ANDE-1
ASME Nondestructive Examination and Quality Control Qualification and Certification Standard

National Board Chief Inspectors Meeting
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Presentation Outline

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Why ANDE?

Industry events, 30 years of round robin studies and recent operating experience (OE) indicates industry action needed to improve the performance and reliability of non-destructive examination and inspection.
ANDE Program Objective

- Review NDE performance indicators and other data that establish need for improvement
- Compare current NDE personnel qualification & certification process gaps to INPO guidelines
- Establish solution using best practices
- Pursue funding and support
- Develop training/examinations
- Implement
NDE Issues Overview

• Decline in qualified workforce due to attrition
• Increasing demand of qualified workforce due to aging plant issues and competing industries
• Variations in employer based qualification and certification
• Human performance issues
• Existing personnel qualification and certification (PQ&C) processes do not align with INPO guidelines and best practices used for other nuclear power plant workers
Industry Studies Show Performance Trends

- Pressure Vessel Research Committee 1971
- US Airforce 1974-78
- PNNL-Piping Inspection Round-Robin (PIRR) 1981-82
- PNNL-Mini Round Robin (MRR) 1986
- European Base Problem for Inspection of Steel Components (PISC 1, 2 & 3) 1985-94
- United Kingdom Program for the Assessment of NDT in Industry (PANI) 1999
- American Petroleum Institute 2001 “API Personnel Proficiency Program-UT”
Industry Experience

• Introduction of Intergranular Stress Corrosion Cracking (IGSCC) in 1982 at Nine Mile Point

  In 1983 EPRI/NRC/BWROG Three-Party Agreement introduced performance demonstration exams resulting in a 19% first attempt and 50% 3 year recertification pass rate

• Thermo Fatigue Cracking in Steam Generator Feed Water Nozzles in Late 1980’s and Early 1990’s

  IGSCC qual. examiners miss called flaws leading to weld failure

• Primary Water Stress Corrosion Cracking in Steam Generator Tubing in late 1980’s early 1990’s

  EPRI Guideline NP-6201 first introduced in 1992 with NEI 9706 required in 2000 for Eddy Current Testing Qualified Data Analyst (QDA)
Industry Experience con’t

• Stress Corrosion Cracking in Alloy 600/82/182 Materials
  Started in the Early 2000’s with NDE Human Performance
  Issues affecting over 20 utilities. One utility has been off
  line 105 days over the past 3 years at a cost of over
  $150M for repairs and lost revenues.

• ASME Section XI, Appendix 8 (PDI) was Implemented in
  the Early 90’s to Address these Performance Issues. Since
  then over $175M has been spent with First Attempt Pass
  Rates going unchanged at approximately 50%. See EPRI
  Number=’ML12342A249’
“... exposure to training and job experience (in accordance with the current employer based process) does not necessarily lead to job proficiency.”

“The pass rate obtained by experienced (NDE) certified personnel is rarely 50% on first attempt at a demonstration test that simulates the examination conducted in the field.”

“Results such as these are not puzzling if one recognizes that unstructured training and job experience may or may not include the key factors that are essential for learning.”
Steven R. Doctor, Ph.D., Laboratory Fellow, Applied Physics/National Security Directorate, NRC consultant and recently retired department manager Pacific Northwest National Laboratory stated in a paper presented at a conference in Chicago, “....detection of these degradation processes did not occur by ISI (in-service inspection by NDE) but were first found by water on the floor.”
Regulatory Perspective

January 12, 2010 NRC Letter to ASME:

“The issue regards questionable qualifications of Nondestructive Examination (NDE) personnel which relate to the ASME Boiler and Pressure Vessel Code (Code). Title 10 of the Code of Federal Regulations (10CFR) 50.55a(b) incorporates by reference the ASME Code, Sections III and XI. The Code addresses qualifications of NDE personnel; thus, these requirements become regulatory requirements with implications across the entire nuclear fleet.”
Regulatory Perspective con’t

• After presenting the NRC’s concern about the most recent 13 events at the June 2013 EPRI NDE Issues meeting, Wally Norris made the following statement:
  • “Who steps back and reviews NDE performance from a broad perspective?
  • The answer is “no one”
  • INPO performs assessments/evaluations of other functional areas in nuclear power plants, but NDE/QC has not been included.
How Does ANDE Differ?
Current Employer Based PQ&C Process

Employer Based Training, Experience, and Examination does not align with INPO Guidelines and Best Practices:

- Implementation varies from Employer to Employer
- Training-Minimum hours only required, No Std, No Industry Evaluation, No Accreditation, No Job Task Analysis (JTA)
- Experience-Time Based Only, No Criteria or Guidance provided, No Qual Cards
- Written Examinations-Only Minimum # of Questions Req’d, No JTA, No Std Level of Difficulty, No Way to Evaluate Effectiveness and Quality of either written or practical exam
- Practical-Costly for each employer with limited sample sets (only 2 req’d/method, 1/technique), typically does not address fabrication and in-service conditions expected in the field
- No Effective way to incorporate operating experience (OE) into decentralized process
- No way to address individual performance issues to retrain/retest/recertify
How Does ANDE Differ? con’t
ANDE Initiative

• New ANDE-1 Standard includes INPO Guidelines with Systematic Approach to Training (SAT), Performance Based concepts, and Psychometric principles
• ANDE-1 Specific Industry Sector (SIS) provision for “Nuclear” in Appendix I. PVP (Non-Nuclear) SIS provision approved October 2, 2015 in Case II/Appendix II
• High School Diploma or equivalent required
• Detail training reqts developed through job task analysis (JTA)
• Standard descriptive experience requirements specified in qualification cards based on JTA
• Centralized examination data base developed using JTA and psychometrics
• Standard performance based practical examinations with realistic flawed samples simulating fabrication and in-service field conditions based on JTA
• Written and practical examinations will be administered by an ASME Certification Body as an independent third party establishing a standard process of evaluation while assuring program integrity
• INPO SAT process (continuous improvement) provides feedback from field performance for continuous training and exam improvement
• Through web based options, deliver written and ship practical (test kits) to utility or vendor locations (when possible) with oversight by authorized inspection agencies
ANDE Qualification and Certification Program
Methods/ Disciplines

• NDE Certifications
  - Ultrasonic
  - Radiographic
  - Magnetic particle
  - Liquid penetrant
  - Visual
  - Eddy Current

• QC Inspection Certifications
  - Mechanical
  - Civil
  - Electrical
  - Instrumentation & Controls
  - Welding
  - Receipt
Who participates?

- ASME*
  - Nuclear Codes & Standards
  - Technology & Personnel Certification
  - Training & Development
- ASME Standards Technology, LLC
- Government
  - US NRC*
  - US DOL*
- Utilities
  - Tennessee Valley Authority*
  - FirstEnergy Nuclear Company *
  - Southern Nuclear Company*
  - Constellation Energy*
- Component manufacturers
- Insurance inspectors
- Consultants
- Design/construction services
- Testing services
- Academia
- EPRI

* - Sponsor
Funding

• Funding Support:
  - Utilities $600K
  - Department of Labor $1.5M
  - NRC $200K ($ and Materials)

• Current Total Funding $2.3M

• Initial Project Estimate for Funding $2.5M
Industry, Academia and Government Unite to Address NDE/QC Workforce and Performance Issues

• ABET Accredited Associates Degree Program
  - In the late 2000’s Industry and Chattanooga State Community College (CSCC) joined together to design and implement a program to meet industry’s increasing high demands.
  - In August 2013, after 3 years of graduating students, the program received accreditation from the Accreditation Board for Engineering and Technology (ABET). This is the first and only NDE/QC program accredited by ABET in the US.

• Technician Training and Certification Program
  - In 2012, as a result of cooperation between Industry, ASME and CSCC, the Department of Labor (DOL) awarded a $1.5M grant to CSCC for the development of the ANDE NDE/QC training and certification program.
  - The program is being developed in accordance with INPO guidelines and industry best practices as included in the ANDE-1 Std.
ANDE Program Status

• ASME national standard “ANDE-1” approved by ANSI on April 22, 2015. A unique performance based approach unlike any other program in the world.
• Practical demonstration test pieces designed by a special industry task group and the Pacific Northwest National Laboratory to allow the measurement of Probability of Detection (POD).
• UT exam data base developed in accordance with JTA/Psychometrics and will be beta tested in November.
• The UT Qualification Card is in committee for review/approval.
• Other NDE/QC JTA’s, examinations and qual cards are in different stages of development, review and approval.
• First ANDE Workshop conducted April 22, 2015, over 100 attended with second scheduled for October 27 at ASNT Fall Conf. in Salt Lake.
• UT on-line training and web based simulation to be beta tested on October 19 during CSCC Associates Degree Program class.
• Implementation scheduled for first quarter 2016.
Conclusion

- Traditional ASME Volunteer Committee/Stakeholders established the certification standard using ANSI accredited procedures (ANDE Committee).
- Improved training and experience followed by assessment based on proven industry best practices and INPO guidelines will result in high performance and reliability.
- Psychometrics applied to exams will assure validity, reliability, and fairness.
- Knowledge and skills examinations will be administered by Certification Body as an independent third-party standard process assuring program integrity.
- Considering multiple options for delivery of written and practical exams including centralized testing centers and utility/vendor locations.
- A single all inclusive web based credential will simplify recognition of certification for vendors, utilities, inspection agencies, and regulators by eliminating costly redundant documentation.
- Centralized certification provides a means to incorporate operating experience, monitor individual performance and probability of detection (POD) that is otherwise not possible with employer based programs.
Why ASME?

Countries Implementing The ASME Code for the Fabrication and Installation of Boilers and Pressure Vessels
“To Me It Seems That All Sciences Are Vain And Full of Errors That Are Not Born of Experience, Mother of all Certainty”

Leonardo DaVinci
(1452-1519)