



U.S.NRC
United States Nuclear Regulatory Commission

Protecting People and the Environment

NRC Independent Flaw Evaluations To Support Relief Requests For Dissimilar Metal Butt Welds

May 25, 2017

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No additional notes.

Discussion

- Purpose: Explain inputs needed for an NRC flaw analysis for dissimilar metal butt welds
- Topics
 - Background
 - Expected Need
 - Loads
 - Weld Residual Stress
- Outcome: Provide clarity to reduce the need for requests for additional information

No additional notes.

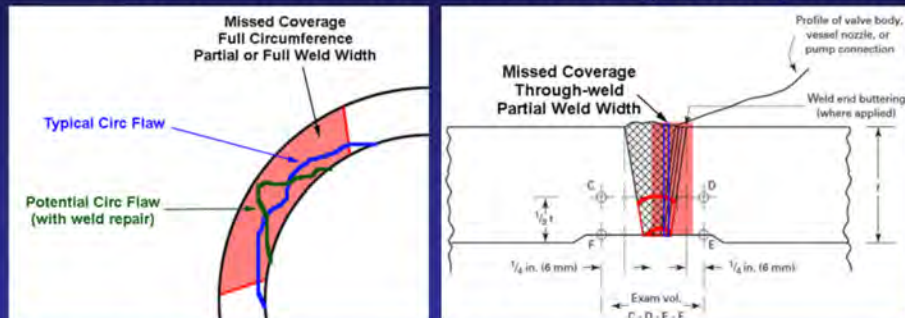
Background

- NRC review of licensee flaw analyses to support relief requests
 - MRP-287, “Primary Water Stress Corrosion Cracking (PWSCC) Flaw Evaluation Guidance,” 2010.
 - Weld residual stress profiles validated against previous industry submittals, NRC research, ASME Code evaluations and EPRI reports.
 - NRC NUREG on weld residual stress work based on NRC/EPRI Residual Stress Evaluation Program (Phases I through IV) output expected in Spring 2018.

For additional information on NRC NUREG see presentation on Weld Residual Stress NUREG.

Expected Need – Coverage & Inspection Frequency

- Coverage relief requests
 - Initial flaw size: detectable size during last inspection



- Inspection frequency relief requests
 - Cold leg temperature welds

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These are two examples of where flaw analysis calculations are used to obtain inspection relief or acceptance.

The NRC staff makes assessments of axial and circumferential flaws, at this time.

The initial flaw size used in a flaw analysis to determine hypothetical flaw growth during periods of operation, is a key input to determine inspection frequency acceptance.

The initial flaw size, in the case of limited inspection cover, should be based on the minimal detectable flaw size during the last inspection, not just a flaw that could exist in the area of missed coverage.

Expected Need - Mitigation

- Inlay/onlay relief requests
 - Initial flaw size depends on,
 - NDE performed, eddy current and/or ultrasonic
 - Qualified detection capabilities



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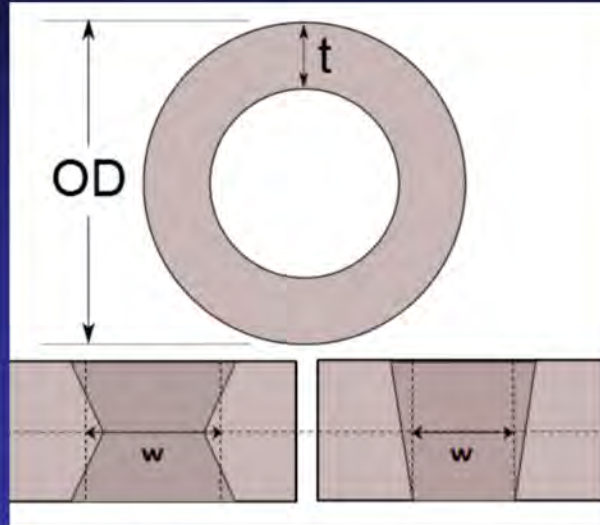
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Some licensees, with replaced SG, used Alloy 52/152 inlays. In order to obtain full inspection credit for use of an inlay for ASME Code Case N-770-2 or later, these licensees must submit a request for authorization in accordance with 10 CFR 50.55a(g)(6)(ii)(F)(2). As part of this request, in accordance with the rulemaking to adopt ASME Code Case N-770-1, the NRC has requested a flaw evaluation based on plant specific or bounding properties be provided to support the inspection frequency change.

NRC Flaw Analysis Input - Dimensions

- Outside Diameter (OD)
- Wall Thickness (t)
- Inlay Thickness
- Weld Width (W)



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The dimensions shown above are requested.

NRC Flaw Analysis Input - Loads

- Operating Temperature & Pressure
- Forces (preferred) or Stresses

Location	Loading	Fx (kips)	Mx (in-kips)	My (in-kips)	Mz (in-kips)
	DW				
	P		X	X	X
	Thermal				
	OBE/SSE				
	LOCA				

DW = Deadweight
 Thermal = Normal (100% Power) Thermal Expansion
 OBE = Operational Basis Earthquake
 SSE = Safe Shutdown Earthquake
 LOCA = Loss of Coolant Accident
 P = Axial force due to normal operating pressure
 Fx = Axial force
 Mx = Torsion moment
 My, Mz = Bending moment components

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Axial Membrane Stress:

Global Bending Stress:

Operating temperature and pressure are required. Loading, provided either as forces, the preferred method, or stresses is requested. The tables provided above are just examples of helpful ways to present this information. Please be clear on units.

NRC Flaw Analysis Input - Weld Residual Stresses

- Provide source of weld residual stress
 - Calculation
 - Reference
- Provide drawing, calling out significant details
 - Safe end weld and centerline distance between welds
 - Pipe bends or branch connections with distance from weld centerline and closest weld edge
- Provide operating condition stresses
 - Include temperature, shakedown, and hydro or explain exclusion (could cause a delay in review)
 - Pressure to be included or excluded, but should be noted

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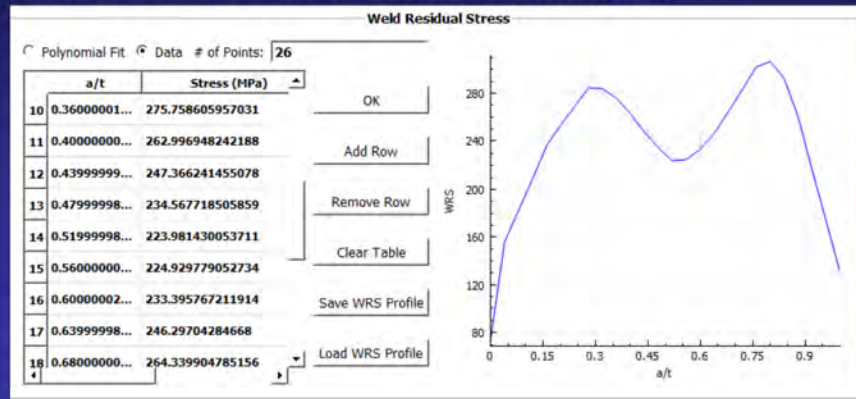
The information above is requested.

Please be clear as to what aspects are included in the flaw evaluation. Incorrect or limited information about what temperature, stresses or loads are included can cause significant delays in the processing of the relief request. This may result in additional RAI's or phone calls to identify why NRC calculations are not validating the licensee's analysis.

If the NRC staff is required to perform a weld residual stress analysis due to uncertainties in this area, NRC staff review time will be increased significantly.

NRC Flaw Analysis Input - Weld Residual Stresses

- NRC flaw analysis software can input up to 200 data pairs for residual stress analysis.



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No additional notes.

Conclusion

- This presentation is not meant to imply that a licensee must submit all of the identified information
- The purpose is to provide an understanding of the information the NRC needs to perform its confirmatory flaw analysis review
- Hopefully, with this information, there is clearer understanding of the NRC review and less need for RAIs.

No additional information is required.