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Alloy 690/52/152 PWSCC Degradation Research Collaboration Status

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Research Motivation

- PWSCC degradation of Alloy 600 and its weld metals continues to plague plants
- Current/planned use of high chromium replacement materials (e.g. Alloy 690/52/152) requires data (on PWSCC at this time) to allow:
 - Understanding of degradation mechanism
 - Reliable predictions on component life (initiation and growth)
- 2008 review of existing knowledge of PWSCC in Alloys 690/52/152 identified substantial gaps that need to be addressed

Industry Research Objectives

- Understand PWSCC degradation (initiation/growth) mechanisms in thick-wall RCS components and develop predictive tools to:
 - Support utility asset management decisions (existing and new plants)
 - Develop basis for optimized inspection requirements
 - Identify improvements in material production, processing & component installation (including welding) to minimize degradation during service
 - Develop flaw disposition curves

Alloy 690 Expert Panel/Collaboration

- Started in 2006/2007 as an expert panel to determine knowledge gaps (MRP-237, Rev 1 published in 2008)
- Transitioned to a collaboration to conduct research to address knowledge gaps
- Data from collaboration for subsequent consideration by one or more expert panels to develop usable products
- Current format is of a collaboration to conduct PWSCC research
 - Working Groups with designated experts established in 2008 to focus in on key aspects of the topic

Collaboration Objectives

- Consolidate knowledgebase on Alloy 690/52/152 PWSCC
- Address knowledge gaps using:
 - Generally-accepted test methods
 - Well-characterized test materials
- Goal is to reach the end-point quicker and at a lower cost to each participant
- Continuing need is to obtain consensus from this group on test matrices for base (including HAZ) and weld metal PWSCC initiation and growth testing
 - This includes definition of test materials

Collaboration Participants

- EPRI
- NRC
- BMPI
- BPMI
- EDF/MAI
- Ringhals/Studsvik
- Rolls Royce/SERCO
- KAERI
- UNESA
- MHI
- VTT
- Thyssen-Krupp
- Valinox
- Sumitomo

Alloy 690/52/152 Collaborative Research Program

Organizational Structure

- **Coordinating Committee ("C"):**
 - K. Ahluwalia (EPRI)
 - D. Dunn (NRC RES)
 - J. Hickling (Technical Secretary)
- **Working Group #1: Crack Initiation ("I"):**
 - *Leader: F. Vaillant (EDF R&D, France)*
- **Working Group #2: Crack Growth ("G"):**
 - *Leader: P. Andresen (GE-GRC, USA)*
- **Working Group Group #3: Data Application ("A"):**
 - *Leader: S. Fyfitch (AREVA NP Inc., USA)*

Alloy 690/52/152 Collaborative Research Program

Working Group #1: Crack Initiation ("I")

- **Scope:** WG#1 will focus on PWSCC initiation in 690/52/152
- **Leader:** *F. Vaillant (EDF R&D, France)*
- **Current Membership:**
 - *T. Allen (Uni. of Wisconsin, USA) / G. Was (Uni. Of Michigan, USA)*
 - *S. Bruemmer / M. Toloczko (PNNL, USA)*
 - *H. Hänninen / U. Ehrnsten (HUT / VTT, Finland)*
 - *S. Kim (KAERI, South Korea)*
 - *D. Morton (KAPL, USA)*
 - *D. Tice (SERCO TAS, UK)*
- **Initial Task:** assess what types of studies are required and how best they should be carried out.

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Working Group #2: Crack Growth (“G”)

- **Scope:** WG#2 will focus on PWSCC crack growth rate in 690/52/152
- **Leader:** *P. Andresen (GE-GRC, USA)*
- **Current Membership:**
 - *B. Alexandreanu (ANL, USA)*
 - *D. Gomez-Briceno (CIEMAT, Spain)*
 - *A. Jenssen (Studsvik, Sweden)*
 - *D. Paraventi (Bettis, USA)*
 - *M. Toloczko / S. Bruemmer (PNNL)*
- **Initial Task:** review data currently being generated, determine gaps and optimize further testing activities.

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Working Group #3: Data Application (“A”)

- **Scope:** WG#3 will focus on data application for PWSCC of Alloys 690/52/152
- **Leader:** *S. Fyfitch (AREVA NP Inc., USA)*
- **Current Membership:**
 - *P. Efsing (Ringhals, Sweden)*
 - *C. Marks (DEI, USA)*
 - *D. Dunn (NRC-RES, USA)*
 - *M. Morra (GE-GRC, USA)*
 - *E. Willis (EPRI, USA)*
 - *T. Yonezwa (Tohoku University, Japan) / Takaharu Maeguchi (MHI- Japan)*
 - *G. Young / E. Richey (KAPL, USA)*
- **Initial Task:** discuss and decide what materials and material conditions need to be tested to ensure that the experimental data generated (for both initiation and growth) are properly understood. Later, this group will take the lead in assessing the practical relevance of PWSCC data for thick-walled Alloy 690 and its weld metals.