Agenda

Ultrasonic Testing in lieu of Radiographic Testing: ‘UT ilo RT’
- NIL Thin Plate
- Innovation in NDT

The case for change
- Why use UT ilo RT
- Suitable UT Techniques

Business Cases
- Project
- Maintenance

Way forward
- Collaboration
UT in lieu of RT: historic information

NIL Thin Plate project 1992

Objectives

▪ To assess the reliability of mechanized ultrasonic inspection, in comparison with the 'standard' non-destructive inspection techniques (i.e. standard radiography and manual UT) for detection of defects in welds in steel plate in the wall thickness range 6-15 mm.

▪ To contribute to the development of suitable acceptance/rejectance criteria and, if necessary, initiate their implementation criteria in national and international regulations on non-destructive testing.

Conclusion

▪ The detection reliability of mechanized ultrasonic testing techniques is at least as good as but usually better than that of conventional non-destructive testing techniques such as manual ultrasonic testing and standard radiography.

Improvements since 1992

▪ Mechanized (PA)UT is standardized and thus reliable. Automated UT (AUT) and semi-automated UT with encoded scan enables permanent record keeping of UT inspection data.

▪ Data storage is now common practice.
Innovation in NDT (These Wassink 2012)

Key points

- It takes a long time to develop and implement changes in NDT applications
- Collaboration of all parties is key, the Cyclic Innovation Model is a way to shorten the time
- Entrepreneurs are needed to make it a success
Why use RT in lieu of UT

RT in lieu of UT?

Historic performance, we have done it so many years with good outcomes
- Large capacity of experienced inspectors
- Common practice, less preparation needed, flexible in application
- Cheaper teams and equipment compared to UT
- Less limitations on geometry/size versus UT

New developments in (digital) radiography
- Fast films
- Lower radiation exposure and shorter distances
- Digital imaging and filing
Why use UT in lieu of RT

**Shop weld inspection**
- RT is either done:
  - In the night → backlog + delay construction
  - In a bunker → logistics

**Field weld inspection**
- Plot clearance is required → delay for construction
- Long backlog of inspection work and feedback to welders
- No opportunity for welders to improve on weld quality!
- RT quality issues when gamma radiation is used, (3mm double wall, 160 KeV X-ray. Ir 480 KeV, Se 200 KeV)

RT inspection is **slow**

RT uses radiation: major HSSE risk → plot clearance / bunker

RT is not sensitive to planar defects
Mechanised and Encoded UT solves these issues:

**Production Schedule**
- No plot clearance required, welding can continue
- Fast inspection (20-40 welds per shift) $\rightarrow$ no backlog

**HSSE risks**
- No radiation risks

**Quality**
- No backlog: direct feedback to welders
- Improved quality: finds critical planar defects
Suitable UT technologies

TOFD

(PA)UT
Time Of Flight Diffraction (TOFD)

Advantages

• High POD and low False call rate
• High Accuracy of Flaw Location and Flaw Sizing
• All inspection Results/Data is Digitized and Stored and can be Recalled and Processed for In-Service Inspection
• Most efficient for inspection of thick-walled vessels where X & Gamma ray would have difficulties

Limitations

• Difficult for thin welds <9mm thickness.
• Sizing of shallow crack close to the inspection surface is less accurate → use surface methods
• Need access to both side of the weld.
• Difficult/impossible for coarse grain materials
Mechanised PAUT

Advantages

• Array transducer enables beam steering and focusing.
• Beam steering enables inspection from one probe location rather than raster scan
• Beam focusing enables increased sensitivity for small defects
• More user friendly and versatile signal display (C scan, B scan, A scan, Sector scan) for defect location, characterization, and sizing.
• All inspection Results/Data can be digitized and stored so that the permanent record can be kept.

Limitations

• Equipment pricing is relatively higher
• Need more extensive operator training
• Difficult for coarse grained materials
Examples in this conference

Day 1
- Doosan Babcock: Applications with qualifications conform ENIQ criteria
- TUV Rheinland Sonovation: project on thin walled stainless steel, significant savings

Day 2
- Gasunie: how UT ilo RT was implemented and is now common practice
- Olympus: This walled heat exchanger tubes

- Many technical presentations with background information to help understand the technological opportunities and restrictions
- Several companies will present their strategic approach
Application case Prelude

Outcomes UT in lieu of RT:
• 100,000 inspected piping field welds on Prelude, of which:
  • 50% was 100% inspection scope
  • 50% was 10% inspection scope

UT in lieu of RT was applied for:
• 2000 carbon steel welds
• 60 stainless steel welds

Only 2% of total scope!
• GAP between opportunity <-> realization
## UT ilo RT for Piping

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The business case for projects

• Significant reduction of QA/QC time
• Direct feedback to the welder
• Cost savings
  • Direct cost per weld
  • Logistics for piping
• 24 hrs/day available for welding and NDT
• If UT inspection is considered in the design stage the outcome also enhances capability for in service inspection.
• Improves life cycle safety and cost of inspection. Eg root corrosion of welds
Application case Steam Boiler repair

**Situation**

- Overhaul of internals in steam boiler, Low alloy steel, 1”-2” diameter and 3.4mm – 11mm wall thickness, thousands welds in scope
- RT scope on critical path, enormous impact on schedule
- PAUT knowledge available
- Regulator agreed with deviation from code which required RT inspection → qualification needed
- Time required before overhaul starts

**Impact**

- 1 (of 5) month construction time reduction
- Significant cost saving, Lower HSSE risk
- Qualification can be replicated and re-used
Implementation

• Increase the knowledge of QA/QC staff of end users
• Explain business cases, simple showcases, gain (€) support for qualifications
• Development of standards with acceptance criteria
• Collaboration between end users and technology suppliers
Thank you for your attention

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