AP1000 RCP Casing: Cast Stainless Steel Weld Inspectability

Westinghouse Electric Company

Agenda

- Safety Brief
- Purpose of the Meeting
- Compliance with DCD and ASME Code Requirements
- AP1000 RCP Casing Configuration and Examination Categories
- Current Volumetric (UT) Inspection Requirements
- Inspection Solutions
- Estimated Schedule
- Conclusions
- Questions and Actions

Purpose of the Meeting

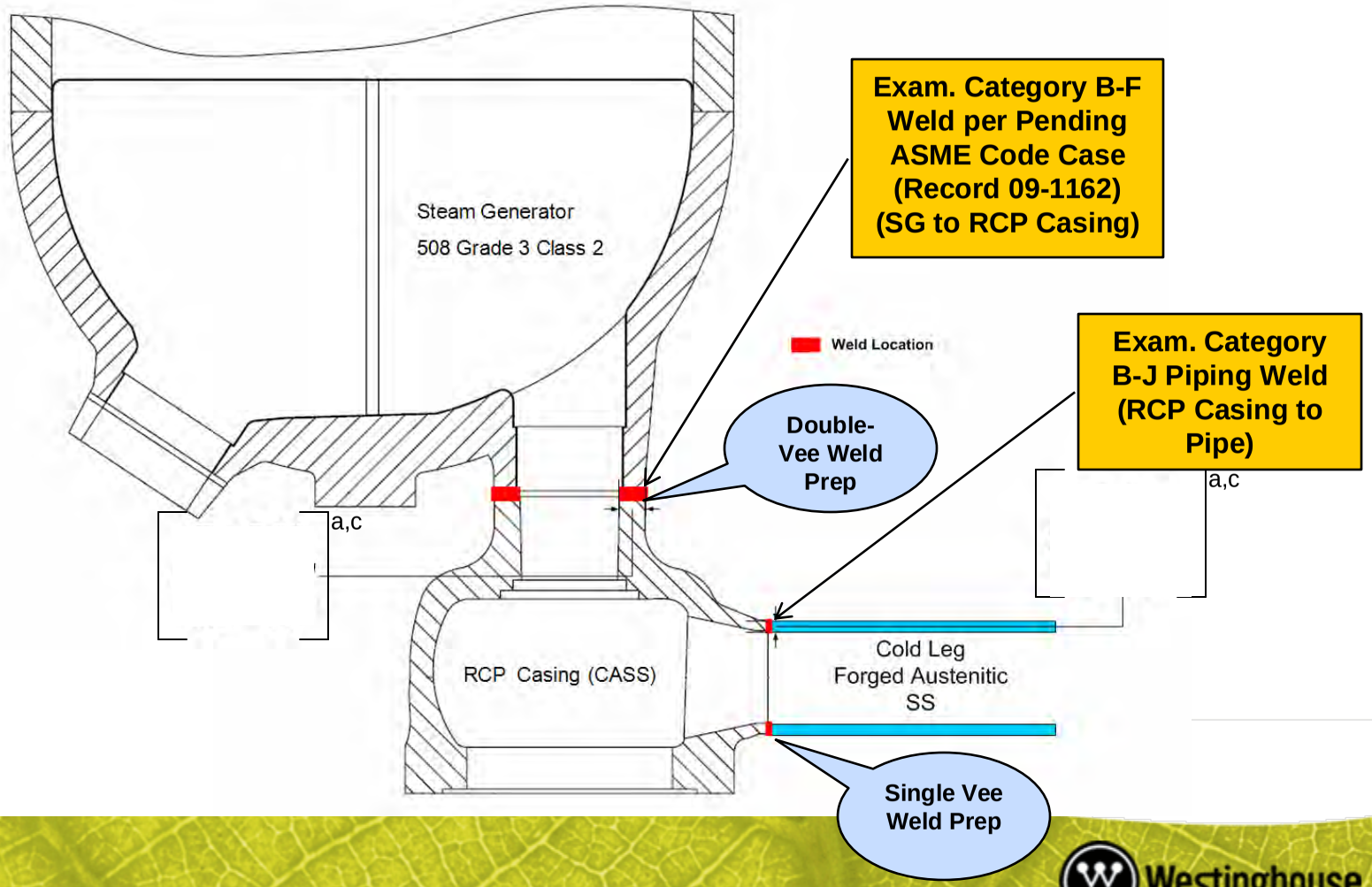
- Provide technical information on WEC examination plans for the RCP-SG and the RCP-MCL welds
- Demonstrate proactive approach consistent with current industry practice for Class 1 dissimilar and similar metal welds
- Provide schedule for actions
- Develop future communication plans

Compliance with DCD and ASME Code Requirements

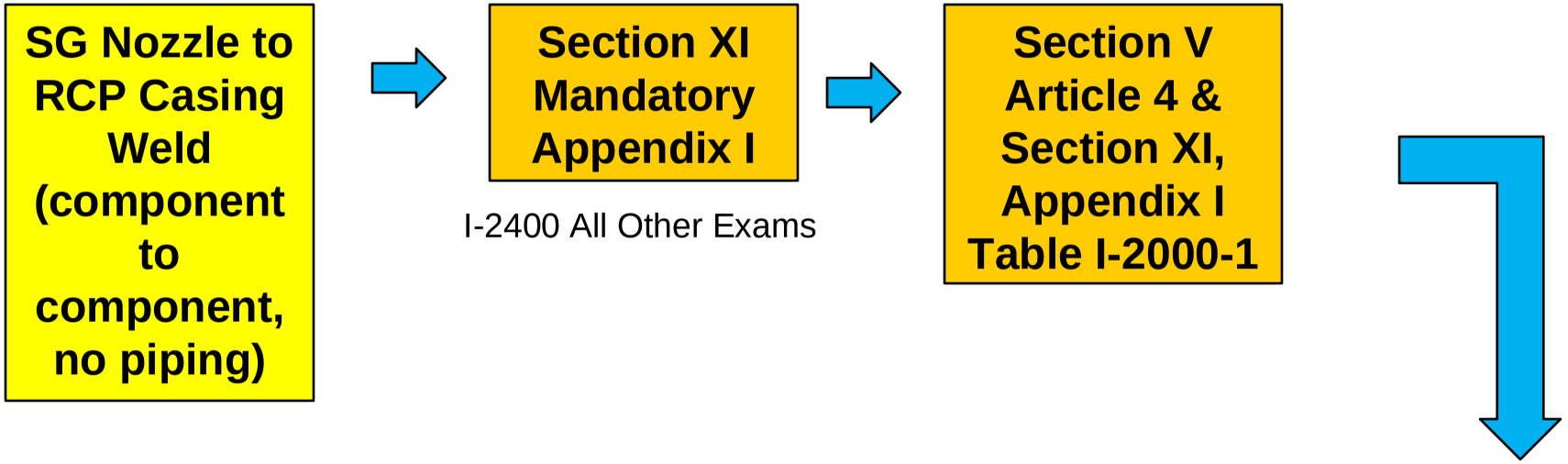
- The DCD mandates compliance with the following:
  - Access for inspection per Section XI, IWA-1500
  - Examination methods of Section XI, IWA-2200 (visual, surface, volumetric)
    - Volumetric – UT, RT

The S/G Outlet Nozzle to RCP Casing weld and RCP Casing to Main Coolant Loop Piping weld are included in these requirements

AP1000 RCP Casing Configuration and ASME Code Examination Categories



Current Volumetric (UT) Requirements - ASME Section XI Inspection Logic for CASS Materials



- **PSI/ISI logic is currently defined per Code rules**
- **No performance demonstration requirements**

Current Volumetric (UT) Requirements - ASME Section XI Inspection Logic for CASS Materials

RCP Casing to MCL Pipe Weld (component to pipe)

→ **Section XI Mandatory Appendix I**

I-2220 Welds in Piping

→ **Section XI Mandatory Appendix VIII**

Table VIII-3110-1: Component Qualification Supplements [Cast Austenitic in course of preparation]

→ **Section XI Mandatory Appendix VIII**

VIII-3110(c): [for piping welds whose requirements are in course of preparation, the requirements of Section XI, Appendix III as supplemented by Appendix I, Table I-2000-1 shall be met]

→ **Section XI Mandatory Appendix III**

Supplement 1 – Austenitic and Dissimilar Metal Welds

- **PSI/ISI logic is currently defined for cast SS materials per Code rules**
- **No performance demonstration requirements for cast SS materials**
- **Appendix VIII, Supplement 2 applicable for wrought SS of MCL pipe side of weld**

Compliance with DCD and Code Requirements

- For radiographic examination the requirements are defined in IWA-2231 and Section V, Article 2

Compliance with DCD and Code Requirements

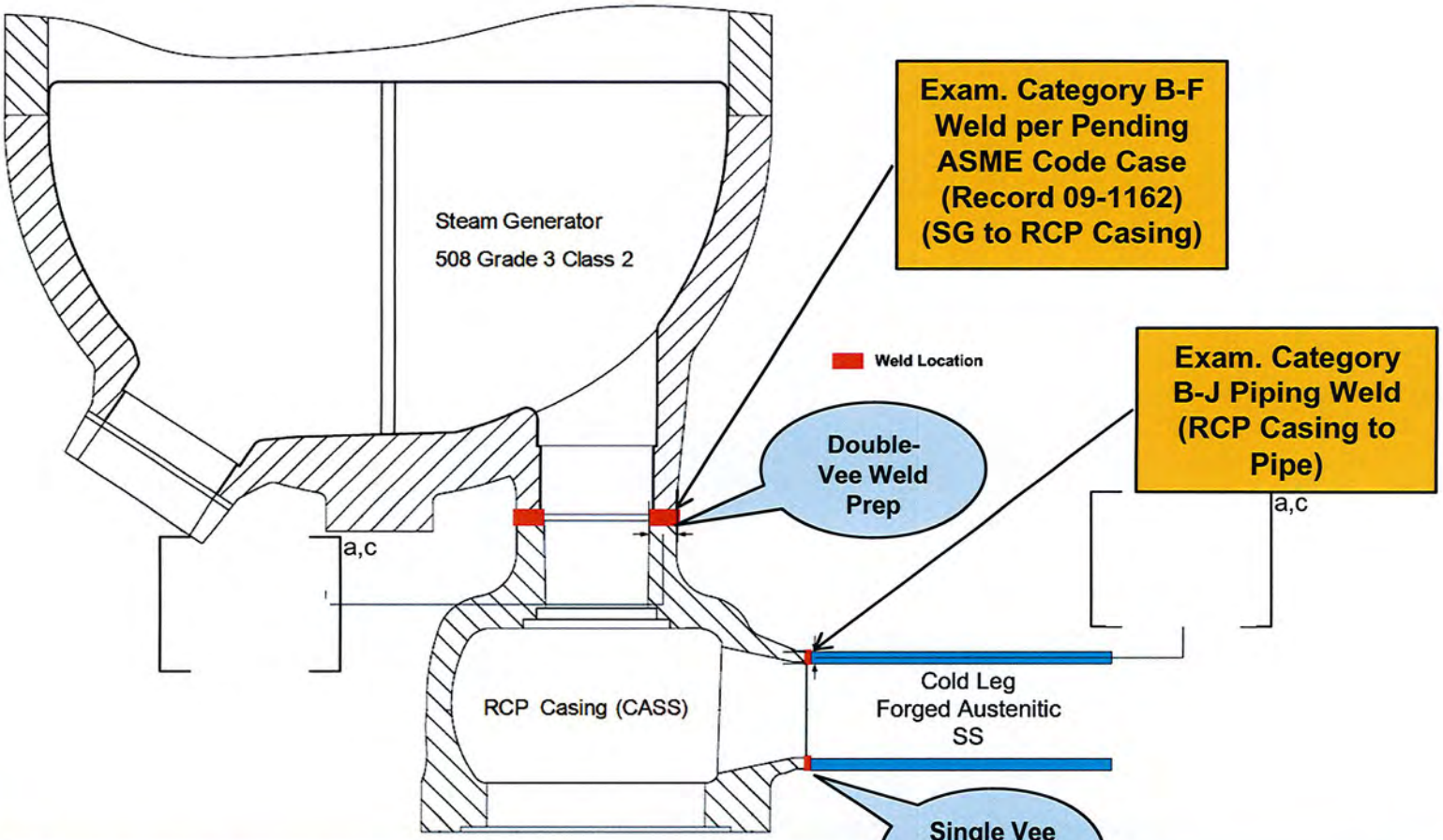
- The current design of the RCP casing attachment welds satisfy all DCD and ASME Section XI requirements for examination
- No relief is needed to meet the applicable DCD and ASME Section XI requirements

Changing Environment

- The use of radiography for pre-service and in-service inspection is being challenged
- Performance demonstration of UT inspection systems is expected

As such, Westinghouse and the COL applicants are looking beyond current requirements

AP1000 RCP Casing Configuration and ASME Code Examination Categories



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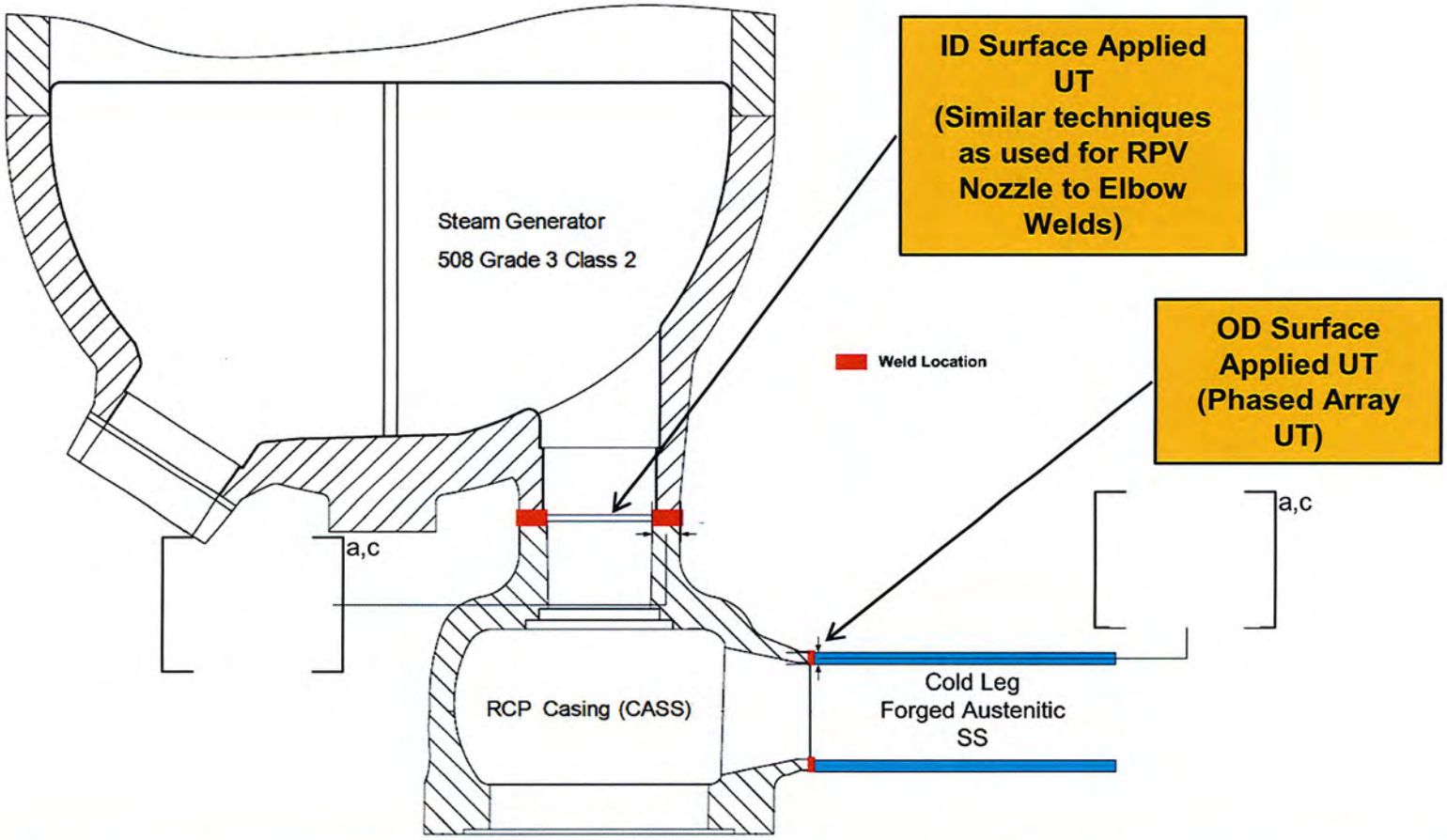
AP1000 RCP Casing Weld UT Inspection Logic for PSI/ISI



Inspection Solution Approach

- Consistent with ASME Code Section XI, Appendix VIII and PDI requirements, where applicable (i.e. diameter and thickness ranges) assuming non-cast SS materials
- Incorporate performance demonstration consistent with methodology in ASME Code Section V, Article 14 for procedures and personnel for the cast SS materials
- Use EPRI as the PDA

Inspection Solution Project Team

Implementers

- **Westinghouse**
- **WesDyne**
- **EPRI**

Technical Advisory Team

- **Westinghouse**
- **WesDyne**
- **EPRI**
- **Southern Nuclear**
- **SCANA**

Inspection Solution Plan

- EPRI to fabricate 2 qualification test specimens representative of each weld configuration; one ‘open’ specimen and one ‘blind’ specimen
- A technical justification is prepared for each weld configuration and submitted to EPRI for independent assessment
- A procedure performance demonstration (non-blind) is conducted for each weld configuration with EPRI as the administrator in accordance with EPRI/PDI protocol document
- Personnel performance demonstrations (blind) are conducted for each weld configuration with EPRI as the administrator in accordance with EPRI/PDI protocol document
- PSI conducted with qualified procedures and personnel

Qualification Test Specimens (Mockups)

- Qualification flaw matrix defined in the technical justifications
- Specimens (particularly blind specimens) designed and fabricated by EPRI
- Blind specimens controlled under the EPRI/PDI protocol document

Inspectability Assessment of Materials

- Secondary Program Objective:
  - Develop a non-destructive in-shop process by which the inspectability of CASS RCP pump casing material (production) can be determined to be within the bounds of the PSI performance demonstration. Possible methods:
    - Comparison of through-wall macrostructures (macro-etch comparison)
    - UT characterization (attenuation, degree of beam skewing, shear/longitudinal wave ratios, etc.)

EPRI Involvement

- Design and fabricate representative flaws in the cast materials while minimizing changes in base material
- Design and fabricate flawed mockups in a controlled manner consistent with EPRI/PDI protocol document
- Maintain confidentiality of the ‘blind’ mockups consistent with EPRI/PDI protocol document
- Parallel developments on the inspection of cast materials
- Conduct of procedure and personnel performance demonstrations consistent with EPRI/PDI protocol document

Tentative Schedule

- Acquisition of Test Specimen Materials – [ ]a,c [long lead items]
- Test Specimens Design – [ ]a,c
- Technical Justifications (1st Issue) Development – [ ]a,c
- Non-Blind Test Specimens Completion – [ ]a,c
- Inspection Procedures Final Development – [ ]a,c
- Blind Test Specimens Completion – [ ]a,c
- Procedure Performance Demonstrations – [ ]a,c
- Personnel Performance Demonstrations – [ ]a,c
- Technical Justifications (Final Issue) – [ ]a,c
- PSI – [ ]a,c

Project Challenges

- Schedule
- Inspectability of cast SS materials
- Realistic flaws suitable for qualification purposes

Conclusions

- Westinghouse moving forward with new plant customers to develop high quality, proactive plant specific demonstration program for the RCP/SG and RCP/MCL connection welds
- Work will be consistent with Industry Standards for demonstration program
- Results of demonstration program not directly applicable to existing plants; specific to AP1000 materials and configurations
- Goal to keep NRC informed of progress and maintain periodic communications and be open to feedback

Future Direction

- Results of work can be factored into the ASME Code process to the extent practical

QUESTIONS & ACTIONS