



Marine Corrosion Forum and Institute  
of Corrosion partnering with

**Dr Prafull Sharma**

CorrosionRADAR

28<sup>th</sup> April 2020



# “Corrosion Under Insulation Monitoring using EMGR Technology”

# About Me

**Dr Prafull Sharma is the inventor of Electro-Magnetic Guided Radar (EMGR) and Co-founder & Chief Technology Officer of CorrosionRADAR Ltd. CorrosionRADAR developed a predictive CUI monitoring system which is gaining global attention. Prior to his current role, Prafull worked for General Electric R&D where he developed several sensing and NDT technologies.**

**Prafull did his PhD from Cranfield University UK. He has over 15 years experience in industrial technology development especially for non-destructive testing and automation in Oil & Gas industry. He is also credited with over 15 international patents and a book chapter.**



# Q&A

Selection of Questions to **Prafull Sharma**, Post-Presentation 28/04/2020

# Questions and Answers – MCF / ICorr Joint Event

## Aberdeen – April.2020

- **Q.** How does it know in 360° perspective, or is that just in 2d plane?
  - **A.** The coverage of the sensor is dependent upon the positioning of the sensor, the sensor only detect changes onto itself. If the sensor is not in the right location it will not cover the remaining section, if it is installed the bottom of the pipe it will only detect at the bottom. Different configurations such as helical gives better coverage. Water normally accumulates at the bottom of the pipe and is the most appropriate location to install. The system is flexible and is installed depending on the requirement of the end user.
- **Q.** What is the typical life of the Sensors ?
  - **A.** The moisture sensors are designed for more than 15 years, this is typically more than a insulation strip duration. As there is no corrosive element which can get damaged in the moisture sensor. The life of the corrosion sensor is dependant upon the corrosivity of the environment. If in a dry environment the sensor could last 10 or 12 years. Even if the corrosion sensor gets fast corrosion (as is its function), the sensor can be refurbished by cutting and connecting new sections.

# Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2020

- **Q.** For EMGR, the impression I get is that it has to be installed from the onset or alternatively retro-fitted onto the pipe
  - **A.** The most appropriate time is when inspections are occurring and insulation is being removed and would piggyback onto that window, typically during a turnaround. At the design and construction stage is the best time to implement.
- **Q.** Why have a combined single installation of Trace Heating + CUI Sensor (Dual / Twin Cable) ?
  - **A.** Heat tracing isn't designed to carry the microwaves needed for the system. We are currently looking at dual sensors, i.e. corrosion and moisture sensors combined into one in the future

# Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2020

- **Q.** Assume also requires some Wireless Signal Repeaters for obstructed Pipework?
  - **A.** We use multiple wireless protocols such as 4g but is specific to the site. the system can be placed remotely from the asset (up to 20m) using the bridge cable to take it outside of the dense pipe network
- **Q.** What is the maximum length of pipeline in the helical sensor configuration?
  - **A.** Maximum coverage is 100m straight length at the bottom of the pipe with one electronic device. In a helical configuration depends on the pitch of the helix and the diameter of the pipe. The length of the sensor will still be 100m but it depends on the level of coverage required by the helix.

# Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2020

- **Q.** Noting the corrosion rate with temperature, what's the CUI mechanism at higher temperatures - doesn't the moisture evaporate?
  - **A.** CUI can occur even at temperatures above 100°C as the moisture is trapped within the insulation and cycles of temperature. Coatings are very susceptible to these cycles as they can create cracks in the surface allowing water to penetrate
- **Q.** How do we distinguish small 'water' peaks from any background noise / interference ?
  - **A.** This is where interpretation is required, but a baseline after installation is always taken with a threshold requirement. Whenever this threshold is exceeded we can say this is a real water event rather than background noise

# Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2020

- **Q.** what is the cost of these sensors
  - **A.** this is a very elaborate discussion and depends upon the requirements of the system i.e. ATEX / non-ATEX, onshore / offshore etc. feel free to contact corrosionradar for more information
- **Q.** how would you go about selecting what areas you would deploy your sensors.
  - **A.** This is a discussion with the end user. They are typically deployed in high risk locations determined from inspection / RBI etc. e.g. pipe circuits within the CUI temperature danger zone (30 – 120 °C) at the lowest parts of the pipelines. At vessels this will include the nozzle / entry points of the vessel, columns and tower rights and nozzles. At these locations the sensor would be installed
- **Q.** is this technique applicable in the industry now?
  - **A.** Yes this has been deployed in Europe, Middle East and South East Asia with current discussions in Latin America and USA.

# Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2020

- **Q.** correlation between moisture detection and insulation cladding joint and how well sealed these are
  - **A.** when insulation is installed they should be fully sealed, but in real life it is difficult to achieve. This sensor can be installed as post installation / construction assurance tool and even as a reduced inspection requirement justification
- **Q.** how sensitive is this tool?
  - **A.** The tool detects corrosion when the sensor thickness is corroded (0.2 mm), if CUI is occurring it will likely detect it within 1 – 2 year timeframe and can be used as an early warning. The moisture sensor is very sensitive and will detect moisture on day 1 when ingress occurs. It is not sensitive to humidity only water ingress or condensation

# Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2020

- **Q.** is there possibility to detect corrosion signal without detecting moisture signal
  - **A.** it would be very strange to detect corrosion without moisture as moisture drive the corrosion reaction. Moisture should be identified and then corrosion will follow. If it was the other case it would likely be due to the moisture sensor being in the wrong location
- **Q.** can new paint applied to sensor by mistake damage the sensor?
  - **A.** no it will not damage the sensor. If the whole sensor is painted it will not function correctly. Areas where paint is applied it would deactivate that section which is painted. The moisture sensor will still detect water if painted
- **Q.** what is the Aging asset, cost effectiveness
  - **A.** Our experience is the most cost effective time to install this is during scheduled inspection this can piggy back to. Most of our applications are retrofits on aging assets.

# Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2020

- **Q.** If a corrosion signal is detected how can you proceed?
  - **A.** when you have the next inspection cycle you would prioritise this location which allows you to narrow down the location where inspection is needed. If no detection of corrosion then there is no need to inspect therefore postpone the inspection until corrosion is detected
- **Q.** Has the process been used on Stainless Steels to predict/ detect pitting corrosion and SCC under insulation?
  - **A.** for stainless steel the corrosion sensors aren't applicable but the moisture sensors are. Moisture leads to risks such as SCC
- **Q.** What is the power consumption?
  - **A.** The sensor only turns on once every 24hr period and is on standby thereafter. It uses the same kind of electromagnetic signals as Wi-Fi so it is not very power hungry

# Questions and Answers – MCF / ICorr Joint Event Aberdeen – April.2020

- **Q.** Should all sensors be placed under the insulation, will it then require stripping the insulation?
  - **A.** yes and yes
- **Q.** Can you confirm again please min. corr. rate detectable ?
  - **A.** the system is detecting wall loss as opposed to a corrosion rate. The thickness of the carbon steel on the sensor is what determines the wall loss and varies between 0.05 and 0.2 mm depending on the requirement.
- **Q.** Do the sensors need annual calibration?
  - **A.** No there is no calibration, once they are deployed and the baseline is set they are ready. It is a TOF system and therefore requires very little calibration
- **Q.** Will sensor limit the UT inspections needs to be done for internal threat?
  - **A.**