United States Nuclear Regulatory Commission Official Hearing Exhibit

 In the Matter of:
 Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3)

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NRC Perspectives on PWR Materials Issues

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Introduction

Retired St. Lucie Pressurizer Nozzle Flaws

• Highly complex technical issues

• Significant level of attention by all NRC stakeholders

 Level of dedication by staff on both sides to try to get things right



PWR RPV Internals Aging Management

- Historical Background
 - PWR internal components may be subject to a number of degradation mechanisms
 - Degradation management an issue for license renewal and power uprates
 - Materials Reliability Program project



PWR RPV Internals Aging Management

Topical Report MRP-227 submitted for NRC review in Spring 2009

- Evaluated components based on susceptibility to a variety of mechanisms and consequences of component failure
- Divided components into several "bins" for inspection
- Identified inspection technologies to be used for component inspection



PWR PWR Internals Aging Management

Next steps

- Review of MRP-227 is a high priority
- The NRC staff is continuing to work with MRP and EPRI regarding staff concerns related to MRP-227
- Review of plant-specific aging management programs
- Implementation of MRP-227 by other licensees



Davis-Besse RPV Head Cracking

- Historical background
 - Cracking and head corrosion in 2002
 - Replacement head from Midland installed also Alloy 82/182/600
 - How long before PWSCC would be observed in the replacement RPV head?



Davis-Besse RPV Head Cracking

➤Current status

- Licensee performed RPV head inspection in Spring 2010 and found evidence of boric acid deposits and indications of primary water stress corrosion cracking in their nozzles and welds
- The inspections identified penetration nozzles and/or welds with indications of cracking
- Timing and extent of cracking was unexpected



Davis-Besse RPV Head Cracking

- ≻Next steps
 - Licensee performing half-nozzle repairs on all nozzles with indications
 - NRC staff reviewing licensee's engineering assessment of the as-found condition of the RPV head
 - Potential generic implications



ODSCC of Stainless Steel Piping

Recent operating experience

- Fall 2008 Leak in Callaway Pressurizer Auxiliary Spray Line
- Fall 2008 Indications in Wolf Creek Pressurizer Auxiliary Spray Line
- Fall 2009 Leaks found in multiple lines at San Onofre, Units 2 and 3



ODSCC of Stainless Steel Piping

➤Current status

- Industry researching operating experience databases for additional instances of ODSCC
- Typical instances of ODSCC involved TGSCC due to chloride contamination of 304 stainless steel piping
- NRC preparing an Information Notice



ODSCC of Stainless Steel Piping



- Industry in the process of developing inspection and evaluation guidelines to be issued under NEI 03-08, "Guideline for the Management of Materials Issues"
- NRC staff will continue to monitor operating experience and review industry guidelines when issued



Repair and Mitigation Technology

Focus on repair or mitigation of PWSCC in Inconel piping butt welds

- Weld overlay/inlay/onlay repair and mitigation
- Mechanical stress improvement
- Developments in welding-based repair and mitigation technology have lead to a variety of repair options



Repair and Mitigation Technology

- >NRC staff focus areas
 - Welding with Inconel Alloy 52

Implementation of new or advanced welding techniques

 Implications of the application of weld overlays to Leak-Before-Break approvals



Repair and Mitigation Technology

≻Next Steps

 NRC will continue to place significant resources on monitoring and reviewing the development of welding-based repair and mitigation technology

 Issuance of Regulatory Issue Summary (RIS) regarding weld overlays and Leak-Before-Break





- Understand that the NRC staff looks at every materials degradation issue from both a plantspecific and generic perspective
- Communication between the industry and NRC is a key issue
- Proactive measures to deal with potential issues are better than reactive measures to deal with an emerging significant issue