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# PUBLIC SUBMISSION

**Docket:** NRC-2021-0166

Acceptability of ASME Section XI, Division 2, 'Requirements for Reliability and Integrity Management (RIM) Programs for Nuclear Power Plants,' for Non-Light Water Reactors

**Comment On:** NRC-2021-0166-0001

Acceptability of ASME Code Section XI, Division 2, Requirements for Reliability and Integrity Management (RIM) Programs for Nuclear Power Plants, for Non-Light Water Reactors

**Document:** NRC-2021-0166-DRAFT-0008

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## General Comment

See attached file(s)

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## Attachments

Response to Draft Reg. Guide DG-1383-

To: USNRC, Office of Administration, Program Management, Announcement and Editing Staff

Response: Comments to Draft Regulatory Guide DG-1383 – Acceptability of ASME Section XI, Division 2, “Requirements for Reliability and Integrity Management (RIM) Program for Nuclear Power Plants” for Non-Light Water Reactors

The following addresses “Basis for Regulatory Guidance Position 5” only.

Criteria for the qualification of NDE personnel is relatively new compared to other professions with similar safety significance concerning workers and particularly the public.

### ASNT Recommended Guideline SNT-TC-1A

In 1968 ASNT published the first recommended guideline SNT-TC-1A for the qualification and certification (PQ&C) of NDE personnel. The guideline was developed by committee and was not subjected to the rigor of the ANSI standards development process. The introduction in the document actually emphasizes it is a guideline only and that the owner should modify to suite needs. ASME Section III adopted SNT-TC-1A in the early 70’s followed later by Section XI. As the nuclear industry implemented the guideline, National Board State Inspectors and authorized inspection agencies found that field NDE examinations had not improved and that the PQ&C process was convoluted and confusing based on the broad interpretations and variations taken by owners across the industry. In an effort to quasi standardize the process, ASME Section III issued a code change in the mid to late 70’s stating that SNT-TC-1A shall be used as minimum requirements.

The next decades would include field failures resulting in multiple round robin studies to determine the qualification level of the work force and identify root cause of NDE performance weaknesses.

The first US Intergranular Stress Corrosion Cracking (IGSCC) through wall pipe failure that occurred at Nine Mile Point nuclear plant in 1982 was a watershed event. This event accelerated concern with a three-party agreement including the NRC, EPRI and BWROG resulting in the implementation of IGSCC qualification examinations at the EPRI NDE Center (a performance-based exam requiring candidates to detect and identify IGSCC in samples representing real plant components). Initial pass rates for employer qualified and certified NDE personnel (SNT-TC-1A) was only 19%. The three-party agreement required re-examination every 3 years following initial qualification. Pass rates slightly improved over time but leveled off at about 50%. For over 30 years the IGSCC qualified workforce returned to the EPRI NDE Center every 3 years for re-examination. Incredibly, the average pass rate for the entire previously qualified workforce during this period was only approximately 50%. No actions have been taken to date to improve pass rates. While puzzling, the requirement for 3-year re-qualification has been eliminated in the face of continuing high failure rates.

## ASNT Standard CP-189/ASME Appendix VIII

In the mid 80's ASME initiated the development of Appendix VIII, Performance Demonstration in response to the weaknesses of SNT-TC-1A including escalating industry events and results of round robin studies. In 1989 Appendix VIII was incorporated into the ASME Section XI Code. ASNT responded and established a committee to develop a new NDE standard. The ASNT/ANSI standard CP-189 was published in 1991. The document was incorporated into ASME Section XI in the mid 90's and is the only adoption of the standard by an industry sector (nuclear) and associated code (ASME) known to date. ASME Section III still references SNT-TC-1A and has chosen not to reference CP-189. A Performance Demonstration Initiative (PDI) committee was established by the utilities and in cooperation with EPRI implemented Appendix VIII by the late 1990's. As another measure to address CP-189 weaknesses, Section XI included Appendix VII with other additions to IWA 2300 concerning training and certification requirements in hopes of improving performance.

It was believed that the above corrective actions would address the well documented NDE weaknesses, improve NDE performance, and ultimately increase the defense in depth safety margin for nuclear power plants. Unfortunately, NDE performance after implementation of ASME Section XI, Appendix VII, VIII and other additions to IWA 2300 did not improve performance since the root cause was not addressed.

## Round Robin Studies

In June 2008 EPRI published "Nondestructive Evaluation: A Review of NDE Performance Demonstrations—NDE Round Robin Report #1016969", a compilation of various worldwide performance tests and round robin studies spanning over 30 years. The following summarizes the conclusions:

- "... 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."

## Examples of Round Robin/Performance Studies. PNNL studies funded by the NRC

- |  |         |
|--|---------|
| • 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 “API Personnel Proficiency Program-UT” 2001
- EPRI Performance Demonstration Initiative (PDI) Pass Rates

## Summary of 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 in 2000 Requiring Eddy Current Testing Qualified Data Analyst (QDA)
- Stress Corrosion Cracking in Alloy 600/82/182 Materials Started in the Early 2000’s with NDE Human Performance Issues affecting over 20 utilities.

Unfortunately, none of these degradation processes were detected by ISI (in-service inspection by NDE) but were first found by water on the floor.

## EPRI NDE Center Utility Steering/Integration Committee Takes Action

The committee reviewed the EPRI round robin report including industry experience and concluded that CP-189 even with the patch work of additional Section XI requirements still did not include the essential elements for skills development. A time-based requirement only approach such as CP-189 absent of specific criteria to obtain skills and a means to demonstrate proficiency during the initial qualification process was the most significant contributor to the NDE weaknesses/failures root cause. After deliberating and considering the compelling data and performance history of NDE, a motion was made and passed to pursue the development of a new PQ&C program based on industry best practices with a history of success.

To establish the initiative, ASNT was first approached with a proposal that the nuclear industry would develop and fund a Nuclear Specific Industrial Sector within the provisions of the already existing ASNT Central Certification Program (ACCP), but a common ground and agreement could not be achieved. A proposal was then made to the ASME Standards and Certification Board of Directors in April 2010. The board of directors unanimously approved the development of the ANDE program.

As a result of escalating events and round robin report conclusions the NRC writes a letter to ASME on January 12, 2010 (ML100140091) expressing concerns about NDE performance: "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." ASME responds: "The nuclear industry in cooperation with ASME has introduced an initiative to develop a third party NDE personnel certification program with the objective to consistently develop the technical workforce to meet current and future demands for NDE methods (UT, RT, MT, PT and VT) through a standardized centrally controlled process".

The NRC then ask EPRI to provide the pass/fail results from the PDI examinations. In 2012 the EPRI NDE Center provides the data showing the average pass rate is around 50% for those qualified and certified under an employer-based program.

Since the introduction of SNT-TC-1A in 1968, there have been multiple field failures, round robin studies, and 100's of millions of dollars invested in an attempt to improve NDE performance. We now find that all of these efforts have made little difference with PDI pass rates at an approximate average of 50% today, essentially the same as those during the initial round robin studies conducted over 40 years ago in the 80's.

## ANDE PROGRAM DEVELOPMENT

With the go-ahead from ASME, a project team was established to develop a plan. A new standard would first be developed based on industry proven best practices followed by implementation. Multiple committees would be established with funding pursued to achieve objectives and deliverables. It was estimated that \$2.5 million would be needed to complete the project.

The NRC has been involved with the ANDE project from the beginning. Initially, the NRC committed a \$600,000 grant to the project but later reduced that to \$100,000 without explanation and subsequently donated stainless-steel pipe for the fabrication of practical demonstration test pieces at an estimated value of \$80,000. A PNNL staff member was also funded by the NRC to participate in the development of the ANDE-1 standard and implementation of the program.

Chattanooga State Community College (CSCC) in Chattanooga, Tennessee during this time had introduced a new NDE Associate Degree program. CSCC was one of the first organizations to join the ANDE project. With CSCC's noted success at receiving grant awards, CSCC, ASME and nuclear utilities collaborated and applied for a \$1.5 million Department of Labor (DOL) grant. The effort was coined as a great example of "Industry, Government and Academia working together to promote workforce development for the benefit of both the individual and

industry”. In November 2012, DOL awarded CSCC a \$1.5 million grant for the development of the ANDE NDE/QC project.

With utilities contributing over \$800,000, the funding goal of \$2.5 million was met.

With funding and the ANDE organization established, the ANDE standards committee quickly pursued the Institute of Nuclear Power Operations (INPO) Systematic Approach to Training (SAT) model for the qualification of nuclear power plant operators and other power plant workers as the ultimate industry best practice. As a result of the 1979 Three Mile Island incident caused by poor operator training, the nuclear industry established INPO to assure the consistent implementation of SAT and to provide oversight of the utilities implementation. Accordingly, the ANDE-1 standard was developed using these same proven and successful practices.

### ANDE-1 Performance Based (INPO/Industry Best Practices) vs Employer Based Self-Certification

#### ANDE-1 Aligns With INPO Guidelines and Industry Proven Best Practices

- 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 a 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

#### 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

**Based on industry experience, field failures and conclusions of the round robin studies conducted to date, it was extradentary to find NRC position 5 supporting the continuance of CP-189.**

### Summary

- For over 50 years the employer based self-certification process has been unreliable to consistently qualify NDE personnel that meet industry expectations (detect flaws before failure).
- All round robin studies have shown detection rates at best are 50%
- No known study has ever shown the process to be effective
- The unstructured training and experience do not include the key factors essential for learning
- INPO and Academia agree the process does not have a path for consistent reliability and success

### Basis for Regulatory Guidance Position 5

Qualification of NDE personnel is not dependent on the type of plant. Therefore, previous NRC staff positions on qualification of NDE personnel also apply to non-LWRs. Use of ASME NDE (ANDE)-1-2015, "Nondestructive Examination and Quality Control Central Qualification and Certification Program" (Ref. 11), was not approved by the NRC when proposed under ASME Code Case N-788-1 "Third Party NDE Certification Organizations Section XI, Division 1" (Ref. 12). RG 1.193 documents that this Code Case is not generally acceptable for use. The NRC has been following and participating in the development of ANDE for several years and is reviewing ANDE as it progresses. Code Case N-788-1 and the ANDE standard do not contain sufficient specificity for use as a qualification or certification program. Several important sections of ASME ANDE-1-2015 are not defined and are to be determined in the future by specific industry sector committees. It is not possible for the NRC to evaluate a certification and qualification program that has not been defined. For this reason, Code Case N-788-1 and the referenced ANDE-1-2015 are not sufficient on their own as a qualification and certification program able to be used as an alternative to ASME Code, Section XI, Division 1, Subarticle IWA-2300. The American National Standards Institute/American Society for Nondestructive Testing (ANSI/ASNT)-CP-189, "Standard for Qualification and Certification of Nondestructive Testing Personnel" (Ref. 13), may be used as provided in ASME Code, Section XI, Division 1.

## Request for Additional Information

In response to position 5 above, the NRC has been involved with the ANDE project since the beginning and has invested both manpower and taxpayer dollars. ANDE-1 has successfully completed both revision 1 and 2 through the ANSI Standards review process with no unresolved NRC comments. It is essential for the NRC to specifically identify what is needed to address the following in position 5: "Code Case N-788-1 and the ANDE standard do not contain sufficient specificity for use as a qualification or certification program. Several important sections of ASME ANDE-1-2015 are not defined and are to be determined in the future by specific industry sector committees. It is not possible for the NRC to evaluate a certification and qualification program that has not been defined.

- What specificity?
- What is not defined?
- "Several important sections of ASME ANDE-1-2015 are not defined." Considering CP-189 defines very little except "Time". Where ANDE-1 defines knowledge and skills through Job Task Analysis with a qual card to document learning/experience and demonstration of proficiency. Specifically, what is not defined?

## Recommendations

### Recommendation #1:

Include ANDE-1 in Regulator Guide DG-1383 as the only option

### Recommendation #2:

In accordance with NRC concerns documented in January 12, 2010 letter to ASME (ML10040091) including industry experience, field failures and round robin study results, communicate to the industry that SNT-TC-1A and CP-189 to be phased out of the nuclear codes and that a process and schedule to be developed for an orderly transition to ANDE-1.

### Recommendation #3:

To assure NDE performance and continued nuclear power plant safety, the NRC should require all PDI supplement qualifications to requalify every 3 years. Based on over 30 years of IGSCC requalification pass rates at approximately 50%, it can only be expected that PDI initially qualified examiners have also lost continuity and proficiency with expected requalification pass rates to be at 50% or less.

Michael L. Turnbow  
Biography

- Over 30 years' experience in Nondestructive Testing

- Retired-General Manager of the Tennessee Valley Authority's Inspection and Testing Services group responsible for NDT, QC, calibration services, metallurgy, chemistry, and instrumentation engineering services for TVA's power plant fleet.
- Past President and Chairman of the Board of the American Society for Nondestructive Testing
- Served 10 years as Chairman of the EPRI NDE Center Steering Committee
- Served over 10 years as U.S. ANSI delegate to ISO for the development of international NDE Standards
- Chairman of the ASME NDE personnel qualification and certification project (ANDE)
- Initial Chairman of the ANDE-1 Standards Committee
- Current Chairman of the ANDE Nuclear Specific Industry Sector Committee