

**4rd NRC – AERB Nuclear Safety Projects Meeting
August 30 – September 3, 2004**

Non-Destructive Examination (NDE) – Regulatory Perspectives



Edmund Sullivan, Senior Level Advisor
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Email: EJS@nrc.gov Phone: 301-415-2796



United States Nuclear Regulatory Commission

Overview of Presentation

- Industry Examiner Training / Qualification
- Non-UT Performance Demonstration Topics
- Steam Generator (SG) Analyst and Technique Qualification
 - NRC Perspectives



United States Nuclear Regulatory Commission

ASME Code Qualification of NDE Personnel

- Section XI, IWA-2300 governs personnel training and qualification for exams performed to prescriptive procedures
 - ANSI/ASNT SNT-TC-1A for Section XI through 1992 Edition
 - ANSI/ASNT-CP-189 for Section XI, 1992 Addenda and later
 - Alternative to CP-189 - ASNT Central Certification Program; provides independent transportability of NDE certification
 - App VII for qualification of UT personnel



United States Nuclear Regulatory Commission

ASME Code Qualification of NDE Personnel

- Sec XI, App VIII, governs personnel and procedure qualification for performance-based (P-B) UT exams
 - Required for reactor vessel and Class 1, 2, and 3 piping
 - Training per IWA-2300
 - Statistically based
 - Includes sizing tolerances
 - Annual training and re-cert to Sec XI, App VII



United States Nuclear Regulatory Commission

Future ASME Code Direction for Qualification of NDE Personnel

- Section V working on an article to establish P-B qualifications for all **non-App VIII** UT
- Section XI working on proposal to use ACCP program for all NDE methods
 - Performance-based qualification
 - Re-cert by practical examination
 - Annual training/practice
- P-B direction consistent with Commission direction on P-B regulation
- P-B direction may facilitate eventual interchange of U.S. and overseas examiners



United States Nuclear Regulatory Commission

Vessel Bottom Head Penetrations (VBHP)

- Leakage found in VBHPs at South Texas Project, Unit 1 (STP 1) in 2003
- UT of all STP 1 VBHPs
- UT relied on TOFD and 0^0 L-wave probe
- Found cracks in 2 VBHPs and lack of fusion (LOF) in all penetration to weld interfaces
- LOF determined to be a contributing factor to cracking



United States Nuclear Regulatory Commission

Vessel Bottom Head Penetrations (VBHP)

- Industry Materials Reliability Project (MRP) performing a safety assessment on VBHPs to develop recommended long-term inspections
- MRP considering inclusion of LOF reflectors in mockups, demonstrate capability to detect LOF – short-term
- MRP expressed goal of transitioning from demonstrations to performance-based qualification program for inspections – long-term



United States Nuclear Regulatory Commission

SG Analyst Qualification

- Conducted by industry in accordance with EPRI SG Examination Guidelines - **Appendix G**
 - Industry standard
 - Requires written program for control and admin
 - Requires minimum of 40 hours training
 - Requires written and practical examination
 - Requires 8 hours of annual training and requal every 3 to 5 years



United States Nuclear Regulatory Commission

SG Analyst Qualification - Written

- Written examination based on:
 - Known tube degradation
 - B&W, Combustion Engineering and Westinghouse SG operating experience
 - Tube examination techniques
- Passing grade of 80% required to proceed to practical examination



United States Nuclear Regulatory Commission

SG Analyst Qualification - Practical

- Practical examination based on:
 - All known damage mechanisms – thinning, pitting, wear, ODSCC, PWSCC, impingement
 - Test data is from actual SGs examinations using techniques acquired by Appendix H techniques



United States Nuclear Regulatory Commission

SG Analyst Qualification - Practical

- Requires evaluation of approx. 5000 intersections
- Correct answer based on expert opinion
- Passing grade on each mechanism required to be considered a Qualified Data Analyst
- Criteria on POD and CL on indications, on RMS sizing error, on orientation, and on overcall rate



United States Nuclear Regulatory Commission

SG Technique Qualification

- Conducted by industry in accordance with EPRI SG Examination Guidelines-**Appendix H**
 - industry standard
 - Provides performance demonstration qualification requirements



United States Nuclear Regulatory Commission

SG Technique Qualification

- Sample sets may be fabricated using mechanical or chemical methods – similar signals to those observed in field
- EDM notch samples are replaced with crack samples as they become available (can result in a technique becoming unqualified)
- Flaw dimensions for samples must be verified



United States Nuclear Regulatory Commission

SG Technique Qualification

- Detection – minimum of 11 flawed grading units " 60% TW
 - Provides 80% POD @ 90% CL " 60% TW
- Sizing
 - Minimum of 5 additional flaws 20 – 59% TW



United States Nuclear Regulatory Commission

NRC Perspectives

- NRC's SG regulatory framework is largely performance-based with prescriptive elements
- NRC provides comments on but does not approve EPRI SG guidelines
- NRC focuses attention on inspection qualification if likely to or shown to contribute to failure to meet performance criteria