



OVERVIEW OF RES/DET NONDESTRUCTIVE EVALUATION RESEARCH PROGRAMS

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WHY DO WE NEED NONDESTRUCTIVE EVALUATION?

- **Nondestructive examination (NDE) provides defense in depth by detecting flaws in reactor components.**
- **The goal of inservice inspection (ISI) programs using NDE is to detect these flaws before they become safety significant.**
- **NRC performs research to verify the effectiveness of various NDE methods, and determine flaw population characteristics**



FOUR CURRENT RES/DFERR NDE PROJECTS

- 1. Evaluate reliability of non-destructive examination (NDE) techniques**
- 2. Non-destructive and destructive examination of salvaged control rod drive nozzles and J-welds from North Anna 2 to verify NDE field and laboratory results**
- 3. Piping – International cooperative research on NDE Reliability**
- 4. Inservice inspection (ISI) and leak monitoring techniques and requirements for light-water reactor components susceptible to degradation**



OVERALL OBJECTIVES

- **As related to ISI, establish reliability of and evaluate improvements to:**
 - Current field deployed NDE methods
 - State-of-the-art NDE (e.g., phased arrays, synthetic aperture focusing technique [SAFT])
- **Evaluate impact of ISI reliability on reactor system component integrity**
 - Where needed, develop improvements for ISI programs (recommendations to ASME Code) to ensure structural integrity



OVERALL OBJECTIVES (cont'd)

- **Provide expert assistance to NRC Staff on events at facilities**
- **Support international programs and technical exchanges to defray the cost of large scope research programs**



Evaluate Reliability of NDE Techniques

- **Stress corrosion cracking in reactor components**
 - Assessment of ultrasonic testing (UT) for reactor internals
 - Assessment of visual testing (VT) for reactor internals
- **Develop density and distribution functions for fabrication flaws in reactor pressure vessels to support the NRC reevaluation of pressurized thermal shock**



Evaluate Reliability of NDE Techniques (Cont'd)

- **Evaluating Performance Demonstration**
 - Coordination with EPRI NDE Center Performance Demonstration Initiative (PDI)
 - ASME Section XI Appendix VIII
 - ASME Task Group assessing the use of eddy current testing
- **Evaluating Inspection**
 - Cast stainless steel
 - Far side inspection of dissimilar metal welds
 - Far side inspection of austenitic stainless steel
 - Cladding



Evaluate Reliability of NDE Techniques (Cont'd)

- **Assessment of advanced NDE methods**
 - SAFT (synthetic aperture focusing technique)
 - Phased arrays
- **Supporting NRC staff in reviewing technical bases of risk-informed inservice inspection (RI-ISI) programs**



Examination of North Anna 2 CRDMs

- **Cooperative effort with EPRI to perform NDE and destructive evaluation (DE) of salvaged control rod drive nozzles and J-groove welds**
- **Correlate field and laboratory NDE findings with DE results**
- **Identify crack initiation sites, investigate leak paths and crack propagation**



Piping – NDE Reliability

- **Development of fabrication flaw density and distribution functions for piping and dissimilar metal welds**
- **NRC international cooperative program for the inspection of nickel-alloy components (PINC)**



Piping – NDE Reliability (Cont'd)

- **PINC addresses generic issue of primary water stress corrosion cracking (PWSCC) in nickel-alloy components (base metal and welds)**
- **3rd year of 4 year program**
 - **Participants: SKI, JNES, Tohoku Univ., Japanese PWR industry team, and EPRI**
 - **Developing: VTT, KINS, JRC, and 3 others**



Piping – NDE Reliability (Cont'd)

- **Task Group developing electronic “Atlas” of PWSCC morphology and associated NDE responses**
- **Task Group assessing effectiveness of NDE for PWSCC in control rod drive nozzles, dissimilar metal welds, and bottom mounted instrumentation nozzles**



Program for Materials Degradation Management

- **Eliminate future materials degradation surprises**
- **NRC developing an international cooperative program**
 - **First meeting in August 2005**
- **Using GALL Report to assess effectiveness of ISI programs for components that have experienced degradation or are susceptible to degradation**
 - **ISI and Leak Monitoring Techniques for LWR Components Susceptible to Degradation**



Program for Materials Degradation Management (Con't)

- **Collect probability of failure data and uncertainty estimates for passive components**
- **Use probabilities of failure of passive components in regulatory decision making.**



Questions/ Additional Information

- **Further details on any of these projects can be provided:**
 - **Evaluate Reliability of NDE Techniques;
Examination of North Anna 2 CRDMs: W. Norris**
 - **Piping – NDE Reliability:**
 - **C. Moyer**
 - **Program for Materials Degradation Management:
S. Malik/J. Muscara**