



**INSTITUTE OF
CORROSION**



Welcome to MCF –
Marine Corrosion Forum
/ ICorr – Institute of
Corrosion (ABZ), 2021
April Webinars.



**INSTITUTE OF
CORROSION**



FORUM

FOR ALL WET CORROSION ISSUES

Institute of Corrosion (ABZ) and
MCF partnering with:

- SPIER HUNTER
- 29th April 2021



“Developments in remote magnetic monitoring of carbon steel pipelines to locate and measure abnormal stress”

SPIER HUNTER - Hamed Habibi

29th April 2021

About Defect Detection

- This presentation outlines recent developments in an emerging non-intrusive sensing technique developed to detect localised abnormal pipe wall stress by mapping variations in the earth's magnetic field around pipelines. Corrosion, metallurgical defects and ground movements result in areas of increased localised stress in pressurised pipelines and a direct relationship has been described mathematically relating magnetic field characteristics to the magnitude of stress due to magnetostriction. The presentation explores how measurements of remote magnetic field can be applied to define the location of defects in operational pipelines, quantify the associated abnormal stress, report the position of girth welds and to concurrently report a 3-dimensional map of the pipeline route.



Hamed Habibi | Spier Hunter

Q&A

- Selection of Questions to **SPIER HUNTER**,
Post-Presentation 29/04/2021

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q1. What distance from the defect location do we see magnetic changes in the pipe? Is it within a couple of Meters, or larger? How do we identify within that region of magnetic change, where the actual defect is, to conduct further verification and interrogation of that defect?
- A1. 1-5m signal distance, mostly 1.5-3m offset. Often there are more than defect in same area.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q2. In the comparison with ILI what ILI inspections were performed as there are many are these referring to, metal loss, geometric, crack detection MFL or UT?
- A2. Principally Geometry Pigs.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q3. How effective is this technique in congested pipeline corridors with multiple utilities above and below the pipeline being surveyed?
- A3. DC Field. AC interference not an issue. If 2 pipes close in Trench <1m apart, can test as combined, strongest signal is the one under test.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q4. How does pipe depth vary the results where pipe depths change from 2m depth to 10m depths?
- A4. Limitation for CT, range of Magnetic Field, aim for within 12x Pipe. Dia. Max. When outside range, magnetic pick-up is poor, and will be reported as such.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q5. Does ROW grade cover such as bitumastic roads, reinforced steel concrete coverings such as across highways effect the accuracy of the technique?
- A5. Magnetic interference is always reported and stress interpretations may be more difficult in this situation.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q6. Are there any International Standards that cover your Field Techniques deployed on Pipelines?
- A6. Not included in presentation but currently ISO standard development is ongoing for CT. There are standards existing in Russia and China presently for CT. No International standard, as yet.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q7. Have you performed many surveys in UK yet?
- A7. Yes, partly funded by National Grid but most field experience in France and North America.
- Separately, CUI CT research is ongoing with OGTC/Oceaneering.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q8. Can impressed current cathodic protection currents influence magnetic behaviour of pipeline steel and how does this affect your SCT outcomes?
- A8. Yes, for DC system could be an increase in magnetism. However, our tests are largely looking for DC gradients for defect detection and any AC is filtered out.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q9. In areas of DC and AC powerlines above the pipeline how effective is this technique, both in parallel with the pipe and when crossing the pipeline?
- A9. As above no issues with AC even HV / AC. DC effects sometimes if less than 1m proximity, potentially an issue. Any interference crossings are reported.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q10. Is there any confusion from weld residual stress v's defect tip stress?
- A10. No, we cannot differentiate if coming from Pipe Wall or weld.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q11. If a pipe has gone through several pressure cycles, can you detect metal loss stress concentrations through changes in remnant magnetism, even when pipe un-pressurised?
- A11. Yes we can do this. Consider no. of Stress Cycles from pipeline history, the relationship with Magnetism.
- Unusual metallurgies (if not known if advance) may affect results.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2021

- Q12. Where multiples indications are detected, what techniques have been used to screen the most critical locations to limit excavation scope? Can the tool detect defects that develop after the pipeline has seen the threshold stress level? (i.e. defect develop when the line is no longer operating at sufficient pressure to generate the threshold stress)?
- A12. Yes, not anticipated to be an issue from past experience.

THANK YOU FOR ATTENDING

This Webinar was brought to you by MCF working in partnership with ICorr
Aberdeen and **SPIER HUNTER**