NDE Examiner Proficiency Challenges with Inservice Volumetric Exams

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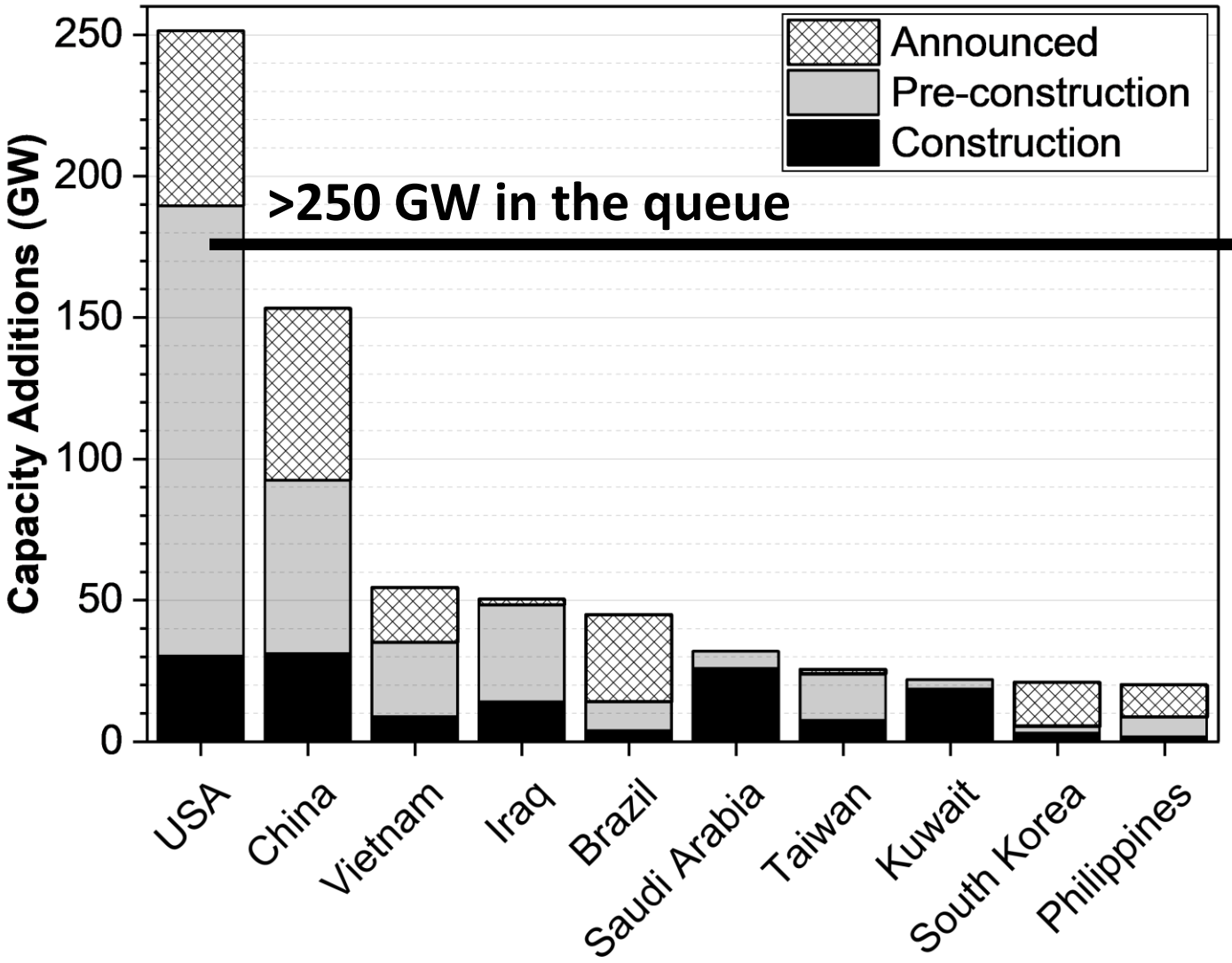
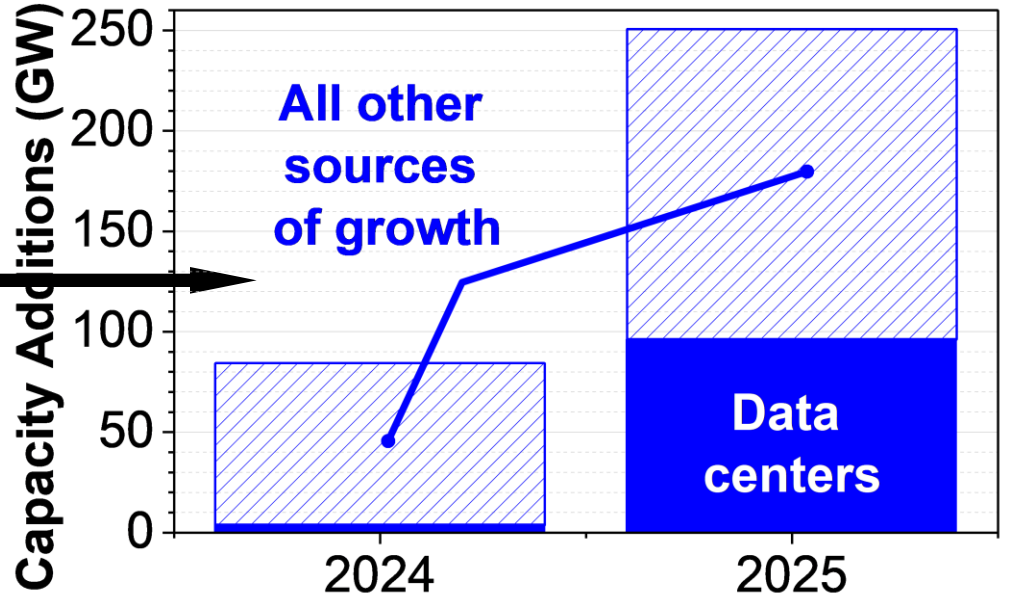
Background

World Perspective

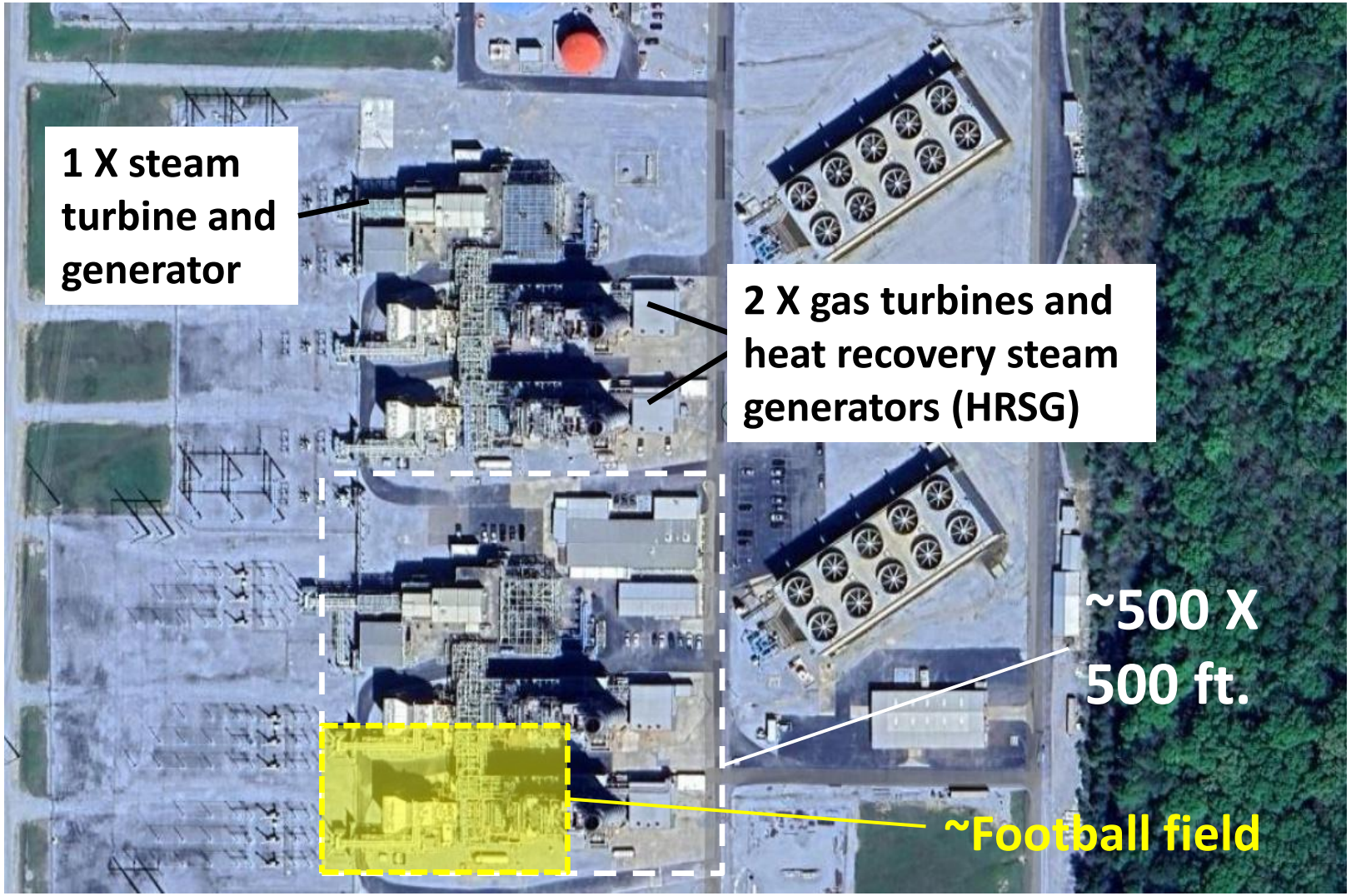
https://www.theguardian.com/environment/2026/jan/29/gas-power-ai-climate





1,000s of HEP systems to manage worldwide with 1Ms of girth welds and other features requiring routine volumetric inspection… and a lot more coming!

Modern combined cycle plant



- Power generation capacity for a site like this ~1 GW (about the output of a single commercial nuclear reactor)
- Gas turbine exhaust heats steam in the HRSG
- Steam is superheated and reheated and transported to the steam turbine via high energy piping systems
  - Modern plants require piping systems measured in 100s of feet and 100s of welds

Considerable number of at-risk features susceptible to creep or fatigue requiring routine NDE over lifetime of the plant

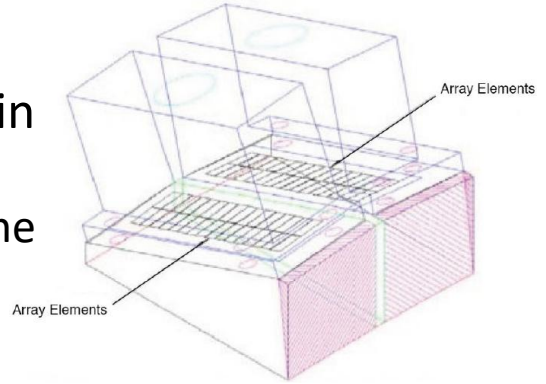
Perspective on HEP failures

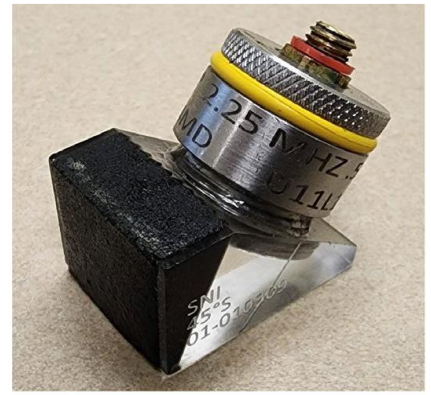
- Small bore failure
  - Release velocity ~90 mph and 1,600 ft-lbf
  - Muzzle energy of popular cartridges ranges from 135 to 5,000 ft-lbf
- Catastrophic release
  - A single HEP system transports steam >1,000°F at 300 to 4,000 psig
  - A rupture is the equivalent of ~1,000 lb bomb or 500 lbs of TNT

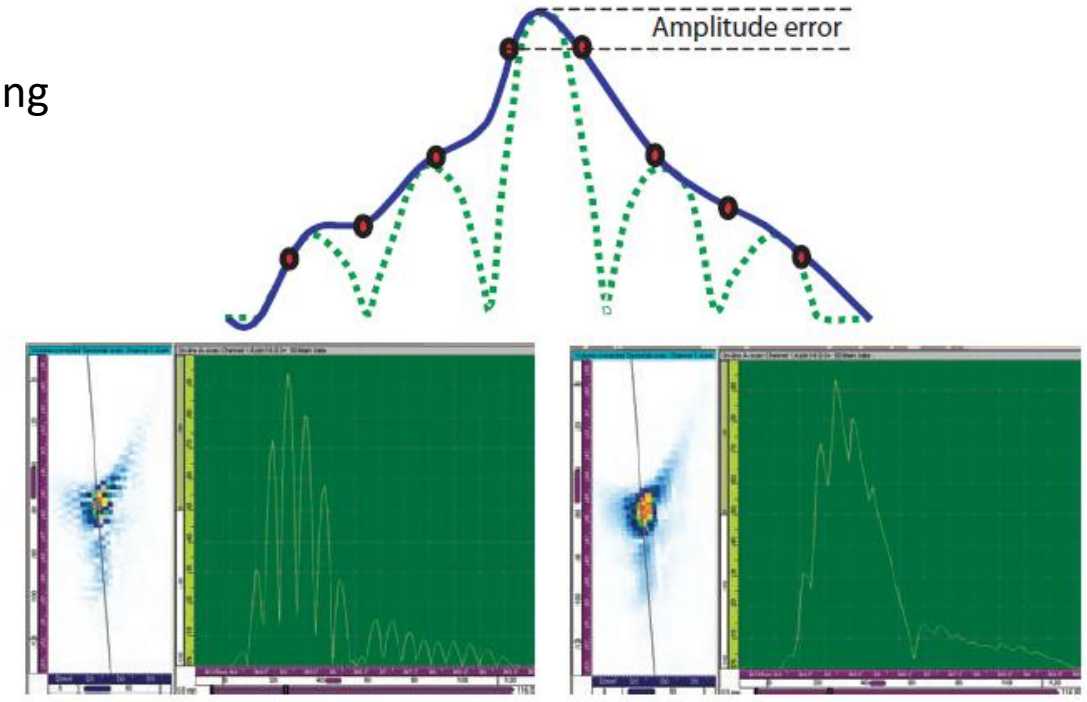
Monitoring the health of HEP systems is vitally important to prevent catastrophic failures and includes a heavy reliance on volumetric examination (phase-array ultrasonics)

Phased array ultrasonic testing

- Phased array UT was introduced for high-energy piping exams in the last 15 to 20 years
  - Inspection/scanning time (20 to 40% reduction in field time in some cases)
- Difference between PAUT and conventional, why it matters
  - Conventional UT uses a single or dual element transducer and fixed angle wedge
  - PAUT probe is a multi-array element which an electronic steering feature that can “sweep” multiple angles
    - Productivity Assessment of Phased Array Versus Conventional Ultrasonics
- The challenges this created….
  - Availability of personnel
    - Technical skillset and training to attain PAUT certifications is limited
  - Equipment Selection
    - More complicated and introduces different hardware and software configurations
  - Indication Interpretation
    - “Noise” occurs with an abundance of data
    - Challenges regarding the determination of inservice versus fabrication flaws







What constitutes being proficient to perform field NDE?

- Proficient = skilled or competent in the execution of a task
- NDE company self-administration of Level I, II or III qualifications does NOT guarantee or demonstration proficiency

Minimum requirements

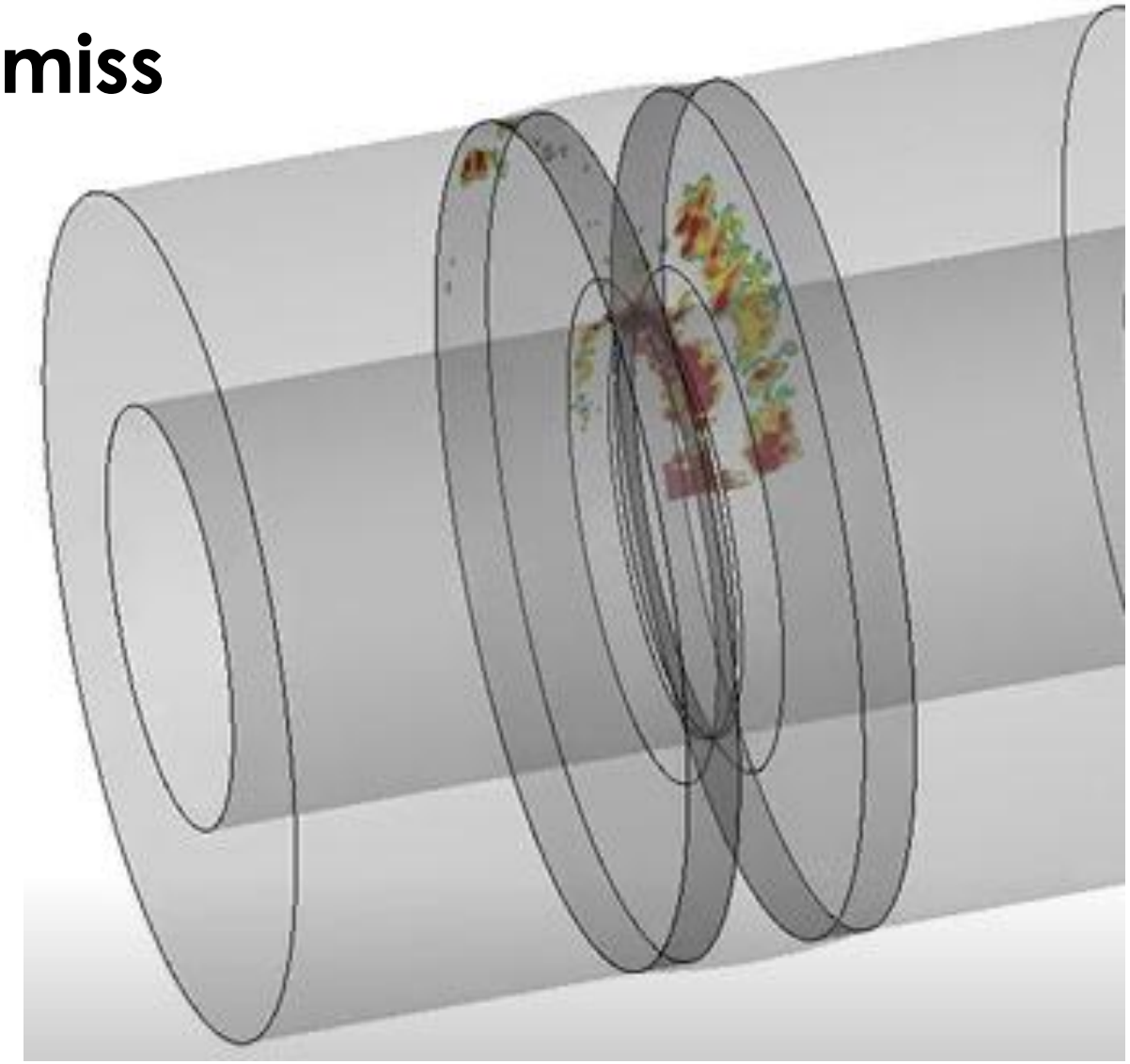
1. Compliance to written practices and procedures
2. Demonstrate equipment selection and use including correct probe, wedge and scope selection
3. Calibration protocols
4. Scan plan preparation specific to the component being examined
5. Basic knowledge of service-related flaws or defects in components or features requiring NDE
6. Selection of appropriate test blocks
7. Detection, sizing and mapping of flaws
8. Evaluation of relevant and non-relevant flaws
9. Documentation, reporting and clarity of findings

Systemic lack of industry proficiency is leading to increased risk, a false sense of security and significant safety concerns in the power generation industry

End-user/owner perspective

Coal unit main steam crack miss

- Inspections on an 895MW supercritical coal unit Main Steam piping (6-in. wall thickness) revealed no indications
- 2 years later, inspections revealed >3-in. long radial mid-wall cracks
- Implausible that this damage developed in a short period of time
- Numerous other cracks detected and significant through wall depth meant weeks of repair



Further investigation of NDE techniques and equipment indicated the initial inspection was flawed and would be incapable of detecting damage

HRSG End Cap Crack Miss

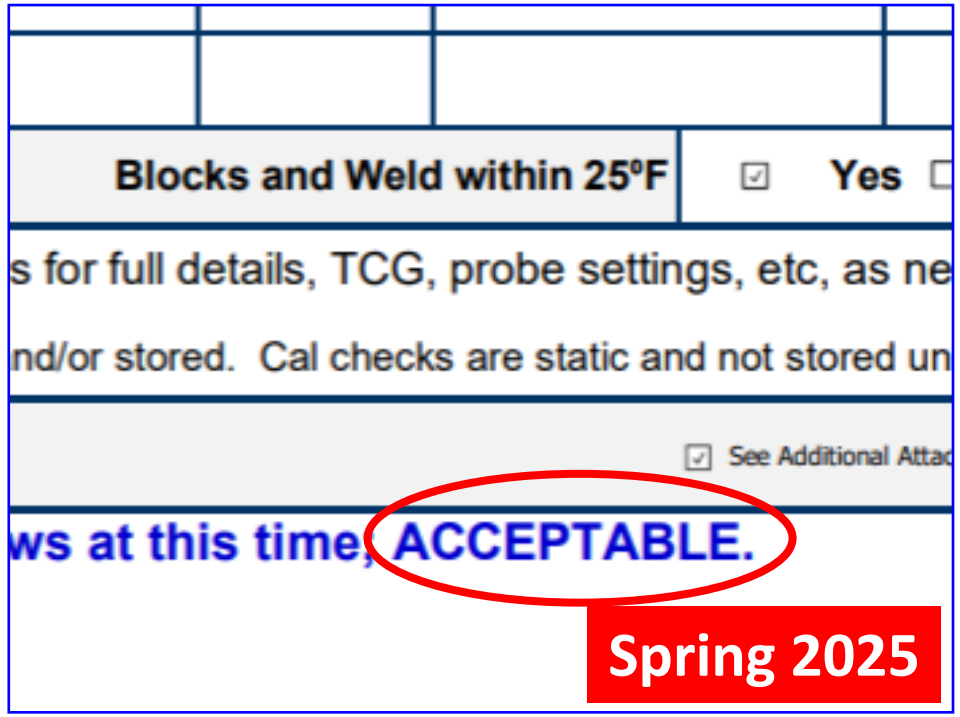
- HRSG end caps are an emerging area of risk in power generation
- Header design creates stress concentrations which are prone to damage development within the expected life of the unit
- PAUT of this damage has proved to be unexpectedly difficult
- Recent lessons learned have lead to frequent reinspection cycles

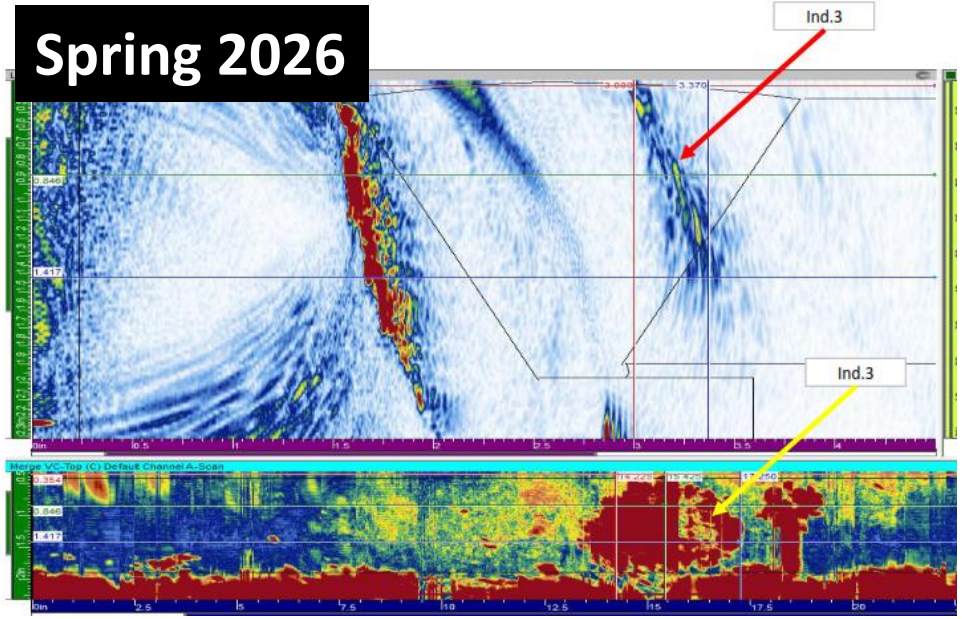
An example of a component geometry at high risk to catastrophic (ejection) failure

HRSG End Cap Crack Miss

- A HRSG design known to be prone to damage was inspected during a planned outage in Spring 2025
- Lessons learned and review of past technique caused the plant to force additional inspections into a short duration outage window in Spring 2026
- A nearly through wall crack 10-in. in length was found that was within a few thousandths of an inch of resulting in a leak
- Outage duration increased by several days, specialty labor was brought in, and cranes were required to lift adjacent pressure parts cut loose to enable a repair
  - **~$750,000 lost power production per day X 10-day extended outage…**

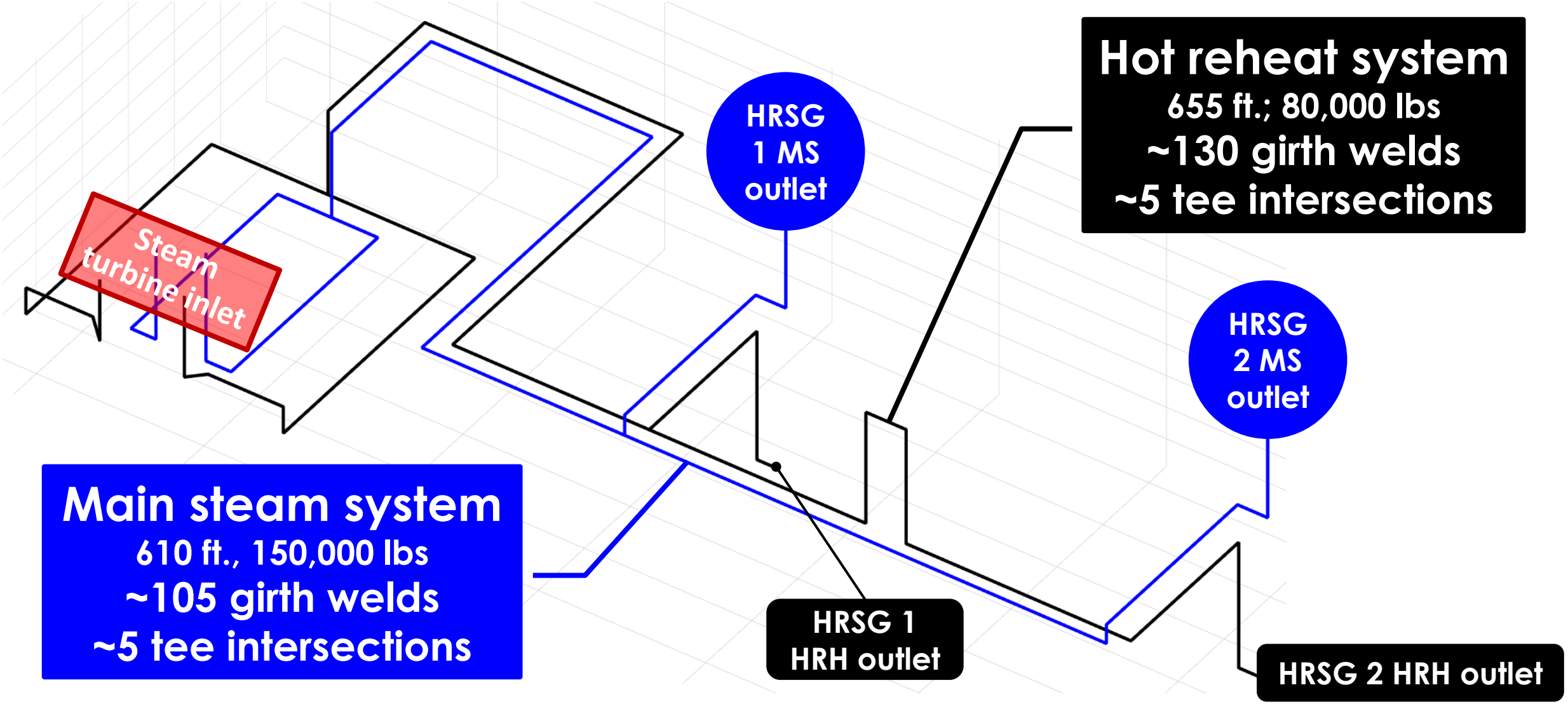
Motivation for more reliable NDE is the ability to properly plan for repair or replacement…





EPRI perspective

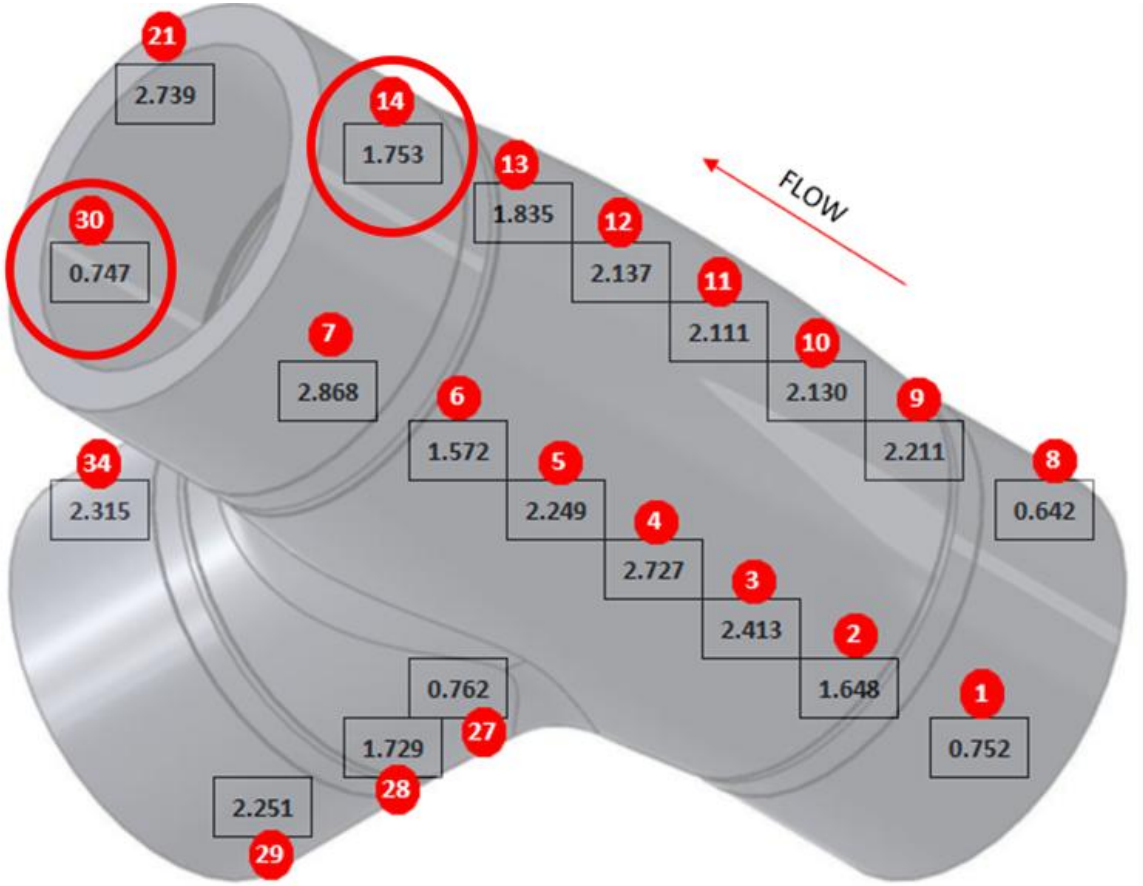
Representative combined cycle plant high energy piping systems



Tee fitting field documentation trends

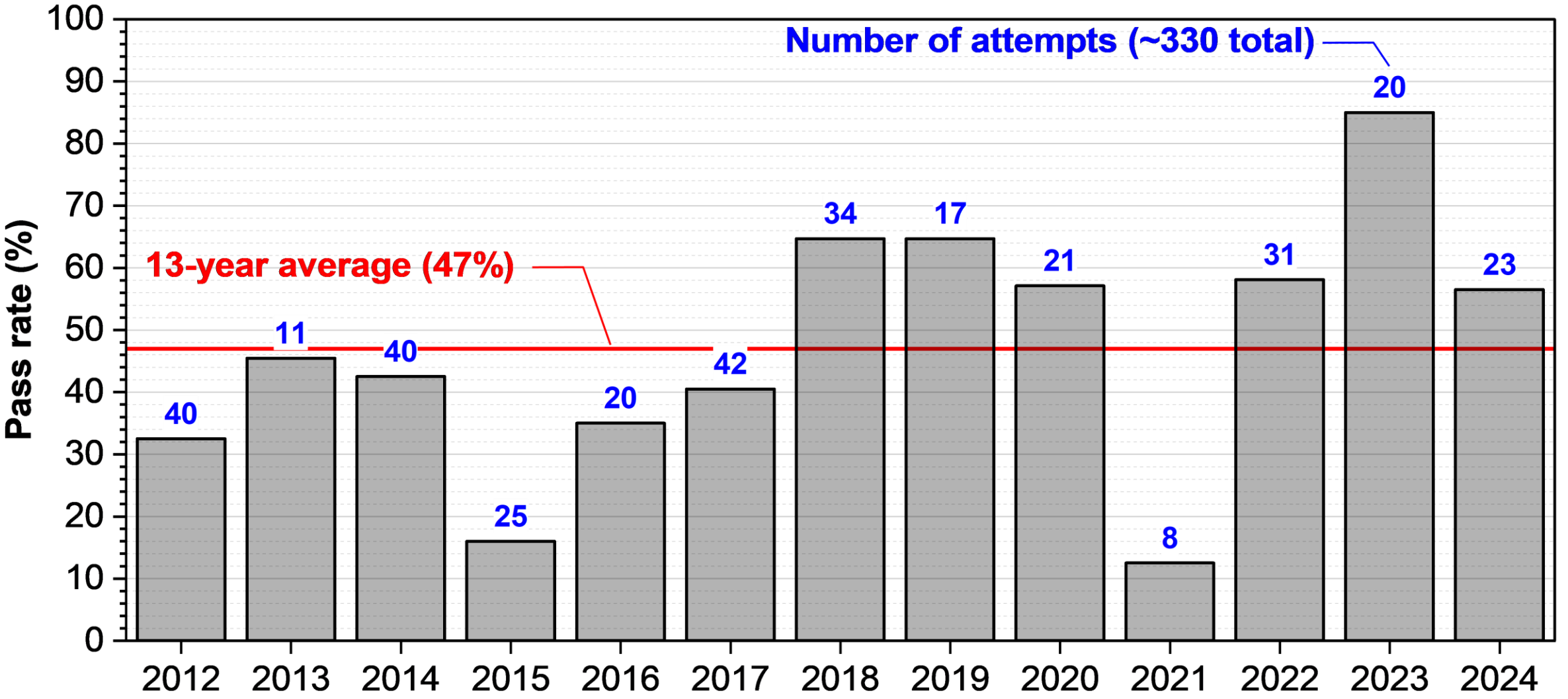
- Countless examples where component markup increased uncertainty via:
  - Mislabeling of flow and/or N/S/E/W
  - Inconsistent/unclear labeling

Incorrect labeling compromises ALL RESULTS!



EPRI database of ~350 tees; 40% exhibited discrepant readings…

Girth weld proficiency assessment trends



47% pass rate in a well-controlled laboratory test setting…

Summary

Industry realities

- While expensive, PAUT equipment is easily sourced, the demand for services is high, and continues to displace other legacy techniques (RT)
- The EPRI proficiency demonstration efforts (and others led by industry) have only tested a small fraction of practitioners and fewer of these have passed
- For the purposes of conducting safety critical HEP volumetric inspections, it is quite difficult to source technicians who are:
  - Adequately trained in the equipment provided to them by their employer
  - Trained and skilled at detecting in-service damage (as opposed to new construction)
  - Understand at least the basics of in-service damage mechanisms so they can make decisions regarding inspection strategy and interpretation
  - Familiar with power generation equipment
  - Capable of adapting to field conditions
  - Easily deployable within the geographic region during peak outage season

Enhanced NDE training and proficiency are essential elements of an informed life management strategy that need to be mandated

Next Steps & Changes Coming

- NBIC Part 2 Code changes – Item #25-81
- Awareness through the NBBI bulletin planned through 2026
  - nationalboard.org/SiteDocuments/Bulletins/FA2025/FA2025.html
  - nationalboard.org/SiteDocuments/Bulletins/SP2026/SP2026.html
- Training and assessment courses offered by EPRI with potential evolution of content
  - Incorporation of critical skills (like labeling and documentation) as part of assessment
  - Unique ‘feature’ considerations
    - Tee inspection training course developed in 2025
  - Piping Corrosion
  - Other needs to be addressed as informed by emerging industry issues

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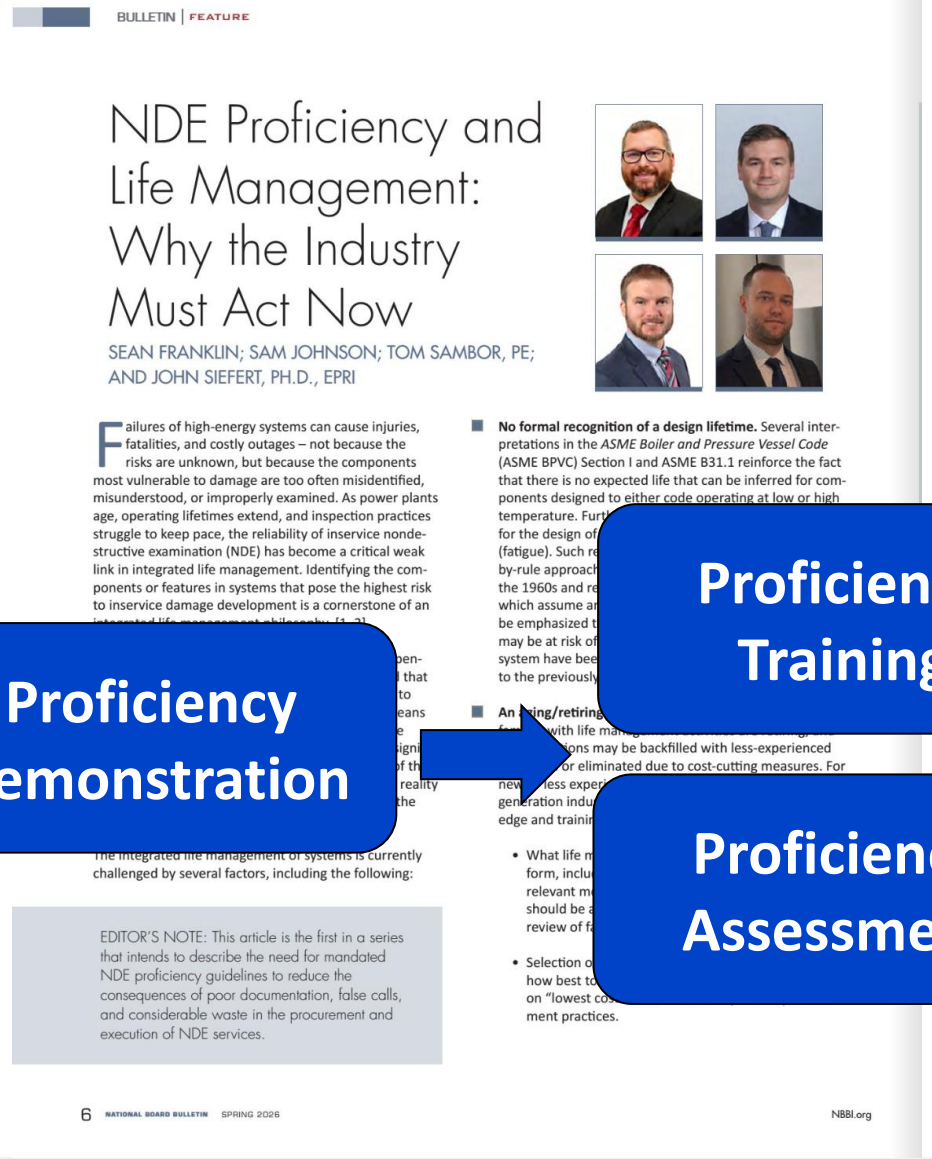

BULLETIN | FEATURE

NDE Proficiency and Life Management: Why the Industry Must Act Now

SEAN FRANKLIN; SAM JOHNSON; TOM SAMBOR, PE; AND JOHN SIEFERT, PH.D., EPRI

Failures of high-energy systems can cause injuries, fatalities, and costly outages – not because the risks are unknown, but because the components most vulnerable to damage are too often misidentified, misunderstood, or improperly examined. As power plants age, operating lifetimes extend, and inspection practices struggle to keep pace, the reliability of inservice nondestructive examination (NDE) has become a critical weak link in integrated life management. Identifying the components or features in systems that pose the highest risk to inservice damage development is a cornerstone of an

No formal recognition of a design lifetime. Several interpretations in the *ASME Boiler and Pressure Vessel Code* (ASME BPVC) Section I and ASME B31.1 reinforce the fact that there is no expected life that can be inferred for components designed to either code operating at low or high temperature. Furt
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The integrated life management of systems is currently challenged by several factors, including the following:

EDITOR’S NOTE: This article is the first in a series that intends to describe the need for mandated NDE proficiency guidelines to reduce the consequences of poor documentation, false calls, and considerable waste in the procurement and execution of NDE services.

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