Other Branch Updates

ICorr Aberdeen: Annual Corrosion Forum (ACF)

On **Tuesday, 27th August 2024**, the Aberdeen Branch held its Annual Corrosion Forum (ACF) and welcomed a total of nine speakers and more than 50 attendees, along with equipment demonstrations from the Key Sponsors (CAN-ENGTEQ) of the One Day event.

Photo: ACF Attendees and Speakers at CAN-ENGTEQ Aberdeen HQ with ABZ Chair Mei Ling Cheah (Far Left Front) and President (Far Right).

The Welcome and Introduction (Safety Moment, ICorr Event Objectives / Benefits) was provided by Aberdeen Branch President, Mei Ling Cheah [Event Chair] – ROSEN with support from Simon Hurst – ENGTEQ.

Photo: Simon Hurst – ENGTEQ, Engineering Director.

Presentations

The Event continued over 3 main Technical Sessions covering a wide range of Corrosion Topics related to Corrosion Management.

1. The Role of ICorr in Corrosion Management by Stephen Tate - Institute of Corrosion President

Photo: Stephen Tate – ICorr National President.

Stephen Tate MBA, PG. Dip Eng, is a recently retired Snr. Corrosion Engineer with Oceaneering, and has supported Total Energies projects and operations for the last 8 years. He was twice Vice Chair and twice Chair of the Aberdeen Branch, before becoming the ICorr President and has worked in the Energy Sector since 1980 supporting the Aberdeen Branch since 2011 and is currently an Observer to its Committee. Although shortly stepping down as President, he will remain on the Institute Board of Trustees until November 2026.

The role of ICorr within corrosion management is primarily one of corrosion awareness education together with specific skills training to improve competency in corrosion prevention. This covers all age groupings and a wide range of corrosion-related disciplines. Every year, the Institute, in conjunction with its authorised training partners—Corrodere, Correx, and Argyll Ruane delivers approved training courses to many hundreds of apprentices, applicators, engineers, technicians, inspectors, and supervisors working in the corrosion prevention industries both in the UK and overseas. ICorr regularly collaborates with other technical bodies and will soon present to the new UK Government P&SC (Parliamentary and Science Committee) on the urgent need for improved UK-wide corrosion management and infrastructure protection. New CP Marine Training centres are planned to operate in 2025 in Aberdeen and Blyth. Additionally, ICorr delivers comprehensive technical programmes through its eight UK branches (recently expanded with the addition of Wales and Central Scotland) and also interfaces with many UK and overseas universities. It has signed a new MoU with AMPP and has similar ones in progress with CSCP (Chinese Society of Corrosion Protection) and Qatar University. Finally, a new CEng direct Chartership Scheme is expected to launch early in 2025.

2. Principles of Corrosion By Steve Paterson, Ph.D, C.Eng, Arbeadie Consultants

Photo: Steve Paterson, Arbeadie Consultants.

Steve graduated from Imperial College London with a B.Sc. (Eng.) and Ph.D. in Metallurgy and has over 40 years' experience in the oil and gas industry, mostly with Shell. He was involved in materials, corrosion, welding, inspection and integrity management and worked in the UK, Netherlands, Norway, the Middle East, and Malaysia. Steve is an independent materials & corrosion adviser with Arbeadie Consultants based in Banchory near Aberdeen. He is a current committee member of the Aberdeen branch of the Institute of Corrosion with responsibility for the YEP Young Engineers and University Liaison Programmes. He was awarded the Institute of Corrosion Paul McIntyre Award in 2019.

Steve provided the opening presentation running through:

- Fundamentals of corrosion and electrochemistry
- Types of corrosion and common corrosion mechanisms
- Corrosion control and management
- Costs and significance of corrosion

After dealing with the technical side of corrosion the presentation focused on the costs and significance of corrosion to demonstrate its ongoing impacts even while we apply considerable resources to control and mitigate its effects. A NACE study in 2016 estimated the global cost of corrosion to be US$2.5 trillion/year, equivalent to circa 3.4% of global GDP (Gross Domestic Product). For the UK this equates to between £60-80 billion per year (similar to the UK education spend). The NACE study found that implementing corrosion prevention best practices could result in savings of between 15% and 35%.

There are many new challenges for the energy sector as we move into alternative fuels and renewables.

Steve introduced details of a programme Hy4Heat explored use of hydrogen in homes.

Testing was done at the UK Fire Service College.

- Structural damage and overpressures three times higher than for methane
- Hydrogen transitioned from deflagration (confined to enclosure) to a detonation type explosion (rupture of enclosure) when hydrogen concentrations near the ignitor were above 20%
- UK Government recommended fitting:
  - automatic shut-off valves in homes to prevent significant leaks of hydrogen
  - hydrogen detectors
  - always-open air vents to ensure any leaking hydrogen escapes into the atmosphere rather than accumulate in enclosed spaces.

Clearly there is a motivation for corrosion engineers to contribute to achieving such savings and to the associated improvement in integrity of facilities and infrastructure and protection of the environment.

3. William Ritchie Kent Plc (Aberdeen). Corrosion Control and Management with Carbon Capturing Systems

Photo: William Ritchie Kent Plc (Aberdeen).

William is a principal engineer with over 15 years of experience with metallurgy and corrosion engineering associated with Energy and Marine industries. He began his career in Aberdeen performing failure investigations on failed structures and pressure systems within a metallurgical laboratory, before moving into asset integrity management of upstream oil and gas facilities. With time, his experience in asset integrity moved towards downstream facilities, such as refineries and petrochemicals, whilst simultaneously branching into design verification of oil and gas, marine systems, offshore wind and other energy infrastructure. In his latest role, his focus is now predominantly based on the design of energy infrastructure, with a broad mixture of existing and new energy markets.

Systems for capturing CO_2 from natural gas and waste gas streams are expected to be rolled out across many industrial sectors as part of an international momentum to meet net-zero commitments. Different technologies exist for capturing CO_2 from a process fluid, with varying degrees of effectiveness and technological readiness. One of the most widely used technologies to-date makes use of amines to capture CO_2 through a reversible chemical solvent process. A great deal of industry experience has been obtained from the oil and gas industry who commonly use amine-based systems to scrub CO_2 from natural gas, as a means to meet gas transmission specifications. Whilst a well-designed and well-managed system can be operated with very few issues, rapid and severe degradation of assets can be encountered when the corrosion threats are not understood, or corrosion management is not effective at identifying the early warning signs. It will be important to ensure that lessons learnt from the oil and gas industry reach engineers within other sectors who will soon adopt this technology. This talk discussed some of the different technologies used for carbon capture and then focused on the speaker's experience of amine systems and cases where problems have been encountered.

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4. Isbelis Lopez-ROSEN (Newcastle). Corrosion Management of Offshore Wind Turbine Towers and Transition Pieces: a Deeper Look at Coatings

Photo: Isbelis Lopez-ROSEN (Newcastle).

Isbelis is a Materials Engineer with a Ph.D. in Mechanical Engineering, her research has concentrated on mechanical characterisation of protective coatings for offshore wind turbine towers and transition pieces. She is an experienced Materials Engineer with over 7 years of experience in Research and Development, with specific expertise in the fields of materials, manufacturing, materials selection and technical support to process operators.

The rising demand for renewable energy is driving the offshore wind industry to move into deeper waters, which allows for larger turbines and an increase in their numbers. However, these remote, unmanned structures present unique challenges. Access to maintenance is limited, and offshore repairs are significantly more expensive than their onshore counterparts. In order to meet these challenges, robust and reliable corrosion protection and control systems are required. One of such systems may be a humble coating. Historically, coating specifications for offshore wind turbines were derived from the offshore oil and gas industry. However, premature failures in the field have prompted a reassessment of standards and procedures to ensure coatings are fit for purpose. The industry continues a quest to develop advanced paint systems capable of withstand high levels of contamination, surface variations across turbine components, and residual stress during operation. In harsh marine environments, coating failure may lead to corrosion, and thus compromise the integrity of the structure being protected.

Currently, qualification tests such as those outlined in ISO 12944, are tailored for each environmental zone to verify the coating's effectiveness throughout the structure's intended lifespan. The use of accelerated testing for certification purposes has the advantage of providing results under controlled, pre-established scenarios. However, passing these tests does not ensure effective corrosion prevention, as durability is influenced by numerous other significant factors. Accelerated tests are conducted under ideal laboratory conditions on optimally coated test samples; these conditions often do not reflect real operational environments. While these tests offer rapid insights, they cannot assure long-term corrosion protection due to various critical factors affecting durability. Disparities between laboratory and field test results have been documented, highlighting the complexities of achieving accurate, reliable corrosion measurements and the importance of factors such as application quality. Isbelis's ongoing work and this presentation delved into these discrepancies, exploring implications and potential solutions for the offshore wind industry.

5. Martin Harley-ROSEN (Aberdeen) Success Factors for Intelligent Pigging Campaigns

Photo: Martin Harley-ROSEN (Aberdeen).

Graduating in Materials Science and Engineering with an MSc. in Underwater Technology, Martin has over 30 years of experience in the oil and gas industry. A chartered Engineer, Fellow of the Society of Underwater Technology and past chair of the Aberdeen SUT committee, his experience includes design and construction projects;manufacturing, fabrication, site installation, subsea and pipeline operations by diver and ROV.

Martin provided a very entertaining talk on the main considerations preceding an IP run.

Before we can collect any intelligent pigging (IP) data, someone must first successfully run a pig through a pipeline without mishap. However ageing fields sometimes mean there is not enough speed in the pipeline for the pig to catch data; there might be inches of wax to scrape and a flexible liner carcass that mustn't be damaged; the pig trap door might struggle to seal with no spares to hand; it's necessary to negotiate with other operators to agree timing and handling at the destination. And just like in a movie, sometimes all seems lost two-thirds through the job when a spanner comes flying out of left-field in one of those 'we didn't think of that' moments.

There are very many reasons why an IP job can come to grief, and the Success Factors for Intelligent Pigging Campaigns were reviewed in great detail, as were some of the more practical and mundane things like rotas and bedding to consider before getting anywhere near launching a pig.

6. Ali Morshed-Independent Corrosion Engineering Consultant and Trainer - London (UK) Reviewing Several Corrosion Management Cases from the Energy Sector

Ali Morshed is a corrosion engineer with around 22 years of experience. He has worked in the UK's North Sea, North Africa, Middle East and South Asia with companies such as: Aramco, Atkins, BP, Cairn Energy, Chevron, Lloyd's Register, NIGC and Wood Group. Ali developed the Morshed Corrosion Management Model in 2012 which has been used both in hydrocarbon and non-hydrocarbon industries in various countries ever since. The model takes into account both corrosion engineering-based and non-corrosion engineering-based integrity management measures. He is the author of five corrosion management and one MIC book, all published by NACE/AMPP since 2012. Ali is currently providing consultancy and training services in the areas of corrosion engineering, corrosion management, RBI and MIC as a freelance corrosion engineer. He is also a member of the ICorr London Branch Committee.

Corrosion remains a major integrity threat for many assets in the energy sector, despite continuous and significant technological advances in a multitude of fields such as metallurgy, coatings, and chemicals. A careful review of some of the encountered corrosion issues, failures and leaks has revealed that the majority of them were due to erroneous or inefficient corrosion control and mitigation practices.

The review has also illustrated the fact that the majority of such corrosion issues and failures could have been easily and conveniently avoided, in the first place, virtually not requiring any extra resources. Further studies of such cases have further revealed that the main culprits or root causes behind them were the lack of performance monitoring and total lack of or inadequate communication and competency.

The latter two culprits were associated with different stages of the asset life cycle: from storage to construction, transportation, storage, installation and finally to the post-commissioning or the operations stage. The prime objective of this presentation was to share valuable integrity and corrosion experience with the pertaining operators and engineering companies in the energy sector in Aberdeen, so they would not repeat similar erroneous practices in future.

Such knowledge sharing should help others to improve their asset corrosion management practices and strategies; thus, enabling them to enhance their company's corrosion failure pre-emption capability while simultaneously optimising their integrity and corrosion costs.

7. Stephanie Okoye- Vysus Group Risk Based Inspection (RBI) in Asset Integrity Management – Overview

Photo: Stephanie Okoye - Vysus Group.

Stephanie is a Chartered Senior Corrosion Engineer with over 15 years of experience in the oil and gas sector. Her expertise lies in corrosion and integrity management of North Sea Oil and Gas assets, as well as gas and chemical processing plants. She holds qualifications as a Senior Corrosion Technologist by AMPP (formerly NACE) and currently serves as an Executive member of the Institute of Corrosion Engineers (ICORR). She is also a project management professional with a proven record of leading teams, managing, and delivering several projects successfully.

Improperly managed oil and gas assets can consume significant amounts of money, time, and resources. A robust asset integrity management system ensures asset availability, safety, and mitigates damage mechanisms that could lead to loss of containment (LoC). Risk-Based Inspection (RBI) methodology systematically evaluates risk, informing decisions on when, where, and how to inspect pressurised equipment in processing facilities due to material degradation. This presentation defined asset integrity, its importance, failure causes/preventions, and the evolution of Asset Integrity Management (AIM). It discussed different RBI approaches, the RBI methodology, and its generic process, including steps to an RBI build, focusing on pressure vessels and piping, and the applicable codes and standards. It also looked into corrosion studies, a crucial aspect of RBI, providing an overview of corrosion, its control/mitigation, reasons behind metal corrosion, and various damage mechanisms affecting process piping and fixed equipment in refining, petrochemical, and chemical processing industries. It particularly focussed on one internal corrosion mechanism (carbon dioxide corrosion) to demonstrate the corrosion risk assessment methodology. The talk also showcased examples of an RBI build, its output (the inspection plan) and a typical inspection plan, and finally outlined the benefits of the RBI methodology.

8. Clare Watt-Intertek CAPCIS. Corrosion Under Insulation – Expect the Unexpected

Photo: Clare Watt-Intertek CAPCIS.

Clare is from the United Kingdom and has over 20 years of operational experience in oil and gas corrosion and integrity management, including senior technical roles with international operators ExxonMobil, Apache and CNRI. She spent 6 years with KAEFER headquarters in Germany developing Corrosion Under Insulation (CUI) expertise and innovation and recently joined Intertek CAPCIS where she works as a corrosion and integrity consultant.

Clare is a member of the Energy Institute Corrosion Management and Asset Integrity Committee and has contributed to various published industry guidance. She has previously delivered corrosion training for Cranfield University M.Sc. students for 13 years and currently co-delivers international CUI training.

Clare shared some of the most surprising and/or interesting things she has learnt through her experience with CUI (insulation) /CUF (fireproofing) and used these illustrated examples to demonstrate why this corrosion threat is so difficult for the industry to manage, with reference to the current innovation landscape that is aiming to rise to the challenges. Themes included how surprisingly isolated CUI can be, the limitations of accelerated short term laboratory testing, and the risky reliance on a very few field datasets which underpin global CUI prediction, along with some unvalidated educated assumptions. CUI preferred designs can sometimes be the most difficult to inspect/monitor. Prediction is currently qualitative and conservative, and not always accurate. Examples of CUI failures that have provided key insights, that are not all currently incorporated into CUI prediction guidance, were shared.

As proving what works is surprisingly difficult for emerging design, detection, and innovation technologies, key success factors for the future were discussed and included some fantastic suggestions from the ICorr Young Engineers 2022 Aberdeen program for which Clare was a lecturer. The talks which generated many questions from the audience concluded with the issue of Certificates of Appreciation for all Presenters.

Photo: All Presenters Received Certificates of Appreciation at Conclusion of Event.

NDT Demonstrations -4 Sets of Demonstrations by Event Sponsors – CAN-ENGTEQ

A series of advanced NDT demonstrations then followed.

Attendees were taken down to the workshop areas where demonstrations were made by CAN Inspection Staff of four of their technologies.

Phased Array Ultrasonic Testing

This provides highly detailed mapping of internal surfaces using a scanning frame which is attached to a surface and can traverse the surface in a rectangular array gathering data very reliably.

ACF Engteq Event - Phased Array Demonstration 2

Photo: Phased Array in Action.

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Phased Array Ultrasonic Testing is applied to many applications where it is seen and proven as a more suitable alternative to conventional ultrasonic testing. The most common applications used with Phased Array Ultrasonic Testing include Bolt Inspection; Detailed Fingerprint Weld Inspection; Flange Inspection and C Scan Corrosion Mapping (Hydroform).

CANdrone-UAV Inspection Services

ACF Engteq Event - Drone Demonstration 3

Photo: Advanced NDT Specialist David Pirie Explains Drone Deployment to ACF Attendees.

CAN's state of the art Unmanned Aerial Vehicles (UAV) enable safe, live plant inspections in challenging areas and are designed to conduct a range of visual, dimensional and thermal imaging inspections in support of structural and mechanical integrity condition assessments both on and offshore. CANdrone services can be used to conduct aerial inspections and assessments of:

- Bridge links
- Confined space inspections
- Flares and elevated structures
- Gas detection/emission surveys
- Hulls
- Tanks
- Ortho/mesh data mapping with GPS overlay
- Pipelines
- 3D photogrammetry modelling

Eddy Current Array

ACF Engteq Event - Eddy Current Demonstration 8

Photo: A range of Eddy Current Probes for Different Geometries are Demonstrated by CAN.

Eddy Current Array (ECA) is an extension of traditional eddy current that can be used on conductive materials; typically applied to non-ferrous metals for the detection of pitting and cracking, it provides rapid inspection and defect evaluation with a complementary C-Scan display. Several coils' assemblies exist, providing flexible and ridged coil configurations for complex component inspections. Individual coils are multiplexed to ensure inspection coverage in multiple directions, which can be readily applied to the area under evaluation.

PA-CAT Demonstration

This provides highly detailed mapping of internal surfaces using a scanning frame which is attached to a surface and can traverse the surface in a rectangular array gathering data very reliably.

ACF Engteq Event - PCAT Demonstration

Photo: PA-CAT Tool (With Coating Stripped for Inspection).

PA-CAT is a multi-angle ultrasonic phased array pitch and catch technique that provides a signal amplitude-based assessment to provide a minimum remaining thickness of inaccessible test locations. Inspection data is collected and processed through a cloud-based platform using specific algorithms derived from LIDAR and Machine Learning data processing.

The Aberdeen Branch provides a very full technical programme of both in-person and online events. Abstracts of potential papers for the Aberdeen Technical Programme are always welcome for consideration, and anyone wishing to present should correspond soonest with the 2024/2025 Chair and Technical Programme Co-ordinator: **meilingcheah@gmail.com**

Further information about the Aberdeen Branch, and past presentations, may be found on their website page: Aberdeen Branch - Institute of Corrosion **https://www.icorr.org/aberdeen/** under Local Technical Programme and to join the Aberdeen Branch mailing list, please contact: **icorrabz@gmail.com**