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PDI Weld Overlay Program Update

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Overview

- Status of Optimized Weld Overlay work
- Status of Weld Overlay Indication Evaluation work
- PDI Overlay Program Enhancements

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OWOL NDE Qualification Status

- EPRI/PDI fabricated 3 new blind test specimens for OWOL UT Qualification
  - Specimen 1 - Shutdown Cooling Nozzle (13” OD)
  - Specimen 2 - Surge Nozzle (14” OD)
  - Specimen 3 - RCP Nozzle (37” OD)
- Specimens “material faithful” (i.e. SS safe-end w/Alloy-182 weld to CS/LAS nozzle and Alloy-52 WOL
- Axial and circ flaws embedded at depths down to 50% thru original DMW thickness
- Specimens/flaws/demonstrations & acceptance criteria comply with intent of ASME XI, Appendix VIII, Supplement 11
  - Actual demonstration criteria is being finalized
  - Builds on already qualified procedures capable of examining the outer 25% of original weld and base material

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Summary of Overlay UT Results

Thin pipe Non-Cast
Detect Circ & some Axials (50-75%) beyond outer 25%
Sizing - Not qualified Refining techniques

Thick Pipe Non-Cast
Detect & Size Circ & Ax in outer 25%
Detect Circs beyond outer 25%
Can't detect axial flaws beyond outer 25% Sizing – Not qualified Refining techniques

Thin Cast
Limited Detection of Circ & Ax flaws (Some flaws missed) -Not qualified
Sizing not qualified

Thick Cast
No detections
Sizing not qualified

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NRC RAI Background

- In 2005, EPRI developed guidelines for PWOL mitigation strategy, MRP-169 provided technical basis for Full-Structural and Optimized WOLs
- NRC issued RAIs on August, 2006 and February 2008 respectively
- Responses to all RAIs submitted to NRC in April 2008 and incorporated into MRP-169, Rev. 1
- Currently only outstanding issue regards OWOL inspection qualification

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NRC RAI Background (Cont'd)

- Approval/SER on MRP-169 before summer 2008 was requested during 2007 NRC meeting to support the applications of OWOL
- Initial OWOL implementation (fall 2008) was postponed due to NDE qualification concern and associated lack of SER on MRP-169

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Proposed Solution

- Proposed Solution to Address NDE Limitations
  - OWOL design should be based on 360° circumferential flaw, 75% thru-wall
  - Designs should be shown to meet Section XI Appendix C flaw evaluation rules for 100% thru-wall axial flaw
  - Fatigue and PWSCC crack growth should be performed to show no growth for 75% assumed initial flaw)
  - NDE to be conducted with expanded UT procedure which is PDI qualified to 50% thru-wall <u>for circ flaws only</u>
  - NDE <u>for axial flaws</u> to be performed using existing, FSWOL procedure (PDI qualified to 75% thru-wall)
    - new design analysis requirement to demonstrate that OWOL is effectively FSWOL for axial flaws
    - revised inspection requirement (outer 25% for axial + outer 50% circumferential flaws)

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MRP-169 Proposed New Schedule

Timeframe	Milestones
November 2008	NRC resumes reviewing MRP169 revision 1.0
February 2009	Submission of MRP169 Addendum or Revised MRP169 to NRC
June 2009	SER of MRP-169
Fall 2009/spring 2010	Implementation of OWOL by Utilities

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Summary OWOL Work

- Qualified to detect and size Circs and Axials in outer 25% in weld and wrought SS of FSWOLs and OWOLs
- Can't inspect overlays on Cast SS
  - CSS not included in examination volume as defined in N-770 or MRP-139 interim guidance
- Can probably qualify UT of OWOLs on non-cast materials and detect for 50% circs and 25% axials
  - Circs more 'critical' to detect
  - Axials will leak and not result in pipe break
  - Sizing not qualified yet
- PDI has not qualified a procedure for OWOL
  - Techniques have been evaluated and we are working on refining depth and length sizing techniques
  - Demonstrations will be performed early in 2008
- Code Case N-754 being developed to address code requirements for OWOL

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Status of Weld Overlay Indication Evaluation Work

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Weld Overlay Indication Evaluation

- The primary goal of this work is to;
  - Perform physical trials on available mock-ups in order to determine the achievable accuracy of the current techniques.
  - Evaluate advance techniques to determine if they could improve the accuracy of the examination.
  - Evaluate research and trials performed by other industry organizations in order to build on the technical basis of the technique.
  - Compile all available data into one report that can be used to support qualification of accurate techniques to that are capable of characterizing and sizing fabrication flaws in weld overlays.

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Weld Overlay Indication Evaluation

- 2007 work showed that accurate flaw sizing was possible and the
  - Significant improvements have been made in measuring the width of laminar flaws
  - Planar flaw sizing of embedded defects is possible
- EPRI report described the techniques used and documented the performance of the techniques
  - ***"Proposed Code Case Criteria for Technical Basis of Weld Overlay Indication Evaluation and Disposition Based on Advanced Technology Assessments Report*** *1015148"*

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Weld Overlay Indication Evaluation

- 2008 activity
  - Fabricated two additional mock-ups
    - Planar flaw sample
    - Laminar flaw sample
  - Each sample contains 30 flaws
  - Planar flaw sample contains both axial and circumferential flaws
- General Sample Dimensions/Specifications
  - Overlay Material Inconel 52M
  - Overlay Thickness 1.5”

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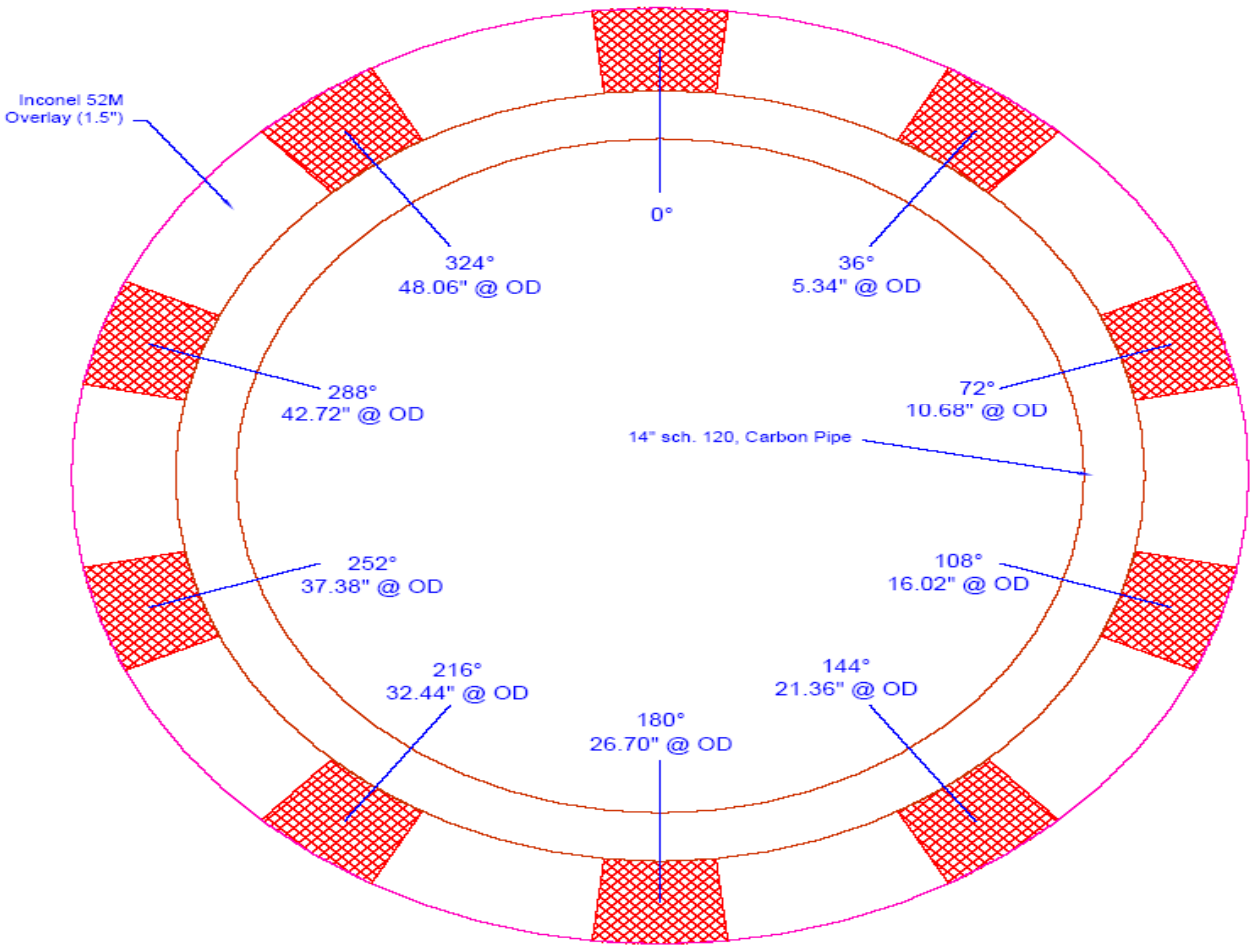
Planar Flaw Sample



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Planar Flaw Sample

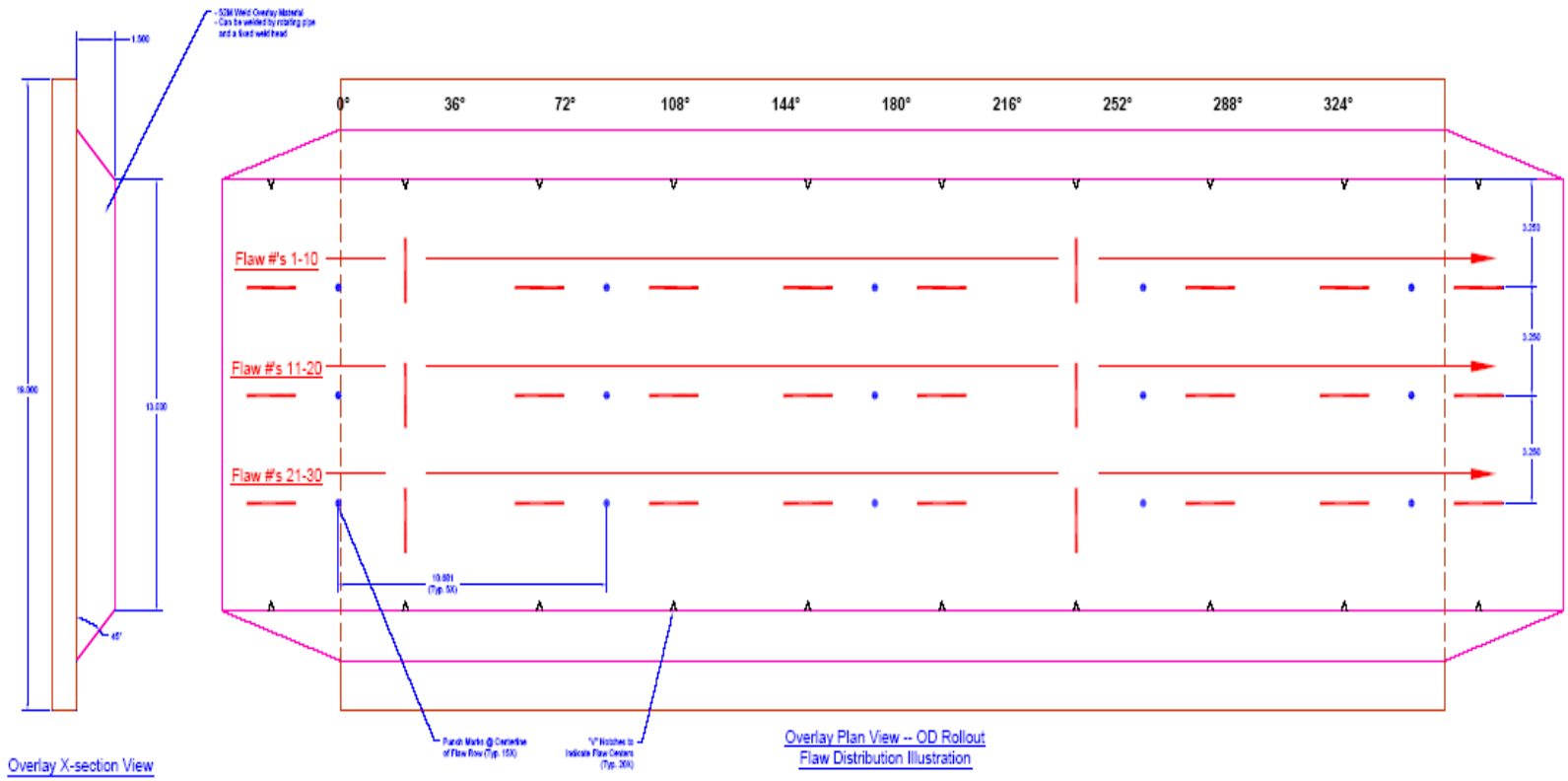

Figure 5-2
Sample roll-out and cross-sectional view

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Laminar Flaw Sample

- Similar dimensions as the planar flaw sample
  - Contains a variety of laminar flaws of different widths
    - Cannot show drawing due to security reasons

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Ongoing Activities

- New update report completed
  - ***"Proposed Code Case Criteria for Technical Basis of Weld Overlay Indication Evaluation and Disposition Based on Advanced Technology Assessments Report*** *1016652"*
- Technique evaluation on new samples are underway
- PDI Guideline being developed to address enhanced sizing techniques
- New EPRI report will be published at the end of 2009 which will include a detailed description of work

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Enhancement of PDI Weld Overlay Program

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PDI Weld Overlay Program Enhancement

- NDEC Steering Committee has approved project to enhance the PDI weld overlay program
  - Fabricate additional weld overlay samples
    - Optimized design overlays
    - Thicker overlays to expand procedures
    - Additional dissimilar metal weld samples
  - Project will increase total population of weld overlay samples available for blind testing and qualification
  - Work to start early 2009 and is scheduled to be complete by first quarter of 2010

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