U.S.NRC
United States Nuclear Regulatory Commission
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NRC Perspective on Ultrasonic Testing in Lieu of Radiographic Testing

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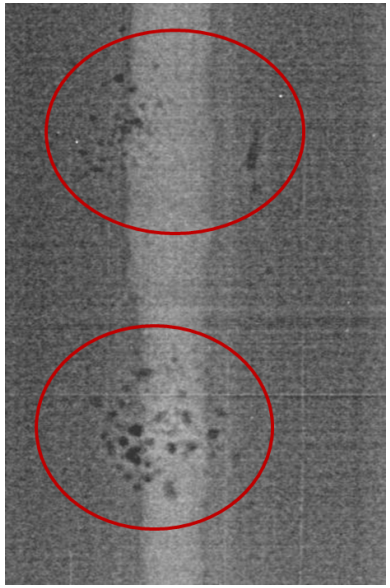
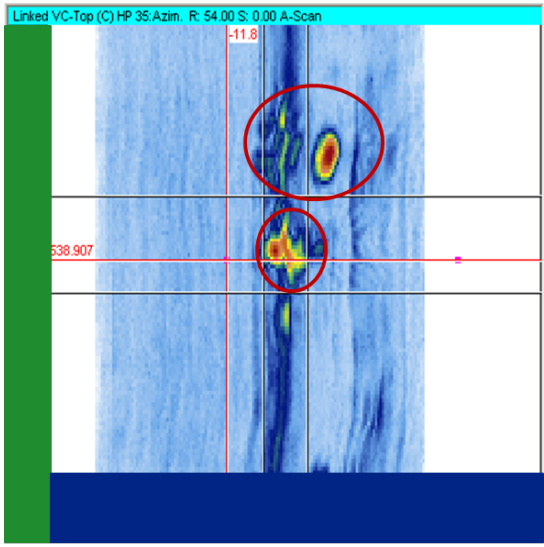
Bottom Line Up Front

- The NRC has generically approved the use of UT in lieu of RT for repair/replacement activities
- The NRC is not opposed to the use of UT in lieu of RT for new construction if a UT process is shown to provide an acceptable examination with the ability to review the data in the future the NRC
- Appropriate Acceptance Criteria are Needed

Challenges with UT in Lieu of RT

- UT for steels has a lower spatial resolution than RT
- UT effectiveness can be degraded (sometimes very severely) by different materials, weld surface and single sided access
- There is no common format for encoded UT data
- Differences in acceptance criteria and ability to characterize flaws





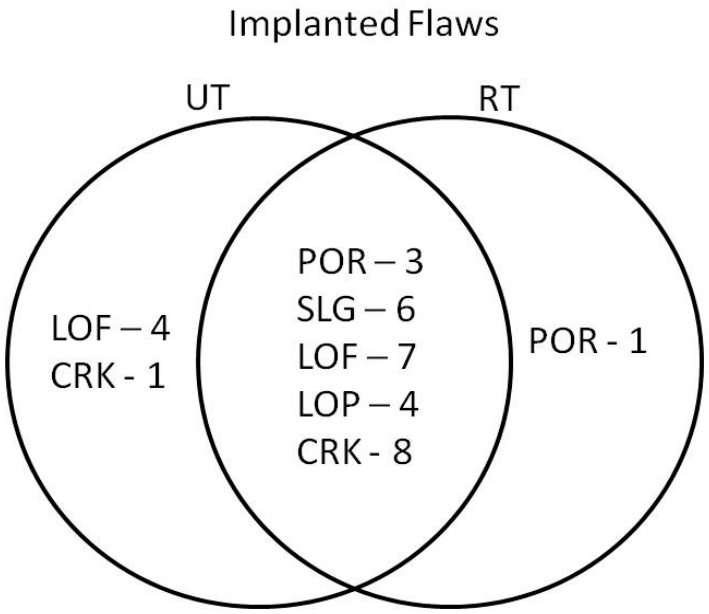
Top View (C-Scan)

From NUREG/CR-7204 Applying Ultrasonic Testing in Lieu of Radiography for Volumetric Examination of Carbon Steel Piping

NUREG/CR-7204 Highlights

Detection Reliability – Implanted flaws in carbon steel piping

- UT and RT appear to have similar detection capability for volumetric flaws
  - UT missed 1 small porosity (5.3 mm (0.2 in.) in length)
- UT has a better detection capability for planar flaws
  - RT missed 5 planar flaws
  - Planar flaws are more likely to grow throughout the service lifetime of the plant and could be more detrimental

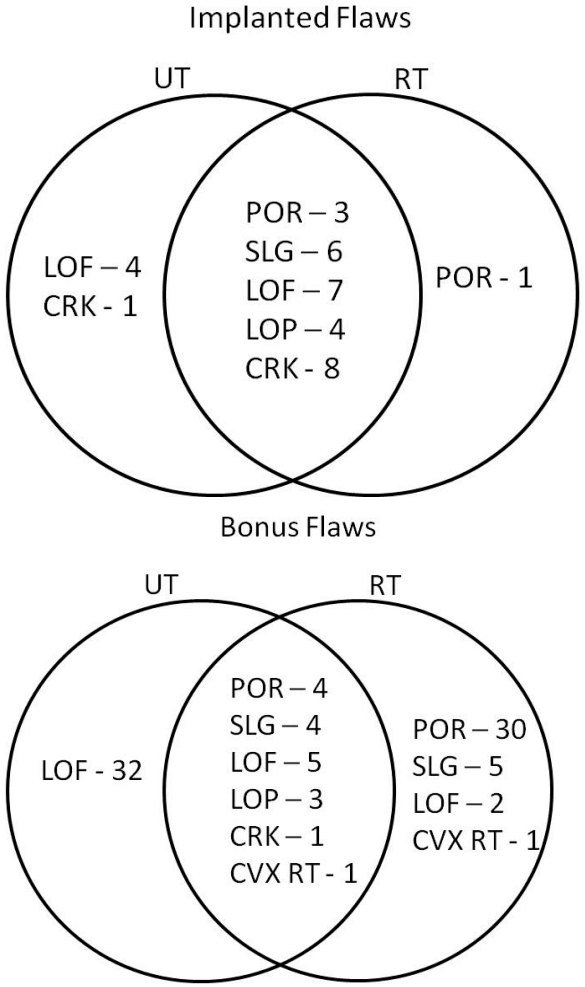


Capabilities of UT vs RT

- UT is more effective at finding planar flaws including small planar flaws
- RT is better at finding small volumetric flaws such as porosity
- For flaws detectable by RT, flaw discrimination is relatively easy
- While possible, it can be very challenging for UT procedures and personnel to distinguish between different flaw types

Acceptance Criteria

- ASME Code Section III allows small volumetric flaws such as porosity and slag but not lack of fusion or cracks
- Operational experience has shown that small embedded cracks and LoF are relatively benign, but inner diameter repairs are associated with service-induced cracking
- Using UT in lieu of RT with Section III RT Acceptance criteria may result in more repairs that do not improve the quality of the final weld
- UT-Specific Acceptance Criteria are likely needed



“Recent” History with UT in lieu of RT

- The different revisions of ASME Code Case N-659 were not approved by the NRC
- Palo Verde and Millstone developed proposed alternatives to use UT in Lieu of RT in 2012-2014
- The experience with applying UT in lieu of RT were used to develop ASME Code Case N-831 and N-831-1

What Changed from N-659 to N-831-1?

- Improved technical basis for UT
  - Industry experience with proposed alternatives
  - Public meetings and ASME Code week discussions describing the progress
  - NUREG/CR-7204
- Performance demonstration for the UT personnel, equipment, and procedure
- Improved technology- Phased Array being available instead of two angle beams

UT vs RT for New Construction

- Criteria necessary
  - Performance demonstration (detection, sizing, and full volume exam)
  - Flaw characterization or other means of differentiating flaws for acceptance (false calls vs undersizing)
  - Requirements for encoding
  - Acceptance criteria

Can the Section III Exam be used as the Pre-Service Exam?

- The Acceptance examination and the pre-service examinations do different jobs
- Acceptance examination is to ensure quality workmanship
- Preservice exam is to provide an as-installed examination and serve as a baseline for future examinations

Path Forward

- The NRC staff are open to combining the pre-service and acceptance examinations, but acceptance would be based on the details
- As an example, the pre-service examination be required to meet or exceed ASME Code Section XI Appendix VIII requirements
- Be performed on installed welds
- The examinations be encoded and recorded for future reference
- Robust acceptance criteria to ensure weld integrity (previously RT and UT performed since they are complimentary)

Questions?