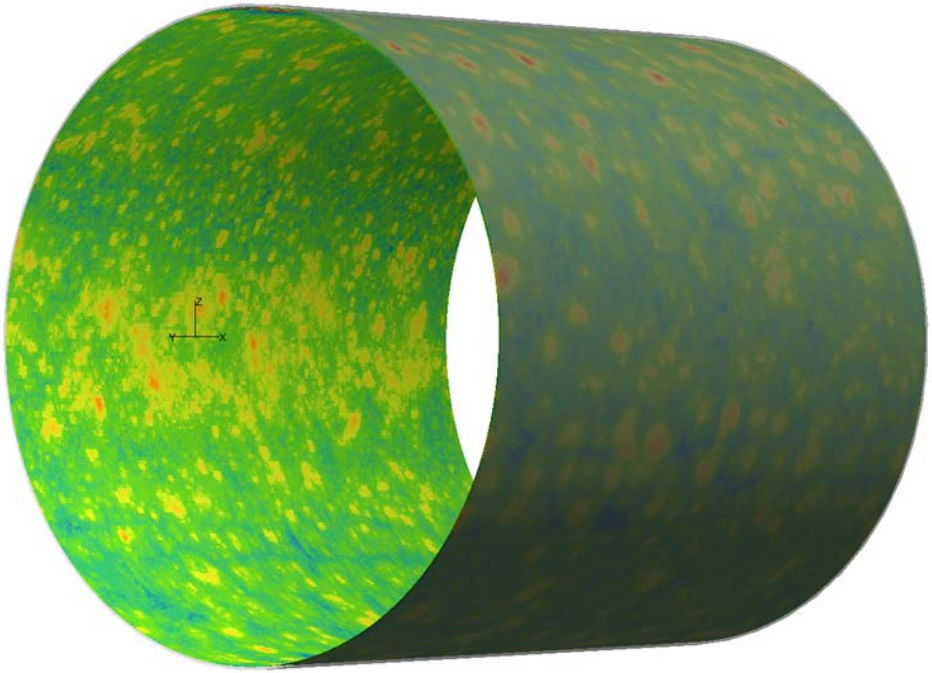
- Results published in EPRI report: *Non-contact Nondestructive Evaluation Technology: Dynamic Response Spectroscopy and Pulsed Eddy Current* (3002013174)
  - C-scan images were generated of the ultrasonic and DRS wall thickness data (upcoming slides)
    - Good visual correlation of the corrosion between the two
    - DRS does not resolve the small features found in the ultrasonic C-scan
      - Due to the ratio of the probe to discontinuity size; for this setup, limitation is 1 cm
  - Comparison of ultrasonic and DRS data for various pit sizes are made in the report
  - Cumulative distribution plot of the ultrasonic and DRS data are provided in the report
  - Natural corrosion discontinuities provide much better results than hard-edged manufactured defects
  - Capable of detecting lack of bond and internal CFRP discontinuities as discontinuity inhibits transmission of energy into the substrate
- These results are promising; additional experimental validation is warranted

2018 Work – DRS Assessment on CFRP Results



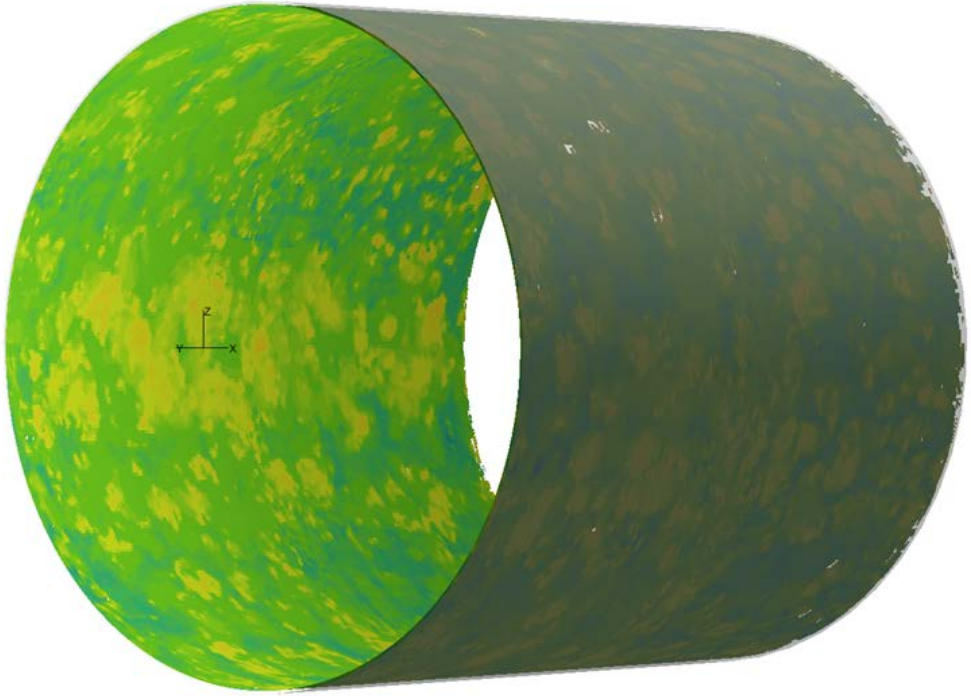


2018 Work – DRS Assessment on CFRP Results



Ultrasonic Results

DRS Results



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Reconciliation of the PD Program with 10CFR50.55a

Kevin Hacker
Dominion Energy

Doug Kull
Carl Latiolais
EPRI

NRC / Industry
NDE Technical Information Exchange Meeting
Washington, DC
January 2019

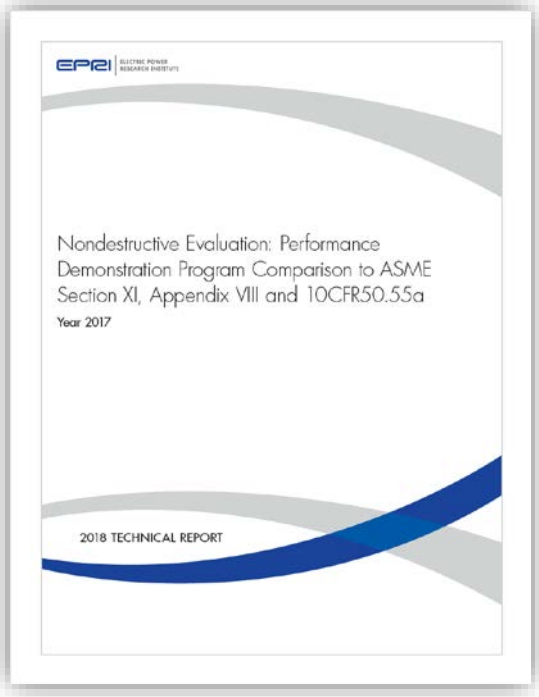
PD Program Reconciliation
Project Description

- The EPRI Performance Demonstration (PD) Program is used to qualify procedures, personnel, and equipment for examinations of
  - Piping
  - Reactor Pressure Vessels
  - Bolts & Studs
  - Reactor Upper Head Penetrations
- The PD Program works to requirements outlined in American Society of Mechanical Engineers (ASME), Section XI, Appendix VIII and applicable Code Cases as conditioned by 10CFR50.55a
  - ASME, Section XI, Appendix VIII, 2001 Edition
  - ASME, Section XI, Appendix VIII, 2007 Edition with 2008 Addendum
  - ASME, Section XI, Appendix VIII, 2013 Edition
  - 10CFR50.55a, Industry Codes and Standards, Amended Requirements, Final Rule, dated July 18, 2017
  - In-Service Inspection Code Case Acceptability, Regulatory Guide 1.147, Revision 18
- The deliverable is a report that utilities us in their ISI program as a basis for compliance with the applicable requirements

PD Program Reconciliation

Project Status

- A revision to 10CFR50.55a was published in July 2017 and the industry had 18 months from the effective date to comply with the requirements
- The scope of the project included reconciliation to 2001 Edition, 2008 Addenda and the 2013 Edition
- Reconciliation of the quality project instructions (QPIs) was completed in August 2018
- The comparison tables were reviewed by an industry panel as well as an outside organization
- The EPRI report documenting the reconciliation was published November 1st 2018
  - Report Number – 3002013136
  - Side by side comparisons of the various requirements and the QPI documents
  - List of required Code Cases that are used by the PD Program
  - Other implementation requirements (e.g. relief requests or alternatives)
  - List of future Code actions that should be considered



PD Program Reconciliation
Code Issues & Findings

- Appendix VIII
  - No major issues identified
  - Several actions will be taken to provide additional clarity and better align Code with program

Code Section	Applicable Years	Paragraph /Item	Comments	Action
Article VIII-3000	2007 &2013	Table VIII-3110-1	Supplement 14 needs to be added to the Table	An action has been initiated to address this issue in future editions of the Code.
Appendix VIII Supplements and Code Cases	N/A	Varies	Practicality prevents the program from obscuring sample identifications from certain sample sets because of the limited numbers or physical size.	Action has been initiated to address this issue in future Code editions.
Supplement 4	2001 2007/2008 &2013	3.2(c)	Paragraph needs to be revised to include “When only depth sizing is being tested,…”	A Code action is needed to incorporate this change.
Supplement 4	2007/2008 & 2013	4.3(a)	The specified percentage in this paragraph should have been updated when the scope of Supplement 4 was changed from 10% to 15% (2007).	An intent inquiry is needed to address this in future revisions of the Code.
Supplement 5	2013	All	When Code Case N-552-1 was incorporated into the Code additional requirements were added which do not align with the processes used in past PD qualifications. Supplement 5 needs to be revised to match Code Case 552-1 and the PD process.	An action should be initiated to address this issue in future Code editions.
Supplement 6	2001, 2007/2008 &2013	2.1 (e)(2)	The word “examinations” needs to be changed to ‘demonstrations”	A Code action is needed to incorporate this change.
Supplement 10	2007/2008 &2013	2.1(d)	This paragraph requires that weld crown be represented in test sets. The PD program is includes the demonstrated surface condition on the procedure and personnel PDQS documents.	An intent inquiry is needed to address this in future revisions of the Code.

PD Program Reconciliation
Code Issues & Findings (Continued)

- Applicable Code Cases
  - Minor changes needed to update references and provide clarity in CC N-695 & N-696 as well as CC N-845
  - Code actions are currently underway to update CC N-729 to address a few administrative items, diameter tolerance, and shift the NDE demonstration requirements out of the body of the CC and into a new Appendix and Appendix VIII, Supplement 15

Code Section	Applicable Years	Paragraph /Item	Comments	Action
Code Case 695-1	N/A	4.0 (b)	Reference to Paragraph 3.1 should be eliminated.	This needs to be addressed when the Code Case is incorporated into future editions of Supplement 10.
Code Case 696-1	N/A	Scope of Applicability	Code Case N-696-1 is intended to be applicable to Supplement 14. However, N-696-1 is written to be a substitution for the coordinated implementation for Supplements 10, 2, &3. N-696 was incorporated into the Code in the 2004 Edition as Supplement 14 but the scope remained unchanged when N-696 was revised.	An intent inquiry is needed to clarify N-696-1 is applicable to Supplement 14.
Code Case N-729-4	N/A	N/A	The RMS equation should only appear once in the Code Case.	This needs to be addressed when the Code Case is incorporated into the future Supplement 15.
Code Case N-729-4	N/A	2500(j)	There needs to be a delineation where the requirements for procedure and personnel apply. i.e it is not practical to have 50% new flaws in procedure qualifications	An intent inquiry is needed to address this issue.
Code Case N-729-4	N/A	2500(a)(2)	The lower limit is listed as 30% which overlaps Paragraph (a)(1). The requirement was likely intended to be 31% to prevent overlap.	An intent inquiry is needed to address this issue.
Code Case N-729-4	N/A	2500	To provide clarity the PD requirements should be removed from the body of the Code Case and included as a new Appendix to the Code Case. This new Appendix will be the template for the new Appendix VIII Supplement 15.	Code Action is needed to update the format of CC N-729-4 and the development of Supplement 15.
Code Case N-845 & N-845-1	N/A	3.2 (d)	The reference to 3.2 should be changed to 3.1 & 4(a).	A Code action has been initiated to address this in the Code.

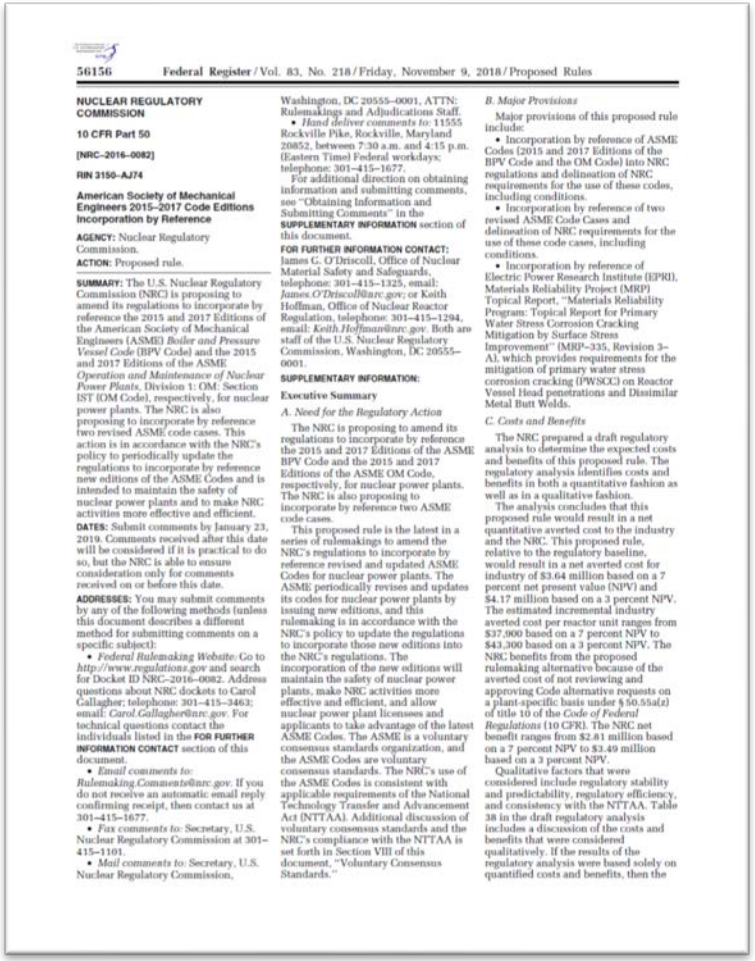
PD Program Reconciliation

Future Reconciliation Projects

- The review process becomes more complex with each additional set of 10CFR50.55a-approved Code requirements.
- It is becoming exceedingly difficult to write PD Program procedures meeting each independent document.
- We would like to isolate future review and reconciliation efforts to only the latest 10CFR50.55a-approved edition or addendum of the ASME Code.
- The 2017 Final Rule included a provision that allows licensees to update to the latest version of Appendix VIII
  - As written it will be difficult to realize the efficiencies that were intended by allowing licensees to update to the latest version of Appendix VIII

PD Program Reconciliation
10CFR50.55a Paragraphs (g)(4)(i) & (ii)

- Paragraphs (g)(4)(i) and (ii) both contain the following provision
  - *"licensees may, at any time in their 120-month ISI interval, elect to use the Appendix VIII in the latest edition and addenda of the ASME BPV Code incorporated by reference in paragraph (a) of this section, subject to any applicable conditions listed in paragraph (b) of this section. Licensees using this option* ***must also use the same edition and addenda of Appendix I as Appendix VIII,*** *including any applicable conditions listed in paragraph (b) of this section."*



56156 Federal Register / Vol. 83, No. 218 / Friday, November 9, 2018 / Proposed Rules

NUCLEAR REGULATORY COMMISSION

10 CFR Part 50

[NRC–2016–0082]

RIN 3150–AJ74

American Society of Mechanical Engineers 2015–2017 Code Editions Incorporation by Reference

AGENCY: Nuclear Regulatory Commission.

ACTION: Proposed rule.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is proposing to amend its regulations to incorporate by reference the 2015 and 2017 Editions of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (BPV Code) and the 2015 and 2017 Editions of the ASME *Operation and Maintenance of Nuclear Power Plants*, Division 1: OM: Section IST (OM Code), respectively, for nuclear power plants. The NRC is also proposing to incorporate by reference two revised ASME code cases. This action is in accordance with the NRC's policy to periodically update the regulations to incorporate by reference new editions of the ASME Codes and is intended to maintain the safety of nuclear power plants and to make NRC activities more effective and efficient.

DATES: Submit comments by January 23, 2019. Comments received after this date will be considered if it is practical to do so, but the NRC is able to ensure consideration only for comments received on or before this date.

ADDRESSES: You may submit comments by any of the following methods (unless this document describes a different method for submitting comments on a specific subject):

- *Federal Rulemaking Website:* Go to *http://www.regulations.gov* and search for Docket ID NRC–2016–0082. Address questions about NRC dockets to Carol Gallagher; telephone: 301–415–3463; email: *Carol.Gallagher@nrc.gov*. For technical questions contact the individuals listed in the **FOR FURTHER INFORMATION CONTACT** section of this document.
- *Email comments to: Rulemaking.Comments@nrc.gov.* If you do not receive an automatic email reply confirming receipt, then contact us at 301–415–1677.
- *Fax comments to:* Secretary, U.S. Nuclear Regulatory Commission at 301–415–1101.
- *Mail comments to:* Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555–0001, ATTN: Rulemakings and Adjudications Staff.
- *Hand deliver comments to:* 11555 Rockville Pike, Rockville, Maryland 20852, between 7:30 a.m. and 4:15 p.m. (Eastern Time) Federal workdays; telephone: 301–415–1677.

For additional direction on obtaining information and submitting comments, see "Obtaining Information and Submitting Comments" in the **SUPPLEMENTARY INFORMATION** section of this document.

FOR FURTHER INFORMATION CONTACT: James G. O'Driscoll, Office of Nuclear Material Safety and Safeguards, telephone: 301–415–1325, email: *James.O'Driscoll@nrc.gov*; or Keith Hoffman, Office of Nuclear Reactor Regulation, telephone: 301–415–1294, email: *Keith.Hoffman@nrc.gov*. Both are staff of the U.S. Nuclear Regulatory Commission, Washington, DC 20555–0001.

SUPPLEMENTARY INFORMATION:

Executive Summary

A. Need for the Regulatory Action

The NRC is proposing to amend its regulations to incorporate by reference the 2015 and 2017 Editions of the ASME BPV Code and the 2015 and 2017 Editions of the ASME OM Code, respectively, for nuclear power plants. The NRC is also proposing to incorporate by reference two ASME code cases.

This proposed rule is the latest in a series of rulemakings to amend the NRC's regulations to incorporate by reference revised and updated ASME Codes for nuclear power plants. The ASME periodically revises and updates its codes for nuclear power plants by issuing new editions, and this rulemaking is in accordance with the NRC's policy to update the regulations to incorporate those new editions into the NRC's regulations. The incorporation of the new editions will maintain the safety of nuclear power plants, make NRC activities more effective and efficient, and allow nuclear power plant licensees and applicants to take advantage of the latest ASME Codes. The ASME is a voluntary consensus standards organization, and the ASME Codes are voluntary consensus standards. The NRC's use of the ASME Codes is consistent with applicable requirements of the National Technology Transfer and Advancement Act (NTTAA). Additional discussion of voluntary consensus standards and the NRC's compliance with the NTTAA is set forth in Section VIII of this document, "Voluntary Consensus Standards."

B. Major Provisions

Major provisions of this proposed rule include:

- Incorporation by reference of ASME Codes (2015 and 2017 Editions of the BPV Code and the OM Code) into NRC regulations and delineation of NRC requirements for the use of these codes, including conditions.
- Incorporation by reference of two revised ASME Code Cases and delineation of NRC requirements for the use of these code cases, including conditions.
- Incorporation by reference of Electric Power Research Institute (EPRI), Materials Reliability Project (MRP) Topical Report, "Materials Reliability Program: Topical Report for Primary Water Stress Corrosion Cracking Mitigation by Surface Stress Improvement" (MRP–335, Revision 3–A), which provides requirements for the mitigation of primary water stress corrosion cracking (PWSCC) on Reactor Vessel Head penetrations and Dissimilar Metal Butt Welds.

C. Costs and Benefits

The NRC prepared a draft regulatory analysis to determine the expected costs and benefits of this proposed rule. The regulatory analysis identifies costs and benefits in both a quantitative fashion as well as in a qualitative fashion.

The analysis concludes that this proposed rule would result in a net quantitative averted cost to the industry and the NRC. This proposed rule, relative to the regulatory baseline, would result in a net averted cost for industry of $3.64 million based on a 7 percent net present value (NPV) and $4.17 million based on a 3 percent NPV. The estimated incremental industry averted cost per reactor unit ranges from $37,900 based on a 7 percent NPV to $43,300 based on a 3 percent NPV. The NRC benefits from the proposed rulemaking alternative because of the averted cost of not reviewing and approving Code alternative requests on a plant-specific basis under § 50.55a(z) of title 10 of the *Code of Federal Regulations* (10 CFR). The NRC net benefit ranges from $2.81 million based on a 7 percent NPV to $3.49 million based on a 3 percent NPV.

Qualitative factors that were considered include regulatory stability and predictability, regulatory efficiency, and consistency with the NTTAA. Table 38 in the draft regulatory analysis includes a discussion of the costs and benefits that were considered qualitatively. If the results of the regulatory analysis were based solely on quantified costs and benefits, then the

emphasis added

PD Program Reconciliation
10CFR50.55a Paragraphs (g)(4)(i) & (ii)

- The following component of the regulation causes an programmatic issue
  - *"Licensees using this option must also use the same edition and addenda of Appendix I as Appendix VIII, including any applicable conditions listed in paragraph (b) of this section."*
- Requiring licensees to adopt the latest edition for Appendix I is an issue because it references other sections of the Code (e.g. Appendix III, Section V) that will require a considerable effort to incorporate into ISI programs.
- If the existing requirement was changed to only require the implementation of the parts of Appendix I that apply to Appendix VIII it would allow utilities to more easily incorporate the updated Performance Demonstration requirements into their ISI programs.
- **Recommended wording for the condition:**
  - *"Licensees using this option must also use the paragraphs in Appendix I (from same edition and addenda) that are applicable to Appendix VIII, including any applicable conditions listed in paragraph (b) of this section."*

Together…Shaping the Future of Electricity

Section XI Update on NDE Activities

Gary Lofthus
Southern Nuclear

Carl Latiolais
EPRI

NRC / Industry
NDE Technical Information Exchange Meeting
Washington, DC
January 2019

Outline

- Actions / items completed in 2018
  - Record number and description of items passed by Standards Committee in 2018
- Items at Standards Committee
- Current items working on in 2019
  - Record number and description of items currently assigned to SG-NDE and applicable Working Group
- Future actions
  - Items identified as needing action within Section XI

2018 Actions / Items Completed

- BC 13-796 BPVC Section III, Division1, NB-4250(c) (Counterbore requirements)
- BC 16-1651 Revision of Section XI, Nonmandatory Appendix N (updated 2006 CP-189 and CP-105)
- BC 16-2307 Develop Code Case for acceptance of leaking brazed joints based on UT inspection
- BC 17-1156 IWA-2200 Matching Editions of SC XI and SC V During Interval
- BC 18-107 Revision to code case N-831, to allow procedure and personnel qualification expansion for additional material (i.e. ferritic, austenitic)
- BC 07-1853 CC N-768 Alternative requirements for Examination of Class 1 & 2 pressure vessel ferritic weld joints greater than 2”

Items at Standards Committee

- BC 18-1626 - BPV XI revision to IWA-2212, VT-2 examination item closed, combined with BC18-322 (need to address 3 comments)

- BC 18-1874 - Update to table VIII-3110-1 to include reference to Supplement 14 (30 approved, 3 negative comments have been addressed)

- BC 18-1946 - Revision to Appendix VIII-3110 and 3120 to add clarity for grading units (35 approved, 5 votes not returned)

Current Items Working on in 2019

- BC 02-3759 - Supplement 9 to Appendix VIII, CCSS material
- BC 07-1221 - Radiography PDI
- BC 10-1074 - UT Laboratory Time
- BC 15-2073 - Incorporate Mitigation Examination requirements, clarify FAC and Socket weld
- BC 16-257 - Code Change to incorporate CC N-639 into Mandatory Appendix I, supplement 1 as conditioned by Reg Guide 1.147
- BC 16-1592 - Third party NDE Personnel Certification Organizations
- BC 16-1918 & 16-1961 - Title clarification of Section XI, Appendix VIII, Supplement 10

Current Items Working on in 2019 (continued)

- BC 16-2908 - Use of encoded PA for small bore socket welds
- BC 16-1629 - PSI and ISI of Class nozzle structural welds by build-up weld techniques
- BC 17-414 - N-788-2 revision to adopt ASME ANDE Standard
- BC 18-1186 - Appendix IV Supplement 5 Qualification requirements for surface examination of piping and vessel welds inservice fabricated with Austenitic stainless steels or nickel alloy
- BC 18-1691 - New Supplement 15 (N-729 incorporation)
- BC 18-1934 - Revision of Section XI to later additions of CP-189

Future Actions

- During the PD Program update, several Appendix VIII related actions have been have been identified to provide additional clarity and to better align Code and PD Program

Code Section	Applicable Years	Paragraph /Item	Comments	Action
Article VIII-3000	2007 &2013	Table VIII-3110-1	Supplement 14 needs to be added to the Table	An action has been initiated to address this issue in future editions of the Code.
Appendix VIII Supplements and Code Cases	N/A	Varies	Practicality prevents the program from obscuring sample identifications from certain sample sets because of the limited numbers or physical size.	Action has been initiated to address this issue in future Code editions.
Supplement 4	2001 2007/2008 &2013	3.2(c)	Paragraph needs to be revised to include “When only depth sizing is being tested,…”	A Code action is needed to incorporate this change.
Supplement 4	2007/2008 & 2013	4.3(a)	The specified percentage in this paragraph should have been updated when the scope of Supplement 4 was changed from 10% to 15% (2007).	An intent inquiry is needed to address this in future revisions of the Code.
Supplement 5	2013	All	When Code Case N-552-1 was incorporated into the Code additional requirements were added which do not align with the processes used in past PD qualifications. Supplement 5 needs to be revised to match Code Case 552-1 and the PD process.	An action should be initiated to address this issue in future Code editions.
Supplement 6	2001, 2007/2008 &2013	2.1 (e)(2)	The word “examinations” needs to be changed to ‘demonstrations”	A Code action is needed to incorporate this change.
Supplement 10	2007/2008 &2013	2.1(d)	This paragraph requires that weld crown be represented in test sets. The PD program is includes the demonstrated surface condition on the procedure and personnel PDQS documents.	An intent inquiry is needed to address this in future revisions of the Code.

Future Actions (continued)

- Applicable Code Cases
  - Minor changes needed to update references and provide clarity in CC N-695 & N-696 as well as CC N-845
  - Code actions are currently underway to update CC N-729 to address several administrative items, diameter tolerance, and shift the NDE demonstration requirements out of the body and into a new Appendix of the CC and develop Appendix VIII, Supplement 15

Future Actions (continued)

Code Section	Applicable Years	Paragraph /Item	Comments	Action
Code Case 695-1	N/A	4.0 (b)	Reference to Paragraph 3.1 should be eliminated.	This needs to be addressed when the Code Case is incorporated into future editions of Supplement 10.
Code Case 696-1	N/A	Scope of Applicability	Code Case N-696-1 is intended to be applicable to Supplement 14. However, N-696-1 is written to be a substitution for the coordinated implementation for Supplements 10, 2, &3. N-696 was incorporated into the Code in the 2004 Edition as Supplement 14 but the scope remained unchanged when N-696 was revised.	An intent inquiry is needed to clarify N-696-1 is applicable to Supplement 14.
Code Case N-729-4	N/A	N/A	The RMS equation should only appear once in the Code Case.	This needs to be addressed when the Code Case is incorporated into the future Supplement 15.
Code Case N-729-4	N/A	2500(j)	There needs to be a delineation where the requirements for procedure and personnel apply. i.e it is not practical to have 50% new flaws in procedure qualifications	An intent inquiry is needed to address this issue.
Code Case N-729-4	N/A	2500(a)(2)	The lower limit is listed as 30% which overlaps Paragraph (a)(1). The requirement was likely intended to be 31% to prevent overlap.	An intent inquiry is needed to address this issue.
Code Case N-729-4	N/A	2500	To provide clarity the PD requirements should be removed from the body of the Code Case and included as a new Appendix to the Code Case. This new Appendix will be the template for the new Appendix VIII Supplement 15.	Code Action is needed to update the format of CC N-729-4 and the development of Supplement 15.
Code Case N-845 & N-845-1	N/A	3.2 (d)	The reference to 3.2 should be changed to 3.1 & 4(a).	A Code action has been initiated to address this in the Code.

discussion

PDI Update

David Anthony
Exelon

Leif Esp
EPRI

NRC / Industry
NDE Technical Information Exchange Meeting
Washington, DC
January 2019

Piping Program Personnel Qualification Activities January 2018 to December 2018

- Personnel Qualifications (General Statistics)
  - 60 Non-Encoded

Test Type	Detection	Length	TWS
Austenitic w/ IGSCC	2	1	5
Austenitic w/o IGSCC	6	4	1
Ferritic (Supplement 12)	6	5	6
Ferritic Only	3	1	0
Weld Overlay	2	2	2
Dissimilar Metal Welds	2	2	2
IGSCC Requalification	3	3	2
WOL Requalification	0	0	0

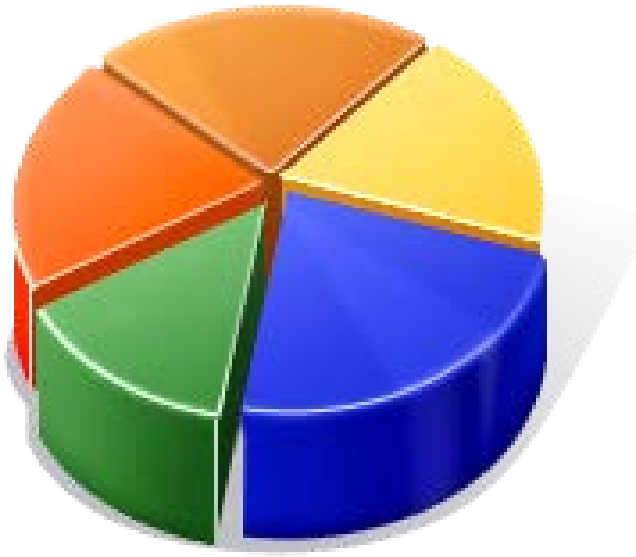
Piping Program Personnel Qualification Activities January 2018 to December 2018

- Personnel Qualifications (General Statistics)
  - 50 Encoded

Test Type	Detection	Length	TWS
Austenitic w/ IGSCC	6	6	3
Austenitic w/o IGSCC	0	0	0
Ferritic (Supplement 12)	6	6	1
Ferritic Only	0	0	0
Weld Overlay	1	1	1
Dissimilar Metal Welds	7	6	2
IGSCC Requalification	1	2	1
WOL Requalification	0	0	0

Piping Program Personnel Qualification Activities January 2018 to December 2018

- Personnel Qualifications (General Statistics)
  - **72%** (79/110) of piping personnel qualifications used phased array
    - **Non-Encoded** qualifications = **53%** (32/60)
    - Encoded qualifications = **94%** (47/50)



RPV Personnel Qualifications Activities January 2018 to December 2018

- Personnel Qualifications
  - Non-Encoded
    - 8 Candidates, Supplement 8 (Bolting)
    - 4 Candidates, Supplement 5 (RPV Nozzles from the OD)
    - 5 Candidates, Supplement 4 & 6 (RPV Welds)
  - Encoded
    - 3 Candidates, Supplement 7 (RPV Nozzles from the ID)
    - 0 Candidates, Supplement 5 (RPV Nozzles from the OD)
    - 9 Candidates, Supplement 4 & 6 (RPV Welds)
    - 6 Candidates, Upper Head Penetration

Procedure Qualifications - Piping & RPV January 2018 to December 2018

- RPV – (Encoded – Automated)
  - Phased Array Supplements 4, 6, and 7 from the ID. In Process
  - UHP Procedure Expansion to small diameter.
- Piping – (Encoded – Automated)
  - Supplement 10 from the OD
  - Supplements 2 & 10 from the ID
  - Supplement 11 from the OD
  - Supplement 2 from the OD
  - Supplements 10 & 12 from the OD
  - Supplement 10 from the ID
    - Small Diameter DM (3.87”) to be used for Auxiliary Head Adapter penetration welds on PWR Upper Heads

Procedure Qualifications - Piping & RPV January 2018 to December 2018

- Piping – (Encoded – Manual / Non-Robotic)
  - Supplement 10 from the OD (Vendor A)
  - Supplement 10 from the OD (Vendor B)
  - Supplement 12 without IGSCC from the OD (EPRI procedure using non-mechanized encoded techniques)
    - Qualification not complete – technique improvements in process

PDI Pass Rates Update

Piping Pass Rates 2011 to 12/31/2018

Initial

Non-Encoded	# Candid. 1st Attempt	# Passed 1st Attempt	# Candid. 2nd Attempt	# Passed 2nd Attempt	# Candid. 3rd Attempt	# Passed 3rd Attempt	% Pass rate 1st Attempt	% Pass rate 2nd Attempt	% Pass rate 3rd Attempt	% Yield
AUST. DETECTION (NO) IGSCC	112	61	42	23	22	9	54	55	41	83
LENGTH SIZING (NO) IGSCC	99	79	19	14	5	3	80	74	60	97
AUST. DETECTION / W IGSCC	63	33	27	14	6	4	52	52	67	81
LENGTH SIZING / W IGSCC	51	35	10	9	4	3	69	90	75	92
SUPPLEMENT 12 FERRITIC DET.	139	81	38	28	9	5	58	74	56	82
SUPPLEMENT 12 FERRITIC LENGTH	128	83	31	24	8	6	65	77	75	88
FERRITIC DETECTION	13	6	8	2	3	0	46	25	0	62
LENGTH SIZING FERRITIC	7	7	0	0	1	1	100	0	100	100
DEPTH SIZING (NO) IGSCC	14	10	7	4	1	0	71	57	0	100
DEPTH SIZING / W IGSCC	56	35	14	8	3	2	63	57	67	80
DEPTH SIZING SUP.12 FERRITIC	65	40	20	11	4	2	62	55	50	82
DEPTH SIZING FERRITIC	0	0	1	0	0	0	0	0	0	0
WOR - SUPPLEMENT 11	47	34	8	6	1	0	72	75	0	85
DISSIMILAR METAL WELDS - DET	30	24	4	3	0	0	80	75	0	90
DISSIMILAR METAL WELDS - LENGTH	27	24	3	3	0	0	89	100	0	100
DISSIMILAR METAL WELDS - TWS	20	11	5	2	0	0	55	40	0	65

Piping Pass Rates 2011 to 12/31/2018

Initial

Encoded	# Candid. 1st Attempt	# Passed 1st Attempt	# Candid. 2nd Attempt	# Passed 2nd Attempt	# Candid. 3rd Attempt	# Passed 3rd Attempt	% Pass rate 1st Attempt	% Pass rate 2nd Attempt	% Pass rate 3rd Attempt	% Yield
AUST. DETECTION (NO) IGSCC	0	0	0	0	0	0	0	0	0	0
LENGTH SIZING (NO) IGSCC	0	0	0	0	0	0	0	0	0	0
AUST. DETECTION / W IGSCC	32	18	9	6	3	2	56	67	67	81
LENGTH SIZING / W IGSCC	25	19	4	4	1	1	76	100	100	96
SUPPLEMENT 12 FERRITIC DET.	26	20	3	2	1	1	77	67	100	88
SUPPLEMENT 12 FERRITIC LENGTH	22	18	2	2	1	1	82	100	100	95
FERRITIC DETECTION	4	3	1	0	1	0	75	0	0	75
LENGTH SIZING FERRITIC	4	4	0	0	0	0	100	0	0	100
DEPTH SIZING (NO) IGSCC	0	0	0	0	0	0	0	0	0	0
DEPTH SIZING / W IGSCC	28	15	12	11	0	0	54	92	0	93
DEPTH SIZING SUP.12 FERRITIC	21	13	8	7	0	0	62	88	0	95
DEPTH SIZING FERRITIC	4	4	0	0	0	0	100	0	0	100
WOR - SUPPLEMENT 11	18	14	0	0	0	0	78	0	0	78
DISSIMILAR METAL WELDS - DET	50	42	3	3	0	0	84	100	0	90
DISSIMILAR METAL WELDS - LENGTH	47	39	5	4	0	0	83	80	0	91
DISSIMILAR METAL WELDS - TWS	33	15	16	7	3	1	45	44	33	70

Piping Pass Rates 2011 to 12/31/2018

Requalification

Non-Encoded	# Candid. 1st Attempt	# Passed 1st Attempt	# Candid. 2nd Attempt	# Passed 2nd Attempt	# Candid. 3rd Attempt	# Passed 3rd Attempt	% Pass rate 1st Attempt	% Pass rate 2nd Attempt	% Pass rate 3rd Attempt	% Yield
AUST. DETECTION / W IGSCC	159	109	50	22	23	13	69	44	57	91
LENGTH SIZING / W IGSCC	142	109	28	19	7	2	77	68	29	92
DEPTH SIZING / W IGSCC	51	32	16	12	5	4	63	75	80	94
WOR - SUPPLEMENT 11	29	19	2	2	0	0	66	100	0	72

Encoded	# Candid. 1st Attempt	# Passed 1st Attempt	# Candid. 2nd Attempt	# Passed 2nd Attempt	# Candid. 3rd Attempt	# Passed 3rd Attempt	% Pass rate 1st Attempt	% Pass rate 2nd Attempt	% Pass rate 3rd Attempt	% Yield
AUST. DETECTION / W IGSCC	60	42	19	16	4	3	70	84	75	102
LENGTH SIZING / W IGSCC	52	45	6	5	3	3	87	83	100	102
DEPTH SIZING / W IGSCC	32	21	10	7	2	2	66	70	100	94
WOR - SUPPLEMENT 11	5	5	0	0	0	0	100	0	0	100

RPV Pass Rates Since the Start of the Program

Non-Encoded	# Candid. 1st Attempt	# Passed 1st Attempt	# Candid. 2nd Attempt	# Passed 2nd Attempt	# Candid. 3rd Attempt	# Passed 3rd Attempt	%Pass rate 1st Attempt	%Pass rate 2nd Attempt	%Pass rate 3rd Attempt	Yield %
Shell (inner 15%) OD (Detection)	165	47	99	49	40	21	28.5	49.5	52.5	70.91%
Shell (inner 15%) OD (Length Sizing)	85	78	7	6	1	1	91.8	85.7	100.0	100.00%
Shell (inner 15%) OD (Depth Sizing)	88	52	36	26	8	4	59.1	72.2	50.0	93.18%
Shell (outer 85%) OD (Detection)	156	86	63	36	21	17	55.1	57.1	81.0	89.10%
Shell (outer 85%) OD (Length Sizing)	85	73	10	7	2	2	85.9	70.0	100.0	96.47%
Shell (outer 85%) OD (Depth Sizing)	87	64	19	14	2	2	73.6	73.7	100.0	91.95%
Noz-to-shell and IR OD (Detection)	57	36	11	9			63.2	81.8		78.95%
Noz-to-shell and IR OD (Depth Sizing)	22	15	5	3	2	2	68.2	60.0	100.0	90.91%

Encoded	# Candid. 1st Attempt	# Passed 1st Attempt	# Candid. 2nd Attempt	# Passed 2nd Attempt	# Candid. 3rd Attempt	# Passed 3rd Attempt	%Pass rate 1st Attempt	%Pass rate 2nd Attempt	%Pass rate 3rd Attempt	Yield %
Shell (inner 15%) OD (Detection)	120	51	45	26	18	10	42.5	57.8	55.6	72.50%
Shell (inner 15%) OD (Length Sizing)	78	69	9	7	2	2	88.5	77.8	100.0	100.00%
Shell (inner 15%) OD (Depth Sizing)	78	44	33	11	21	16	56.4	33.3	76.2	91.03%
Shell (outer 85%) OD (Detection)	120	82	25	15	7	6	68.3	60.0	85.7	85.83%
Shell (outer 85%) OD (Length Sizing)	93	77	16	11	5	4	82.8	68.8	80.0	98.92%
Shell (outer 85%) OD (Depth Sizing)	93	46	46	30	16	8	49.5	65.2	50.0	90.32%
Shell (inner 15%) ID (Detection)	177	118	57	50	5	5	66.7	87.7	100.0	97.74%
Shell (inner 15%) ID (Length Sizing)	141	131	8	6	2	1	92.9	75.0	50.0	97.87%
Shell (inner 15%) ID (Depth Sizing)	144	104	39	29	8	5	72.2	74.4	62.5	95.83%
Shell (outer 85%) ID (Detection)	184	104	77	47	24	18	56.5	61.0	75.0	91.85%
Shell (outer 85%) ID (Length Sizing)	138	101	37	31	3	3	73.2	83.8	100.0	97.83%
Shell (outer 85%) ID (Depth Sizing)	139	69	72	40	25	4	49.6	55.6	16.0	81.29%
Noz-to-shell and IR OD (Detection)	40	18	23	10	10	4	45.0	43.5	40.0	80.00%
Noz-to-shell and IR OD (Depth Sizing)	31	18	7	5			58.1	71.4		74.19%
Noz-to-shell and IR ID (Detection)	70	33	33	26	17	10	47.1	78.8	58.8	98.57%
Noz-to-shell and IR ID (Length Sizing)	41	36	3	3			87.8	100.0		95.12%
Noz-to-shell and IR ID (Depth Sizing)	43	34	7	5	2	1	79.1	71.4	50.0	93.02%

Bolting Pass Rates

Examination Type	# Candid. 1st Attempt	# Passed 1st Attempt	# Candid. 2nd Attempt	# Passed 2nd Attempt	# Candid. 3rd Attempt	# Passed 3rd Attempt	%Pass rate 1st Attempt	%Pass rate 2nd Attempt	%Pass rate 3rd Attempt	Yield %
From End	340	272	56	49	5	3	79.2	87.0	60.0	95.29%
From Bore	95	60	21	6	4	3	62.2	29.4	66.7	72.63%

PDI Pass Rate Summary

- PDI continues to monitor pass rates

- No significant changes have been observed since last update

Summary of Appendix VIII Activities in 2018

- Generic Procedures have been revised based on latest experiences
  - PDI-UT-4
  - PDI-UT-5
  - PDI-UT-8

- Bi-Annual review of additional Generic Procedures are in process to capture any necessary changes / updates
  - PDI-UT-1, PDI-UT-2, PDI-UT-3, and PDI-UT-10 piping procedures
  - PDI-UT-6, PDI-UT-7, and PDI-UT-11 RPV procedures

Summary of Appendix VIII Activities in 2018

- PDI Guideline documents have been revised to provide the industry with the latest applicable guidance
  - PDI-GL-001 Rev. C – Hands-on Practice Guideline
    - Document has been strengthened to provide for a consistent application of the hands-on practice process for Appendix VIII qualified examiners
    - Has NEI 03-08 'Good Practice' ties
  - PDI-GL-002 Rev. C – CRC Guideline
    - Applicable to examinations performed from the OD on austenitic components that have CRC applied to the OD of the component
    - Document has been strengthened to provide more complete guidance
    - No NEI 03-08 ties – just an informational guideline for industry use

discussion

Together…Shaping the Future of Electricity

MRP-60 update (VE for Leakage of RVUH Nozzles)

Kevin Hacker
Dominion Energy

Jack Spanner
EPRI

NRC / Industry
NDE Technical Information Exchange Meeting
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Background

- MRP report for the visual examination (VE) for Leakage of PWR reactor vessel upper head (RVUH) penetrations was initially developed in the early 2000s
- Objectives:
  - Capture OE of leakage identified on top of the RVUH
  - Provide guidance for utilities and examiners for performing VE
  - Increase examiner awareness of the appearance of penetration leakage
- Contained:
  - Lessons learned for evaluating penetration leakage – light cleaning such as vacuuming or controlled compressed air (40-60 psi) to determine if deposit is tightly adhering
  - Images of penetration leakage
- Head leakage from the highly susceptible heads was easy to identify
- Report periodically updated to capture ongoing OE and leakage images

Images of Leakage from Highly Susceptible Heads (Early 2000s)

Code Case N-729-4 VE Requirements

- -3141 (c) defines VE relevant conditions as evidence of reactor coolant leakage, such as corrosion, boric acid deposits, and discoloration
- -3142.1 (b)(1) requires relevant conditions to be further evaluated to determine the source of the leakage and correction of the source of leakage
- -3142.1 (b)(2) requires:
  - relevant conditions to be evaluated to determine the extent, if any, of degradation
  - boric acid crystals and residue to be removed to the extent necessary to allow adequate examinations and evaluation of degradation
  - a subsequent VE of the previously obscured surfaces prior to return to service
  - a VE of the previously obscured surfaces in the subsequent refueling outage
- -3142.1(c) A nozzle whose VE indicates relevant conditions indicative of possible nozzle leakage shall be unacceptable for continued service unless it meets the requirements of -3142.2 or -3142.3

Recent RVUH Penetration VE OE

- Most highly susceptible heads have been replaced
- Recent RVUH visual examinations has resulted in relevant conditions being identified that are not related to head penetration leakage due to cracking
- These conditions need to be properly evaluated to avoid unnecessary repair or supplemental actions

Examples of Recent Relevant Conditions not Associated with Penetration Leakage

White debris masking the penetration annulus

Surface staining

MRP- 60 Update

- The MRP report for the VE for Leakage of PWR reactor RVUH penetrations has been revised in 2018
  - Contains a section that focuses on recent visual examinations (2014 – 2018)
    - Includes images and examination results of recent relevant conditions of penetration leakage and non-penetration leakage
  - Contains sections that includes images and examination results of examinations performed prior to 2014
  - Captures lessons learned on the characteristics of boric acid deposits resulting from head penetration leaks and methods for determining the source of the leakage
  - Provides an evaluation process for guidance to assist in the evaluation of the relevant conditions being identified
- MRP-60 Rev 5, “Visual Examination for Leakage of PWR Reactor Vessel Upper Head Nozzles”, December 2018, 3002013268
  - Does not contain an NEI 03-08 element

MRP-60 Evaluation Process Guidance

- Guidance is provided to assist utilities with the evaluation of VE results
- Perform initial bare metal visual (BMV) examination
  - Review history of spillage and leaks from maintenance and refueling activities
  - View down into annulus around each penetration
  - When relevant conditions are identified in or around the penetration annulus, view the penetration above the annulus to identify any potential source of leakage from above
  - Review previous examination results
  - Record relevant conditions

MRP-60 Evaluation Process Guidance (continued)

- Use VE data to distinguish between relevant and non-relevant conditions
  - Relevant conditions
    - Evidence of reactor coolant leakage such as corrosion, boric acid deposits, and discoloration
      - Boric acid may appear as tightly adherent, spaghetti shaped, or ball shaped; may have a glossy texture
      - Evidence of possible reactor coolant leakage such as streaking, spray patterns, light residue over an area
  - Non-relevant conditions such as debris, insulation, foreign materials

MRP-60 Evaluation Process Guidance (continued)

- Relevant Condition Evaluation
  - Obtain chemical and radiological samples if sufficient material is present (MRP-372 Appendix A, Sampling and Analysis Guidance for Deposits Found on Reactor Pressure Vessels at Various Locations is a useful reference)
  - Perform light cleaning such as vacuuming or controlled compressed air (40-60 psi) to determine if deposit is tightly adhering
  - Review previous examination results for comparison to current examination results
  - Perform volumetric or surface examinations, if needed
  - Evaluate the relevant condition to determine the source of leakage and correct the source of leakage
    - Conditions not indicative of possible nozzle leakage is acceptable if corrected by repair replacement activity or by corrective measures necessary to preclude degradation

MRP-60 Evaluation Process Guidance (continued)

- Evaluate the relevant condition to determine the source of leakage and correct the source of leakage
  - Conditions not indicative of possible nozzle leakage is acceptable if corrected by repair replacement activity or by corrective measures necessary to preclude degradation
  - Conditions indicative of possible nozzle leakage is acceptable if repair/replacement activity corrects the defect in accordance with ASME Section XI IWA-4000
- Boric acid residue and crystals shall be removed to the extent necessary to allow adequate BMV examination and evaluation of the degradation. Evaluate all relevant conditions to determine the extent of degradation, if any.
  - Note: This may require aggressive cleaning such as dry-ice blasting, steam cleaning, or hot water cleaning, but sampling must be attempted before this step
- Prior to return to service a BMV of the previously masked surface shall be performed. The BMV shall be repeated at the next refueling outage.

MRP-60 Evaluation Process Guidance (continued)

- Documentation
  - It is recommended to document the examination results via photos of the nozzle in the as-left condition, particularly when conditions are evaluated for comparison to subsequent examinations.

Summary

- Many of the recently identified relevant conditions identified with the VE are not related to penetration leakage and need to be properly evaluated
- MRP-60, Revision 5 provides a good source of VE OE to prepare examiners for examinations by increasing their awareness of relevant conditions and images of relevant conditions
- Relevant conditions need to be properly evaluated to avoid unnecessary repair or supplemental actions
- MRP-60, Revision 5 provides guidance to assist utilities with the evaluation of VE results
  - Does not contain an NEI 03-08 element

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