A journal of the Institute of Corrosion

Corrosion Management

Issue 168 July/August 2022

Overview of the concept of fabric maintenance of offshore structures

INSTITUTE OF CORROSION

AkzoNobel rises to challenge of protecting world's biggest offshore wind farm

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The President Writes


Institute of Corrosion President, Bill Hedges.

Welcome to this edition of your magazine and I hope you're enjoying the wonderful warm weather we've had so far? As usual there is plenty of activity within ICorr which you can read about in this edition and which I hope you enjoy.

As I noted in the last issue our long serving and dedicated office Manager, Denise Aldous, retired at the end of June but thankfully she is remaining to help us with our financial administration on a temporary basis. The office is now in the very capable hands of Becky, the office supervisor, and Trish. They are both working flat out and learning all the things that Denise did for us – so please be patient with us as we adjust to this change.

In May we hosted a meeting with the Institute for Apprenticeships at Corrosion House to re-energise the Coating Applicator Apprentice Programme which had stalled during Corvid. There were twenty attendees representing employers, training providers and ICorr. The meeting was very successful, and a forward looking programme was developed which everyone was excited about. Many thanks to David Mobbs, Kevin Harold and David Horrocks for organising the meeting and making it so successful.

I'd also like to thank David Mobbs again for all of his work as ICorr's Business Development Manager which ended in its current form in June 2022. David took the role in 2018 and since then he has championed many successful programmes and we have seen our membership and revenue streams increase. Many of our courses have been updated, we have a strong social media presence, and undertaken a highly successful re-branding exercise.

In June we had our annual ISO 9001 audit which went very well. We had four minor non-conformances which will be fixed over the coming year. I'd like to thank Jo and Kevin Harold, David Harvey and Chris Williams for all their hard work on this to ensure we retain our certification.

In the area of Cathodic Protection (CP) I have a request. We would like to build a new CP training centre and we are looking for a small plot of land to buy or a building we can rent to do this. Ideally it would be near our office in Northampton. If you are aware of any opportunities for us to do this, please let me know using the email below.

In the last few months we have sadly lost two outstanding corrosion professionals: Dr John Scully, who's contributions to our profession is highlighted in this issue, and Prof. Anne Neville. They will be missed.

As I close, I'd like to highlight the 30th August as a date for your diary when our Aberdeen Branch are holding a one-day forum on the "Energy Transition – Corrosion and Material Challenges". Attendance is both in-person and on-line and you can find more details on the website.

Until next time.

Bill Hedges, Institute of Corrosion President
Email: president@icorr.org

From the Editor

Welcome to the summer issue of the magazine. I hope you have all had a good holiday break, or that you have one planned soon.

This issue has the usual columns and technical articles, except for "Ask the Expert". All our panel have been on holiday, but don't worry they will be back to answer your technical questions in the next issue.

The three technical articles have complementary themes relating to fabric maintenance and inspection. Simon Hope describes a methodology for the control of fabric maintenance of offshore structures. Ali Morshed discusses how to reduce corrosion failures, by maintaining a leak register of an asset, and Chukwuma Onuoha explains the use of external corrosion direct assessment in relation to pipelines.

As always, I welcome readers comments about the magazine, and remind you to send in your technical questions for answer by our panel of experts.

Brian Goldie, Consulting Editor
Email: brianpce@aol.com

How the Institute of Corrosion operates

Members often ask what the organisational structure of the Institute is, and to answer this, a series of articles has been planned, starting with an overview of the Institute's structure.

The Institute of Corrosion is a not-for-profit organisation, dedicated to putting its members at the heart of the global corrosion prevention community and ensuring that all that is done is aligned to its core values:

- **Trust and respect**
- **Experts and leaders in the field**
- **Innovative and forward-thinking**
- **Supportive and inclusive**

The organisational structure is the framework that enables this, and in which many talented and hard-working corrosion professionals help us to achieve our goals. The Head Office, Corrosion House, is where all the admin work is conducted, and is located in Northampton, where the staff of three work tirelessly to ensure the smooth running of ICorr.

The Council of the Institute of Corrosion

The Council is like the Board of Directors of a large company. It is the Institute's highest decision-making body, and every branch, division, and committee, reports to the Council, which is made up of the following members:

- **The five trustees/directors**
- **Branch and division chairs**
- **Committee chairs**
- **The chair of Young ICorr**
- **The technical Editor of Corrosion Management magazine**
- **Various co-opted members**

The Trustees of the Institute of Corrosion

There are five trustees, and these form the 'committee' that oversees the routine running of the Institute between Council meetings. The trustees are the following Institute members:

- **The President**
- **The Vice President**
- **The Immediate Past President**
- **The Honorary Secretary**
- **The Honorary Treasurer**

Beneath the Council, the structure allows information and operations to flow freely in all directions.

The Branches of the Institute of Corrosion

The six regional branches let us reach deep into the heart of the corrosion community in the UK:

- **Aberdeen**
- **London**
- **Midlands**
- **Northeast**
- **Northwest**
- **Yorkshire**

The work they do, and the networking opportunities they present to our members is vital. The branches have a great deal of autonomy, and run various events, including technical meetings/webinars, workshops, and social events.

Every event within the branches is a networking opportunity, and a chance for members to learn and share ideas, experience, and best practices.

The Two Divisions of the Institute of Corrosion

The two divisions stretch across every part of ICorr.

The Corrosion Engineering Division (CED)

The CED is made up of five working groups which look at specific aspects of our industry. The CED also runs an annual Working Day and Symposium. These Working Groups are:

- **Nuclear Corrosion**
- **Coatings**
- **Cathodic Protection**
- **All Energy**
- **Corrosion in Concrete**

The Corrosion Science Division (CSD)

This division consists of representatives from the corrosion research community – primarily academia and research – and runs the annual Corrosion Science Symposium.

Young ICorr

While the experience of senior corrosion professionals is crucial to our industry and to the Institute, equally important are the younger engineers and scientists who are entering and progressing in their careers in corrosion control.

Young ICorr is a vibrant and forward-looking group, through which many initiatives and early-career networks are formed, and from which the corrosion industry leaders of tomorrow will develop.

The Committees of the Institute of Corrosion

Finally, to the committees - without which the Institute could not function effectively. This is where much of the day-to-day work is managed. These teams meet when needed, collaborate with other teams, and ensure that actions agreed are carried out.

The Awards Committee

Responsible for overseeing the portfolio of ICorr awards, and for the nomination of members for external awards. The recognition of excellence both internally and externally helps us to demonstrate the authority with which the Institute operates and the professionalism, knowledge, and expertise of our members.

The Building Management Committee

This committee is responsible for the maintenance and upkeep of our Head Office, Corrosion House. They may not get their hands dirty with building work, but without them we might not have a home!

The Course Approval Board

The education of the corrosion community, at whatever stage of their individual careers, is crucial to the future of our industry, and, indeed, the future of our world. The Course Approval Board is responsible for approving new courses proposed by the Professional Development & Training Committee.

The Professional Development & Training Committee (PDTC)

PDTC is responsible for one of our most important strategies – the development and upgrade of training courses offered by the Institute. To achieve this, PDTC has two sub-committees:

- The Cathodic Protection Governing Board (CPGB), responsible for cathodic protection courses
- The Surface Treatment Governing Board (STGB), responsible for surface treatment courses

The Digital Strategy Committee

In our digital world, it is easier to connect, build networks, and share expertise than ever before. However, to do this effectively, it is essential to develop and follow a strategy that aligns with the goals of the Institute. This is the remit of the Digital Strategy Committee.

The Membership Development Committee

The real strength of the Institute lies in its membership. The broader and deeper our membership is, the more we can offer and provide to them and the global corrosion community.

The Membership Development Committee is responsible for initiatives to increase our membership and highlight the benefits for members.

The Professional Assessment Committee (PAC)

While the Membership Development Committee is responsible for driving up membership applications, it is the PAC that handles membership and upgrade applications.

Correx Limited

Although the Institute is a not-for-profit organisation, our commercial activities are key to the present and future sustainability. However, it is also crucial that the operation of these is kept at arm's length to satisfy the requirements of the Charity Commission. To ensure this is the case, we registered Correx Limited in 2003 (the name was derived from "Corrosion" and "Exhibitions"). Correx organises all of our commercial activities, and especially the administration of ICATS (Industrial Coating Applicators Training Scheme), which is mandated by the Highways Agency and Network Rail for all coating applicators – and it is also a requirement for many other major structure owners including Oil Companies, Power Generators, and Infrastructure Owners.

It is intended to explore each element of the organisation structure of ICorr in more detail in future articles, to help our members and the wider corrosion community to have a greater understanding of all parts of the Institute and the tremendous amount of work that goes on behind the scenes. If you're interested in getting involved in any of these activities, please get in touch with us.

World Corrosion Awareness Day 2022 Activities in Qatar

In commemoration of the world corrosion awareness day held annually on the 24th of April, The Gas Processing Centre (GPC) at Qatar University, in collaboration with ICorr, organised an informative technical seminar titled "Degradation of Structure Material for Net- Zero Emissions."

The seminar was part of a series of technical events that the GPC arranges collaboratively with international corrosion associations. Due to COVID-19 preventative measures, the seminar was held virtually. It focused on reviewing corrosion challenges associated with developing technologies targeting net-zero carbon emissions.

The seminar opening speech was delivered by Prof. Muftah El-Naas, who thanked the organisers, and gave a brief overview of the capabilities and role of GPC in supporting student's education, and addressing the challenges and opportunities facing the state of Qatar's gas processing industry. Following that, Muhsen Elhadddad, Material and Corrosion subject matter expert, thanked the Gas Processing Centre at Qatar University for the continuous support of the corrosion community in Qatar, and for the commitment made in hosting technical seminars on corrosion related topics.

Bill Hedges ICorr President highlighted the importance of effective corrosion management for reducing costs and ensuring safe and reliable facility operations, in his technical presentation. He also briefed the audience on the objective and outcome of a research study performed by one of the leading research institutes in the UK to support smooth energy transition and net-zero carbon emissions by 2050.

He emphasized that corrosion is still one of the leading causes for facility releases. He also indicated that more efforts are indeed required to mitigate the risks of corrosion and bring down its cost. Bill also discussed with the audience the approach taken, and the focus of the survey question that involved leading energy operators in the UK. Different elements of corrosion management and the role of every individual in the organisation to strengthen corrosion barriers were also discussed.

The technical seminar closed with an open question-and-answer session moderated by Prof. Muftah El-Naas. This interactive session offered a great opportunity for GPC members, students, corrosion experts to engage in a question-and-answer session related to this important topic.

Bill's presentation can be found at https://www.icorr.org/qatar-presentation-24-april-2022/.

ICATS/CORREX

Apprentice End Point Assessment

The most recent ICorr, ICATS apprentices have been deeply affected by Covid over the last 18 months. With college staff being unwell leading to eventual loss of staff and students unable to attend college and other factors, the final End Point Assessment was carried out on the 20th July with one student only.

That student, Rory Voulgar, was a credit to himself and the Jack Tighe organisation for seeing it through to completion.

The day started with the professional discussion between myself, John Moody, BINDT, and ICATS senior trainer Robert Hurley and of course Rory.

Rory's answers were clear and concise, and he remained so for the hour duration discussion.

This was followed by the practical session to test Rory's preparation and application skills. Once more he was able to demonstrate all the skills necessary to become a fully trained ICATS apprentice.

After completion of the EPA, we were very proud to announce to Rory he had achieved the grade of 'distinction'.

Other news

With all Covid restrictions removed our work at the larger asset owners and projects has resumed once more, and this is particularly true of the nuclear facility Sellafield in Cumbria. I recently visited Sellafield to see Eddie Blackmore, Jacobs Coatings Manager, who will be teaching all of the ICATS courses from the Jacobs main office at Sellafield. This is an amazing development for ICATS and we look forward to working with Eddie on his quest to progress all things paint and quality.

I have started travelling once more to visit our clients and further develop ICATS. I am also being helped in this by David Mobbs and senior ICATS trainer Robert Hurley.

KevinHarold,
CORREX Managing Director

EFC Honorary Fellow Award to long standing ICorr member

The European Federation of Corrosion has made an Honorary Fellow Award to Dr Douglas Mills, well known to members of ICorr (he was Technical Secretary 1999-2017).

The EFC jury recognised his outstanding accomplishment in the field of interpretation of electrochemical response of coatings on metals using techniques such as Electrochemical Impedance Spectroscopy (EIS) and particularly Electrochemical Noise (EN). He has also had a positive and long-term devotion to the EFC, with active involvement in a wide range of EFC Working Parties, in particular WP 14 (Coatings), but also WP 8 (Physico-chemical Methods of Corrosion Testing), WP 21 (Corrosion of Archaeological and Historical Artefacts), WP 1 (Corrosion & Scale Inhibition) and WP 11 (Corrosion of Steel in Concrete). He has submitted papers to all of these working party sessions at EUROCORR at various times. He has also attended and presented papers at most of AETOC (Advances in electrochemical techniques for organic Coatings) workshops /conferences that arose from the EFC coatings working party. He has supported EFC activities by being Editor of the EFC Newsletter from 2016 to 2022, and by providing regular scientific EUROCORR reports in the Corrosion Engineering Science and Technology journal.

This award is a nice recognition of Douglas Mills's contribution, not only to the EFC, but more generally to corrosion science and technology. He will receive it in person at the opening ceremony of EUROCORR 2022 which will be held in Berlin on August 29th.

Visit the ICATS website www.icats-training.org

Local Branch News

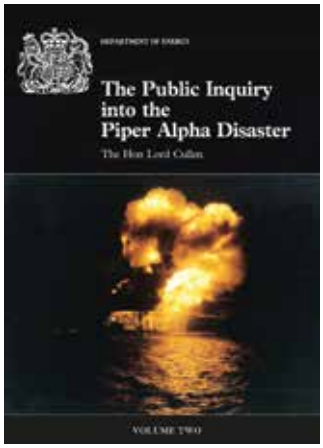
Aberdeen Branch

The May meeting of the branch was a hybrid presentation from the Palm Court Hotel by Martin Worth, Director, Plant Integrity Management (PIM), entitled: **SECEs: It's time for a rethink!**

The recent anniversary of the Piper Alpha disaster reminds us all of the need for effective safety controls. Our UK Oil and Gas industry was shaken to its core on 6th July 1988, when 167 people perished in the fire and explosions, and many others were traumatised and injured.

The subsequent Cullen inquiry, which took 2 years to complete, led to the Safety Case Regulations* being established, and the Offshore Industry thereafter moved to a goal setting safety regime, characterised by the introduction of PFEER (Prevention of Fire and Explosion, and emergency Response on Offshore Installations), and DCR (Design and Construction Regulations) – put in place to ensure that duty holders of offshore installations dealt appropriately with the requirements to provide measures to prevent, mitigate and respond to major accidents.
* See, HSE website:
The Offshore Installations (Safety Case) Regulations 2005 - SPC/ENF/158 (hse.gov.uk)

Prior to the Safety Case Regulations there was the 1974 Offshore Installations Regulations, which required that there was an Operations Manual and a Certificate of Fitness. These were prescriptive regulations, and were all about certification. These documents were essentially 'How to build and operate an offshore platform' and specified six organisations that you needed to use to certify your platform operation.



Piper Alpha Incident 6 July 1988 Lord Cullen Enquiry Report.

Process Pre-Safety Case Regulations.

However, during the Cullen enquiry there was the immediate introduction of the "Forthwith Studies", in advance of, and in preparation for, the Safety Case requirement for each asset by UK Operators. These identified areas requiring priority attention:

- Emergency Systems Review (ESR)
- Smoke and Gas Ingress (SGI)
- Fire Risk Analysis (FRA)
- Evacuation, Escape & Rescue (EER)

This was put together by large teams within the industry, but was second guessing what might be required when the Safety Case regulations came out.

These new Safety Case Regulations involved a formal Safety Assessment process, based on goal setting.

1. Identify Major Accident Hazards (MAH)
2. Identify all Mitigation Measures and Barriers
3. Specify Measures (SECEs and Performance Standard Criteria)
4. Apply the Performance Standards Process (Maintain/Assure/Verify)

Performance standards based around Functionality, Availability, Reliability and Survivability became the norm. Today, these are referred to as the "Safety and Environmental Critical Elements (SECE)", and according to the regulations, can be either hardware or software based, including management systems.

Process Post-Safety Case Regulations.

Setting performance standards for certain types of hardware can be very challenging. For example, a performance standard for a pipe or vessel may state that it shouldn't leak, but in practice we shouldn't be waiting for items to leak before we consider them to have failed as SECEs.

Martin debated that any hardware-based system shouldn't be the principal SECE, and that while many operators today claimed to be carrying out assurance, in practice some were doing little more than performing inspections, incorrectly leaving the assurance elements of the process to the verifier.

Following on from this, Martin suggested that changing the emphasis of SECEs to focus on Management Systems and Integrity Management Systems (IMS) would deliver increased efficiency and reduced costs. As, if it can be demonstrated that the IMS is well formulated and correctly implemented, this will automatically confirm that the elements it covers are inspected, their functionality confirmed, anomalies managed, repairs carried out, backlogs controlled, planning addressed, and their condition endorsed. Thus, removing the need for the specific assurance of individual items.

Martin's presentation was very thought provoking and again featured significant international attendance with a comprehensive Q&A following the event.

The Presenter

Martin graduated from the University of Liverpool in 1988 with a First-Class Honours degree in Physics, and has had over 30 years of experience within the field of safety management in the oil and gas industry, and was one of PIM's founding Directors. As an established figure within the oil and gas industry, his breadth and depth of experience has been gained through a variety of technical safety roles within both operator and consultancy environments, specialising in safety management but having particular interests in the linked fields of: risk management, process safety and risk-based decision making.

Upcoming Events

The branch is now looking forward to its AGM planned for September 2022, ahead of the start of the new technical sessions at which a new committee will be elected.

The next event of the 2022-2023 calendar after the Annual Corrosion Forum in August, will be a joint one with TWI. This will be given by Neil Gallon, Principal Engineer of Rosen, with a talk on "Re-purposing of Pipelines for Energy transition" - Thursday 22nd September 2022 at 6pm. Abstracts of potential papers for its Technical Programme are always welcome, and anyone wishing to join committee should correspond with: Hooman Takhtechian, **htakhtechian@oceaneering.com**

London Branch

The branch committee has been strengthened by some younger ICorr members, and the new committee met over the summer to discuss how best they can meet the needs of members, and developed the following mission statement.

The Branch's mission is to promote the understanding of corrosion, its impact, and how to mitigate it, in the various industries, through community knowledge sharing and transfer. The Branch also aims to meet the needs, and provide networking opportunities, for local ICorr members and the greater engineering community in London and beyond.

Following on from this, a questionnaire was sent out to the branch members asking for their views on how we can fulfil this statement, and these are being analysed. The branch is also looking for new committee members, so if you are interested, please get in touch.

The first meeting of the 2022/2023 season will be on 13th October at the usual venue, The Lancaster Hall Hotel, Bayswater, when Anthony Setiadi, Wood Thilsted Partners, will present "Corrosion protection considerations for offshore wind foundations". This presentation will primarily focus on monopile foundations, and the design considerations that would need to be taken onboard.

Details of future branch technical meeting can be found on the diary page of the magazine.

North East Branch

The branch has arranged a technical talk in December, to be held in the IMME offices in Newcastle, from Ing. Britt Gevaert, Acotec, Belgium, on their Humidur® brand of Passive Fire Protection coatings.

The branch is also organising a two day "Sustainability Conference "in 2023, in collaboration with IMME.

Continuing with the introduction of the committee members of the newly reformed branch announced in the last issue.

Patrick Johnson is currently Technical Marketing Manager with Carboline Europe and has extensive experience in the coatings industry R&D, business development, sales management and marketing.

Treasurer: Josie Terri Watson, is a Project engineer at Metec Cathodic Protection. She works in the technical department generating engineering documents such as manufacturing drawings and inspection test plans. She will be a great asset to the Committee and demonstrates the wide span in experience to the branch. Josie hopes to raise awareness with the youth and female members, and she will be the Young ICorr.

Secretary: Chris Langley has been working in the Coatings industry for 35 Years, and most of his career has been in the energy sector and chemical industry, focussed on corrosion inspection, and project managing fabric maintenance projects. He is currently a Field Consultant with the Safinah-Group, working in the energy and offshore sectors.

Events: Matt Fletcher is currently Global Linings Product Manager at International Paint. In addition to his masters degree in Mechanical Engineering from Newcastle University he is Diplom-Ingenieur (FH), SSPC Concrete Coatings Inspector Level 2, and has a Professional Diploma from the Chartered Institute of Marketing.

Barry Turner has also joined the committee. He is a very experience technical, sales and marketing professional with almost 40 years experience in industrial coatings. He is a recognised expert in pipe coatings and sits as a representative of the UK on ISO standards development groups for pipe line coatings, and is now working as an independent consultant.

North West Branch

The branch held its AGM on 29th June at Heyrose Golf Club, Knutsford, Cheshire. Representatives from Taziker, Wood Group, Analysis Scientific, Intertek and Mott MacDonald, were in attendance at the AGM, and began the process of planning events for the Autumn programme, and beyond.

At the golf day, despite the odd shower (not a description of anyone playing), the players enjoyed the challenge of Heyrose GC, and some (occasional) fine shots peppered the pins.

Anyone wishing to become involved with the NW Branch or the committee should contact **greg.brown@mottmac.com**, or **brenda.peters@analysis-scientific.co.uk**

Dr John Christopher Scully, FICorr, FIMMM, CEng

(9 July 1934-30 May 2022)

John Scully was born in Fulham (London, United Kingdom) to Anne and Christopher Scully, a nurse and carpenter, respectively. Both were of Irish Catholic descent. They encouraged John to look for opportunities further afield. After school, he joined the army for two years' National Service, following which he was awarded a scholarship to Downing College, Cambridge. During his six years in Cambridge (1955-1961), he gained a degree in Metallurgy and a Ph.D. in corrosion, the latter mentored by Dr T P Hoar. After defending his PhD, he worked for two years at the Olin Mathieson Corporation in New Haven, Connecticut, USA. He then returned to the UK to join the academic staff of the University of Leeds as a Lecturer in Metallurgy. He spent the remainder of his life based in Leeds.

Coming from a working class background, John was the only person from his school to receive a university education. That he then went on to become a university lecturer and an internationally recognised research scientist was a huge accomplishment.

While at Cambridge, John married Celia (née Shopland), a graduate in Physics from the University of Oxford and longstanding friend. The two met in London while members of the Labour Party in Fulham, which in those days was a working class part of London. Their marriage lasted more than 60 happy years. Celia passed away in 2019.

John's early years were spent in Fulham during and after the Second World War. He credits the League of Youth (the youth organisation of the British Labour Party) for providing the major opportunities and encouragement for intellectual growth during his teenage years. As a teenager, he escaped from the influence of the Catholic Church into full-blooded atheism—a world view from which he never wavered. As he approached the end of his school years, he

considered spending the next years of his life working for the Labour Party, instead of attending university. An influential older mentor at the League of Youth insisted that a person of John's talents must attend university. Fortunately, John followed that advice. He remained a member of the Labour Party all his life.

John's field of expertise in corrosion gained him global recognition. His work on corrosion is familiar to generations of metallurgists and corrosion technologists worldwide, thanks to his exceptional research efforts and supervisory role educating many undergraduate and postgraduate students. His scientific contributions have been captured by numerous technical articles and educational books, including The Fundamentals of Corrosion, The Theory of Stress Corrosion Cracking and Corrosion: Aqueous Processes and Passive Films. His publications are highly cited, influential as educational texts and still used by many practicing corrosion engineers. He was appointed Editor in Chief of Corrosion Science Journal, a leading publication of the field. He held this role successfully and effectively for many years.

In 1989, John Scully was presented with the U.R. Evans Award from the UK Institute of Corrosion - the pinnacle of accolades in corrosion, made for outstanding international achievements in pure or applied corrosion science, and for service to the corrosion community worldwide.

John had a lifelong devotion to literature, which began early in his life and flourished throughout his later years. He also had an avid lifelong interest in theatre and opera. After retiring from academic life in 2001, John turned his talent to writing. He wrote an autobiographical memoir, "Memories from Fulham", and several novels, which were published privately. The memoir evokes his youth in Fulham and the influences that shaped his world view. Reflecting on his time in Fulham, he said: "you can take a boy out of Fulham but you cannot take Fulham out of a boy". The book reflects his passionate belief in democracy, social change and the potential of politics to improve people's lives.

John's easy manner and love of life endeared him to the whole of his academic family, one of which was myself during the 1970s. He was an exceptional person, kind, considerate, always generous with his time and very willing to respond to anyone who asked. His hospitable nature went a long way as he and Celia entertained his PhD students who came from far afield, to summer garden parties with croquet and Christmas dinners at their beautiful house in Bramhope near Leeds.

He will be truly missed by all who knew him and also by the broader community for his technical knowledge that in some areas was unique.

I would like to thank John's sons, Christopher and Ralph, who have helped me with some of the details of John's life described here.

We all remember him fondly.

Bijan Kermani

Industry News

Aquatec Scoops Two Prestigious Awards at Offshore Technology Conference 2022

Aquatec has won OTC's 2022 Spotlight on New Technology Award and ASME's 2022 Albert Woelfel Best Mechanical Engineering Achievement Award.

The company received the Small Business Spotlight on New Technology Award for its KINEKtron® Retrofit Subsea Strain Measurement System, an innovative technology developed to measure and communicate strain levels on structural tubular members, pipelines, and other load-bearing infrastructure. The OTC-exclusive award recognises broad interest technologies that are innovative, marketplace-ready, and positively impact the industry.

Also, for its KINEKtron® system, the company received ASME's (American Society of Mechanical Engineers) prestigious Woelfel Best Mechanical Engineering Achievement Award. The Woelfel BMEA Award recognises a company for a product, device, or system displayed at the OTC Conference that best reflects innovation and practical use of mechanical engineering in solving problems, improving design, or maximising performance.

***Left*: 2022 Spotlight on New Technology Award 2022**
***Right:* 2022 Woelfel Best Mechanical Engineering Achievement Award**

SeaShield 2000FD™ System selected for jetty pile protection at RNLI Lifeboat Station

RNLI Padstow Lifeboat Station, with contractors applying Denso™ Marine Piling Tape (inset).

Winn & Coales (Denso) Ltd.'s SeaShield 2000FD™ System was recently specified for the protection of 31 jetty piles at the Royal National Lifeboat Institution's (RNLI) station in Padstow, Cornwall.

The existing epoxy coating on the piles had begun to fail due to its length of time in service, and abrasion caused by exposure to the local marine environment. The complete coverage of each pile required the installation team from PSJ Marine Services to work at height, from the beach, and subsea to fully protect the 16 piles of 762 mm diameter and 15 piles of 813 mm diameter.

The SeaShield 2000FD System, consisting of Denso Paste S105™, Denso™ Marine Piling Tape and a tough outer HDPE jacket, offers heavy-duty protection from corrosion and is suitable for application both above and below the water line, making it the ideal choice for this project and making Padstow the latest RNLI site to be protected with a SeaShield system., concluded the company.

AkzoNobel rises to challenge of protecting world's biggest offshore wind farm

Located around 89 kilometres off the east coast of England, Hornsea 2 is due to be up and running by mid-2022. It has the capacity to produce more than 1.3 gigawatts of energy – enough to power over 1.3 million homes.

The foundations of all the turbines (which tower 204 meters above sea level) have been coated with Interzone 954 from the company's International brand. Originally designed for the demanding protection of offshore oil and gas structures, the product has now also become the go-to solution for offshore wind farms.

Protecting turbines right-first-time enables them to continuously operate in the most challenging locations. Offshore wind farms are particularly susceptible to atmospheric corrosion, due to the high humidity and chloride content in the air. The splash zone of each wind turbine – which is intermittently wet and dry due to tides and waves – is the most prone to corrosion.

According to the company, Interzone 954 has a unique blend of properties, including excellent barrier protection, exceptional abrasion resistance and high film build. It's also resistant to a wide range of chemicals.

Book Review

Beyond The Pail

This book is a personal history of Raouf Kattan and his involvement in marine coatings. It focusses on his life, the influences, factors, adventures he had, which resulted in his establishment of Safinah Ltd, as a consultancy to the marine industry. He describes working with the main players in the industry internationally, and the enjoyment, and tribulations, he felt during his career.

Raouf has written many technical articles about the marine coatings industry and its problems throughout his career, including several in this magazine.

This is an interesting history of the marine coatings industry over 30 years from one professional's experience, and hopefully could encourage newcomers to the industry that there is great career to be had in marine coatings.

The book is available as a free downloadable ebook at, https://www.safinah-group.com/beyond-the-pail/

EUROCORR 2022, 28th August – 1st September, Berlin

EUROCORR 2022
European Corrosion Congress · Berlin · Germany

The European Corrosion Congress – EUROCORR, the EFC's annual conference, is the flagship event of the international corrosion calendar. Attracting upwards of a thousand delegates, it is held every year in September in a different European country. EUROCORR is famous for its high technical standard and its popular social programme.

For more information, and to view the programme, go to **www.eurocorr.org**

Geothermal Energy

Geothermal energy could be the "invisible key" to unlock new energy sources and help meet net zero greenhouse gas emissions by 2050, according to Queen's University Belfast researchers.

Professor Mark Palmer and Joseph Ireland from Queen's University Belfast have been working on a new landmark report for the Department for the Economy and the Northern Ireland Geothermal Advisory Committee.

The report, "Net Zero Pathways: Building the Geothermal Energy Sector in Northern Ireland", highlights that building the geothermal energy sector can help transition Northern Ireland towards a low-carbon future and create an emerging market.

Future geothermal energy use is considered key in decarbonising Northern Ireland's heat sector as it is a clean and naturally occurring source of energy. It uses the natural subsurface as a source of heat and has the potential to provide cooling and seasonal storage of energy.

Launched as part of Northern Ireland Geothermal Energy Week, the Queen's University report offers detailed recommendations for the way forward and f ocuses on the confidence-building actions needed to unlock the opportunities for energy from geothermal heating and cooling.

Eiffel Tower Plagued by Rust

In a leaked confidential report, it's been suggested that Paris' Eiffel Tower is in poor condition given the amount of rust plaguing the structure.

According to the French magazine Marianne, who received the leaked report, the monument requires a full repair which experts have noted would involve stripping the structure to bare metal, various repairs and repainting.

Completed in 1889, the Eiffel Tower in Paris was constructed as part of the world's fair. Designed and built by civil engineer Gustave Eiffel, the historic landmark stands 324 meters (nearly 1,063 feet) tall and is made of 7,300 tons of puddle iron—giving the structure its nickname, "The Iron Lady."

Puddle iron was invented in Britain during the Industrial Revolution through a process that produced high-grade and purer wrought iron by removing carbon from pig iron in the melting process. These metal pieces were then placed together with what is estimated to be 2.5 million rivets.

Before officially opening to the public, the Eiffel Tower received four coats of red lead paint. Although banned today, at the time lead paint was believed to be the best anti-corrosive agent. Despite its ability to prevent corrosion, Eiffel suggested that the structure would need to be repainted every seven years.

According to the report, despite regular maintenance coatings work, the tower requires more than the current 60 million euros ($61.2 million) painting "facelift" its undergoing. This recoating work on the structure is still underway as Paris prepares for the 2024 Olympics.

The PDA Europe Conference & Exhibition

CONFERENCE & EXHIBITION
PORTO 2022

The PDA Europe Conference & Exhibition will take place on 17-18 November 2022 in Porto, Portugal.

After almost two years of online events as a consequence of the Covid-19 pandemic, the organising committee are looking forward to welcoming you in-person for an exceptional **two-day gathering** in the beautiful region of Porto.

Registration for this is now open. For further information, including exhibit space and hotel accommodation, see: **www.pda-europe.org**

Innovative Products

Satellite-based remote monitoring for cathodic protection installations

Remote monitoring specialist Omniflex has released the latest in its industry-leading Teleterm range of remote monitoring instruments — the Teleterm SW1 module — an IoT-focused satellite-based remote monitoring module for the global cathodic protection (CP) market. Suited for use in a variety of applications, such galvanic CP installations on highways, bridges and pipelines in remote locations, the SW1 enables satellite-based remote monitoring and control where there is limited mobile connectivity and power supply.

The new SW1 remote monitoring module is solar powered using a tiny built in solar panel, so it requires no additional connections to power, and has no specialist set up requirements, other than requiring a clear view of the sky. It uses the low-cost Swarm satellite constellation, which provides 100 per cent global coverage, meaning users can now benefit from remote monitoring in environments where it was not previously possible due to the lack of mobile phone coverage, such as remote highways, pipelines and offshore installations, concluded the company.

Universal Primer

Global liquid and powder coatings supplier Axalta, has recently launched what it calls the first premium universal thermosetting powder primer available in the world. Alesta ZeroZinc UniPrime has been released in the EMEA region and is available from local Axalta offices.

According to the company, like other products in the Alesta ZeroZinc range, UniPrime has been formulated in accordance with High Density Ccrosslinking technology to prevent corrosion and extend a painted structure's working life. The epoxy resin-formulated primer is reportedly easy to apply and meets stringent anti-corrosion requirements.

ZeroZinc UniPrime can be applied to all types of substrates, including steel, hot dig galvanized steel, metallised steel, aluminum, etc. It can also cover hard-to-reach places and demanding shapes, such as expanded metal, perforated sheet steel and sharp edges, concluded the company.

Latest Literature

Optimisation of adhesion to improve steel corrosion protection

A new study focused on the possibility of using siloxane resins with epoxy modification to delay corrosion of metal substrates for hydraulic applications.

Formulations aimed at metal protection were designed, without including anticorrosive additives, and deposited on 11SMnPb37 steel. Thin monolayer films were obtained by dip coating in different process conditions, avoiding primers. The developed procedure was simple and able to provide solid and well-anchored coatings. They were characterised in terms of morphology, scratch and wear endurance, and resistance to a corrosive environment. The optimum formulation and deposition parameters were determined and the selected coating showed remarkable adhesion to the substrate, good mechanical properties, and resistance in a saline environment, proving to be suitable as a protective barrier against corrosion. The protective effect was ensured not by additives but through the excellent adhesion of the coating and its endurance to scratch and wear.

The study was published in Journal of Coatings Technology and Research, Volume 19, May 2022.

Water transport through epoxy-based powder pipeline coatings

The water permeation kinetics of two common epoxy-based powder coating systems for pipelines across a range of industrially-relevant temperatures (from room temperature to 80 °C) has been studied. The nonlinear dependency of water transport on the vapour concentration at 65 °C was also analysed. The vapour transport analysis of epoxy coatings demonstrated a turning point around this temperature, perhaps due to clustering of water molecules. At higher temperatures, break-up of water clusters and plasticisation of the polymer expedited the transport.

The researchers also examined microstructural changes of the epoxy network due to water transport and found evidence for irreversible damage to epoxy coatings under hydrothermal exposures. It appears that the combination of thermal exposure and internal stresses in the glassy epoxy leads to a phase separation of filler particles from the epoxy matrix, as well as to a distinctive cavity formation in the coating membrane. The results indicate that hydrothermal exposure is likely to increase aggregate porosity of the coating. Analysis of wet-state permeation is not only crucial for protection of transport pipelines, but it also is of high relevance to process equipment and underground storage tanks.

The study was published in Progress in Organic Coatings, Volume 168, July 2022.

STANDARDS UP-DATE

ISO

The following documents have obtained substantial support during the past two months and have been submitted to the ISO member bodies for formal approval.

ISO/PRF 1461 Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods (Revision of 2009 standard)

ISO/FDIS 4215 Corrosion of metals and alloys —Test method for high-temperature corrosion testing of metallic materials by thermogravimetry under isothermal or cyclic conditions

ISO/DIS 4905 Corrosion of metals and alloys— Electrochemical test methods— Guideline for electrochemical measurements in high temperature molten salts

ISO/DIS 18115-1 Surface chemical analysis — Vocabulary — Part 1: General terms and terms used in spectroscopy (Revision of 2013 standard)

ISO/FDIS 24139-1 Petroleum and natural gas industries — Corrosion resistant alloy clad bends and fittings for pipeline transportation system —Part 1: Clad bends

New International standards published in the past two months

ISO/TR 4340:2022 Water aggressiveness evaluation and optimized lining choice

ISO 12696:2022 Cathodic protection of steel in concrete

ISO 18768-1:2022 Organic coatings on aluminium and its alloys — Methods for specifying decorative and protective organic coatings on aluminium — Part 1: Powder coatings

ISO 18768-2:2022 Organic coatings on aluminium and its alloys — Methods for specifying decorative and protective organic coatings on aluminium — Part 2: Liquid coatings

ISO 24656:2022 Cathodic protection of offshore wind Structures

Fellow's Corner

This series of articles is intended to highlight industry wide engineering experiences, practical opinions, guidance, and focused advice to practising technologists. The series is written by ICorr Fellows who have made significant contributions to the field of corrosion management. The articles in this issue feature contributions from David Harvey, who gives a personal view of his career as a senior CP Engineer, and Douglas Mills, who discusses the use of Electrochemical Noise Measurement in determining corrosion.

A Cathodic Protection Engineer at work.

A Career as a Cathodic Protection Engineer

This article highlights some aspects of an interesting and rewarding career in the cathodic protection industry and with the Institute of Corrosion. It aims to show what can be experienced within the workplace and outside of it, in a varied, fascinating and satisfying career over 50 years gained with consultants, oil and gas operators, cathodic protection companies and engineering design houses. Hopefully this will encourage newcomers to the industry that there is great career to be had in cathodic protection.

I, like many others, came into cathodic protection by accident. I joined a CP Specialist Consulting Engineering Company as a draughtsman while still completing my day-release HNC in Electrical Engineering. I was fortunate to have an excellent mentor in David Lewis, former ICorr President, who gave me John Morgan's "Cathodic Protection" textbook to study. I progressed on to become a CP design engineer. As I did not drive at that time and site visits were limited, I benefitted from picking the brains of my colleagues' knowledge and site experience, as back then, junior engineers were teamed up with a senior engineer to learn their trade, which regrettably does not happen today. However, one of the enlightening aspects about the CP Industry is that senior engineers are generally very open in sharing their knowledge and experiences – both good and bad - to enable us to continually improve the way we approach projects and produce more cost effective, efficient designs.

CP Engineers come from many different disciplines (e.g. mechanical, electrical, chemical, civil etc) some from grass roots and others from universities. The application of CP to structures requires detailed interaction with all disciplines so one ends up knowing a little about a lot, rather than a lot about a little, unless specialising in one particular area. Rarely are two projects identical as there are so many different parameters to be considered. Today, there are training courses, exams and certification offered by ICorr at all levels from Tester to Senior Design Engineer (Levels 1- 4 of ISO 15257). However, CP is something you also need to learn from field experience – often by trial and error. It is not something you can just study and apply effectively from a desk alone. Design spreadsheets can often contain errors or have bad data inputted so the output needs strong experience to know if it is sound or "rubbish".

My practical experience was initially gained by secondment to Middle Eastern oil companies. It covered applying cathodic protection to oil and gas fields, pipelines, associated tankage, and marine facilities. This was a very exciting time for a young man who had not previously been out of the UK. Working in the desert oil fields was almost like being on Safari. On return to UK, I was appointed a CP project engineer. Over time, I moved up to Engineering Manager and Consultant in a number of cathodic protection companies, design houses and as an independent consultant.
I was responsible for all aspects of sacrificial anode and major ICCP systems for pipelines, refineries/petrochemical facilities, and inshore/offshore marine structure projects.

My career as a cathodic protection engineer has given me the opportunity to visit and work in more than 25 different countries and meet many exceptional people at all levels. Occasionally, one could find sufficient spare time to visit some of the local tourist attractions, e.g. various roman ruins, Great Wall of China, Great Pyramids, Panama Canal etc. which were very enjoyable benefits I would not have otherwise gained.

ICorr Activities

As the industry expanded in the 1980's, I became involved in ICorr activities when they had the Joint Venture with NACE (CCEJV), which became the Corrosion Engineering Association (CEA).

Initially, I joined a CCEJV cathodic protection work group to assist with the preparation of a State-of-the-Art Report to be published by ICorr and NACE. This enabled me to learn from my peers and, at the same time, put some of my experience back into the industry for the younger engineers to benefit from. Later, I became Work-Group Chair, then Task-Group Chair. I was then appointed Technical Activities Coordinating Committee (TACC) Chair. This role also included being the Conference Programme Manager for "UK Corrosion" which was a major three-day event in the corrosion world 1987-1991. As TACC Chair, I also attended NACE Committee Weeks and Corrosion Conferences in USA as the UK ICorr/CCEJV representative. This was a tremendous opportunity for interaction with cathodic protection engineers and manufacturers from around the world. Regrettably, after much good work, NACE and ICorr parted company in 1988 and the CEA became the Corrosion Engineering Division of ICorr.

I also became the representative for Pipeline Industries Guild and the Institute of Petroleum on the BSI CP GEL 603 committee in 1985 which was revising the UK CP bible, BS CP1021. This was eventually published as BS7361 in 1991. In 1993 I was elected to chair this committee, a post I held for the next 19 years, coordinating the UK input into numerous BS/CEN CP standards prepared and published during this time.

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Apart from the BSI committee, I also became involved in various ICorr committees and Council:

- Member of Council 1998-Present.
- Chair of Professional Assessment Committee 1998 – 2012.
- Chair of CP Certification Sub-Committee 2006-2019.
- Chair of Course Approvals Board 2013-2019.
- Member of CP Governing Board (2002- 2020).
- Member PDTC Committee (1998-2020).
- QA Advisor attaining ISO 9001 Certification.
- ICorr Representative for UK to CEOCOR (2008 – 2012).
- Professional Affiliate Engineering Council Coordinator with Society of Operations Engineers – current role.
- Primary author/updater of 5 ICorr CP training Courses to ISO 15257 for On-land and Marine Structures.

As a result of these activities, I was awarded Honorary Fellow Member of ICorr in 2018.

One of the other milestones in my career was attaining Professional Affiliate Status for ICorr with the Engineering Council. This was followed by the setting up a Registration Agreement with the Society of Environment Engineers enabling suitably qualified and experienced members to apply for registration with the Engineering Council as a CEng, IEng or EngTech. Having set the system up, I thought I should be the guinea pig to try it out. My application was successful and I was awarded CEng. With the demise of SEE, I set up a new Registration Agreement with the Society of Operations Engineers.

As a result, more than 50 of our members have become registered as Chartered Engineers – a tremendous benefit available for our professional members.

In Conclusion

As I look back over the last 50+ years, I can reflect on the many good memories of a varied career, the many friends and colleagues I have worked with and the opportunities I was given to expand my knowledge. I have tried to put back some of this for young engineers to consider that a career in CP can be very interesting and rewarding. To be honest, I still get satisfaction from it and in retirement, I am still dabbling, doing some CP design appraisals/approvals. A long and interesting, satisfying career in CP is very achievable albeit with a lot of hard work.

David Harvey CEng, FICorr(Hon)

Electrochemical Noise

This article will look at the Electrochemical Noise Method for corrosion monitoring. Firstly, what are its attractions?

Well, it's as unintrusive as its possible to get, just using the fluctuations which are produced naturally by the corrosion process to tell us the corrosion rate and also, by looking at the plots, the corrosion processes (the degree to which it affects the item being measured is maybe as little like the effect on the star of using the James Webb telescope to obtain its distance based on the red shift!). Secondly the measurement is quick (a few minutes) and interpretation of results is intrinsically simple. It can operate on battery power and the equipment is portable and with appropriate sensing electrodes it can be used for continuous monitoring. The remainder of this article gives examples of how results can be obtained using the ENM technique, not just from organic coatings, but also from reinforcing bars in concrete, and to screen inhibitors. The inhibitors work is part of an ongoing programme at Nottingham university and the other two pieces of work were done by students in Northampton.

First how does the electrochemical noise arise, and what do the results look like?

$$R_n = \sigma_v/\sigma_I \quad \text{1}$$

Where R_n is noise resistance,

σ_v and σ_I are the standard deviations of voltage and current values, respectively, measured during a given time period is given by:

$$\sigma_v^2 = \Sigma V_j - V_m)^2/(n-1) \quad \text{2}$$

$$\sigma_I^2 = \Sigma I_j - I_m)^2/(n-1) \quad \text{3}$$

In equations 2 and 3, Vj is the voltage value measured at the jth time interval, V_m is the mean voltage in the given period of time, I_j is the current value measured at the jth time interval, I_m is the mean current in the given period of time, and n is the number of time intervals. [1] For coatings, Rn equates to the DC resistance (Rdc), and EIS (0.1 Hz impedance). [2] There is evidence from this work and others that when there is significant corrosion rate, Rn relates to the value Rp obtained from Linear Polarisation Resistance (LPR). The analysis software creates a value of Rn, and typical ENM data are shown in Figure 1.

The first application of the ENM method described is to an anti-corrosive organic coating system.

The actual Noise arrangement used is known as the single substrate (SS) method, diagrammatically shown in Figure 2. You need two working electrodes for noise measurements, and with the single substrate arrangement you can have these as two areas of painted substrate on the same panel, isolated in lab work, by being contained in cells (but in site work, a dry piece of coated steel with a Calomel electrode in each cell, is adequate). The third electrode (reference) is the panel itself. When you examine an organically coated metal, the noise signal tends to be attenuated by the ionic resistance of the coating, and you end up with that resistance being dominant. In this example, the coating was applied to Q panels, cells were attached, and the coated area within each cell was exposed to 0.1 M chloride solution for several months (with occasional topping up). The ENM results were compared against DC resistance. The results are shown in the Figure 3. As can be seen, some areas of coating started with low values of resistance which tended to drop with time, while others had higher initial values, and these remained high. There was a strong correlation between the Rn values, the Rdc values, and the visual appearance. Also, the effects of thickness and number of coats were investigated. Thickness proved more critical than number of coats, although both were important, the higher the thickness the more protective the coating. The advantage of the electrochemical measurement over visual observation is, a) it tells you what is happening earlier, b) It indicates problems when you cannot see what is going on, c) it can be automated, and d) it gives you a number!

These advantages also apply in the case of the second example, that is measuring the corrosion rate of reinforcing bars in concrete. This is little more complicated to set up. The lab work was designed

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to be a precursor to taking the equipment out to site so non-glass electrodes were used viz solid-state silver /silver chloride solid electrodes, which worked just as well as Calomel electrodes. There is an ENM arrangement which can be applied to a coating or to concrete, which is the NOCS (No connection to the substrate) arrangement. This offers the attraction of being able to get a result without actually making any connection to the rebar itself. The experimental set up is shown in figure 4 and some typical results in Table 1. This work involved two sets of three bars in mortar, one of which contained no added chloride, and the other of which had 4% added chloride. The results were quite clear, the bars in the 4% were corroding (corrosion rate inversely proportional to Rn) many times faster than the bars in the 0% NaCl, although there was some minor variation between bars. Unlike the coating work, we cannot check these particular samples yet as they are still under test and have not been broken open. However previous published work [3] showed beyond reasonable doubt that the Rn value correlated very well to the subsequently observed corrosion.

The third example is testing inhibitors This was driven by the wish to test green inhibitors and see if they could be used as alternatives to conventional more toxic inhibitors such as propargyl alcohol. The application considered was the need to inhibit corrosion of the steel pipes used to carry the CO_2 saturated oil, containing some sea water. The experimental set up is shown in Figure 5. Two small nominally identical rectangular steel samples were contained in a sample holder made employing the 'additive manufacturing' process (a form of 3D printing). In this case it was from an ABS polymer powder. The black blanking-off compound was provided by an anticorrosion coating manufacturer. It was found essential to stir the solution to get reproducible results, although in practise a significant flow rate is likely. Some results are shown in Figure 6, where a particular green inhibitor (sugar beet) proved more effective than conventional inhibitors. The lab investigation compared the ENM method both against corrosion loss by ICP-MS analysis, and also against the more commonly used LPR method. This work has not yet appeared in a journal publication. But a paper has been submitted to EUROCORR 2022.

This has been whistle stop tour showing the application of this ENM technique to three different fields. If anybody wants to find out more, get in touch with the author.

1) Yang, L. and Chiang, K.T. (2010) On-line and real-time corrosion monitoring techniques of metals and alloys in nuclear power plants and laboratories. *Understanding and Mitigating Ageing in Nuclear Power Plants.*, pp. 417-455

2) Comparison of ENM, EIS and DC Resistance for Assessing and Monitoring Anti-Corrosive Coatings Douglas J Mills JCSE 2000

3) Mills, D.; Lambert, P.; Yang, S. Electrochemical Noise Measurement to Assess Corrosion of Steel Reinforcement in Concrete. Materials 2021, 14, 5392. https:// doi.org/10.3390/ ma14185392

Acknowledgements

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Douglas J Mills

Figures

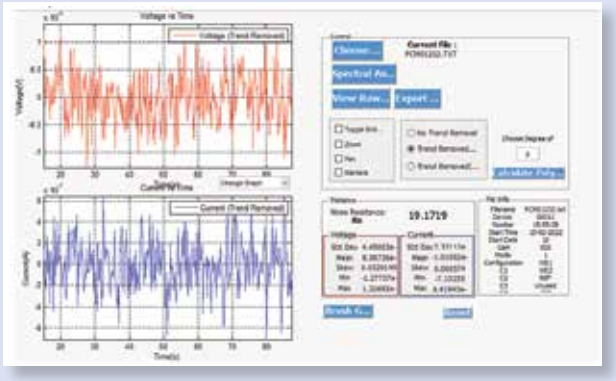

Figure 1: Typically Noise plots of current and voltage against time.

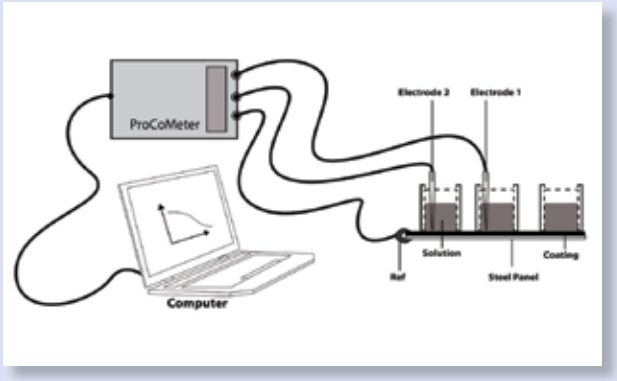

Figure 2: Schematic diagram showing how ENM is applied to coated metal (Single Substrate arrangement) (Solution is typically 0.1 M NaCl).

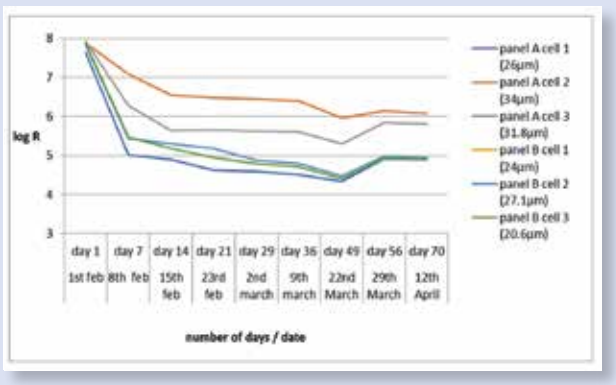

Figure 3: Typical results obtained from Hammerite coating of Resistance against time.

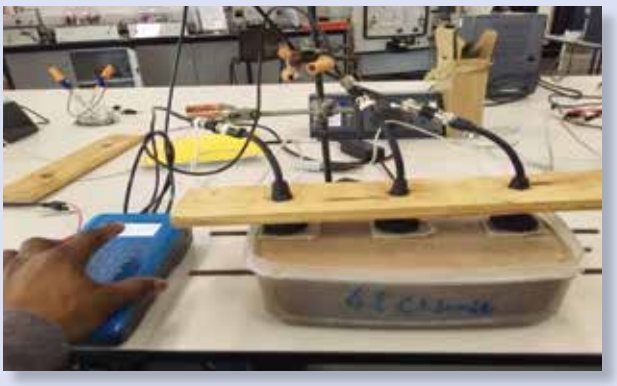

Figure 4: Set up for measuring Rebar in concrete using NOCS arrangement of ENM.

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Table 1 NOCS results after 97 days				
Date	Cl- conc'n	Log Rn Bar A	Log Rn Bar B	Log Rn Bar C
5th May	0% Cl	3.45	3.51	3.58
5th May	4% Cl	2.23	2.31	2.43

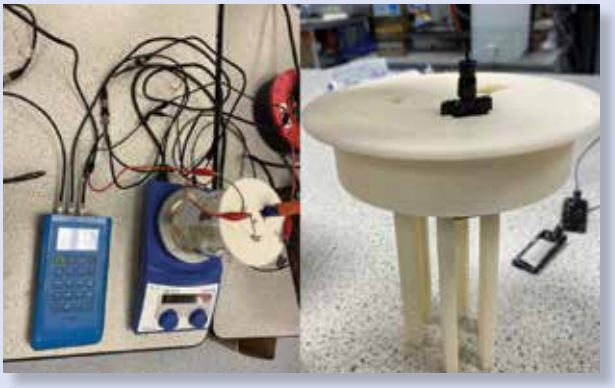

Figure 5 Set up for measuring Inhibitors of ENM.

Figure 6 Rn Results obtained comparing conventional inhibitors with green inhibitors (sugar beet and broccoli) in a CO_2 saturated solution of 3% NaCl at RT.

Overview of the concept of fabric maintenance of offshore structures

Simon Hope, Auquharney Associates Ltd

Fabric maintenance is conducted primarily for two end objectives, that is to say asset protection and cosmetic appearance. In real terms the former is probably the most important but least understood, and the latter the most often cited as required.

Asset protection is the investment of time and money to protect and conserve the capital value invested by the company in its assets. Without proper maintenance steel will revert rapidly to its original state, iron oxide, especially in the working environment that it is subjected to in a marine/offshore environment. By implementing a properly controlled maintenance programme the degradation of the asset can be minimised to levels that reduce risk to the integrity of the structure and the then associated need for massive steel replacement. This requires that the item be in good condition as a starting point.

This article describes the needs and requirements relating to the fabric maintenance of a clients assets to achieve the optimum coating performance and corrosion control.

Cosmetic appearance is nearly always the reason for coating work to be undertaken, unfortunately the end result is not necessarily always giving the asset the best protection for the funds expended. The "just give it a quick chip and scrape then slap on a coat of gloss" approach gives little or no improvement to protection and tends only to give a very short term cosmetic improvement. Correctly managed maintenance on the other hand will give as an end result the bonus of an asset with a good cosmetic appearance that should last.

Operational maintenance is the work done on a routine basis to keep the state of the asset within guidelines laid down. Should the condition of the asset fall outside these standards the matter needs to be addressed by the most practical method.

An offshore platform on the whole tends to comprise of a few very large areas, to get a realistic evaluation of condition it needs to be broken down into "Practical Painting Packages" (PPPs). That is to say manageable, defined areas that can be easily tackled by the painting squad as individual projects, within an acceptable time frame. These PPPs then need to be further broken down into individual components within the package. Once reduced to this level, it is a simple job to assess the condition of the "detail" by giving it a "Condition Code". The Condition Code is best described as a score, where the level of breakdown is given a number in a range, normally from 1 to 6 where 1 is the best condition, and 6 is the worst, and where significant steel loss has occurred.

Using this information, along with a measure and description of each of the components, an accurate database for the overall condition of an asset can be built up, and from that, generate work packages needed to maintain a given standard. If this is updated regularly (i.e. every six or twelve months) it is then possible to give accurate budget cost estimates by predicting the areas that will require work, and when the optimum time to do this work is.

The system of monitoring needs to be simple and easy to understand once it is set up and running, and should only involve a walk through the asset to compare the previous condition with the present condition. From this it is straightforward to determine the changes, be they improvement due to maintenance work, or degradation to a higher condition level.

This system will also allow for a more pictorial/numerical analysis rather than relying on language, and thus presentations of the condition will be easier to understand.

Suggested condition codes to be adopted,

1 **0-5%** Not requiring work

2 **6-15%** Work to be done at this point gives optimum timing for spot repair

3 **16-30%** Work to be done if practical whilst surrounding items are being done, otherwise the item is allowed to degrade to Condition 5.

4 **30-60%** As Condition 3

5 **61-99%** Optimum time to undertake a full coating refurbishment, ideally just before degradation to Condition 6

6 **Steel loss** This is where steel needs to be replaced, or at least confirmed as fit for purpose before any work is done.

The above percentages are based **not on breakdown**, but on the **area to be primed/coated**, as this gives a more sensible and realistic assessment of the actual amount of work and materials required to refurbish an area.

An area should be further down-graded on the scale if defects other than corrosion exist that are liable to cause premature failure. Defects in this category are for example poor adhesion, low film thickness, excessive film build due to prior repairs, and coating damage due to wear, tear and other factors.

Ideally the condition of the asset should be maintained in Condition ***1*** or Condition ***2***, as this is the level at which any maintenance is only a matter of spot repair rather than full refurbishment

Once an area is allowed to degrade to Condition ***3***, or ***4***, it is best left to degrade to Condition ***5***. Conditions ***3*** is a level of coating failure that is too great for touch up as the work and cost required to produce an acceptable level of repair will be reaching, or greater than, that for a full re-coat, also it is normally cosmetically undesirable. Condition ***4*** is the level where degradation justifies total repair rather than touch up, though the coating still has a finite protective life left. Allowing the coating to degrade to total failure, Condition ***5***, with its associated cosmetically unacceptable state, means that the steel is in a condition that it can be re-coated and the maximum value has been extracted from the previous coating system.

Using the above system makes it apparent how well an asset is managing to keep up with maintenance needs with the on-site staff. It gives an indication of when it would be most effective to organise assistance in the form of a fabric maintenance 'painting squad' to tackle a defined repair programme to bring sections of the asset up to Condition ***1 or 2***. A person with some basic knowledge should be appointed on the asset, due to the need to systematically walk round all areas at regular intervals checking condition at a "detail" level. An awareness can be generated as to the performance of the protective coatings and their rate of degradation in different areas as these reports build up over time. From these reports it is possible to create meaningful programmes and also pre-empt major, serious breakdown.

A further benefit, when considering aged installations reaching towards end of life is that it allows forward projections to be undertaken as to the expected conditions of the asset when this time in the future is reached. This then means that only areas where the degradation is likely to reach high end Condition ***5*** or Condition ***6*** are deemed a risk and so earlier reduced level maintenance can be used to prevent integrity issues in these areas.

The surveying and reporting should be run between the OIM/ Maintenance Supervisor in the field and the Integrity Engineer from Head Office, with the help of the Offshore Inspection Engineer (OIE) onboard. A prioritised programme of work should be generated from the survey results to cover the fabric maintenance 'window' period, and agreed. Paint ordering is related to specific areas on the survey, thus there is quantity control, as the required amounts can be calculated from the areas and specifications, rather than an arbitrary guess.

Monitoring of the correct information being put into the survey and its update needs to be done to ensure uniformity throughout the field and stop confusion due to individuals interpreting the system as they see fit. The fabric maintenance supervisor, or OIE, should do this on a regular basis during a maintenance campaign along with the contractor. Visits by the Integrity Engineer and Technical Authority will allow for checks to ensure that the quality of the work being done also meets the standards laid down, and that the database is being updated correctly. Should the need arise, this is the time that re-education, training and guidance, is best carried out, as it is possible to show exactly what is required by the individuals concerned - practical demonstration is easier to implement and to know that what has been explained is fully understood. Instructions in writing do not necessarily get across what is actually needed.

Initially a lot of work will be needed to set up the database and indoctrinate personnel in its use and benefits, but once up and running it will simplify the method by which fabric maintenance is conducted, and the understanding as to how, when, and why. A monthly update of work done using the area references in the survey, sent from the field to onshore management, along with a stock list and a lost- time breakdown, will help give an overall picture of progress.

Equally important is the need to ensure that personnel are aware of the standards that work is expected to be done to, and the restrictions that working to these standards impose. It is essential that there is a uniform standard of quality control throughout the field. The contractor's representative in charge of the workscope needs to be trained in the basics of coating inspection, that is to say :

1) Correct job planning and methodology.
2) Keeping a daily log sheet and weekly summary.
3) Taking regular ambient condition readings and their interpretation.
4) Surface preparation methods and cleanliness.
5) Recognising different standards of preparation.
6) Correct mixing of coatings and the effect of thinners.
7) Methods of coating application, and their differences.
8) Measuring wet or dry coating film thickness.

9) Recognising basic defects and their required remedies.

10) Knowing when to ask for help.

This can be done through a combination of visiting the site by the contractor's Technical Authority to give practical instruction and organise training such as ICorr, BGas or NACE. Also, the contractor is expected to produce detailed work scopes that go through the necessary procedures step by step. The standard of this inspection also needs to be monitored by regular auditing visits to the work sites to ensure that the quality of the work is consistent and compliant, and to the required specifications.

The assets that are undergoing capital projects involving fabric maintenance by the dedicated painting squads need to be checked and audited at the start of the project to ensure that all parties understand the scope of work to be done and the standards and specifications to be used. Dependent on duration, further visits may be needed to be certain that progress is as planned and that standards are upheld. These dedicated projects need careful planning. Consideration for as many variables as possible need to be addressed, not just the scope of work but also difficulties that may be encountered such as weather, bedding allocation, and access restrictions. Due to the costs associated, progress vs. budget needs to be closely followed, and any deviation from expected needs to be flagged up before matters get out of hand, the reason for the deviation must be addressed and corrective action taken. Materials to undertake the work must be available onboard at all times so that there is no downtime attributable to this. Contingency plans also need to be in place to cover any potential downtime, which must be properly documented.

The personnel selected for these dedicated maintenance painting squads must be competent and capable of working to the standards laid down. A system of verification as to competency needs to be established, this would normally be based either on the standards laid out in NORSOK M-501 or ASTM D-4228. The contractor will be expected to provide records of competency assessments for all personnel on site along with clearly defined limits of individuals' abilities. The same crews preferably, once fully trained, are to be kept to reduce the amount of time wasted in the initial start up of each project. This will also make the job of monitoring quality and progress easier as the crew will have a good idea of what is required and having worked together in the past, know their individual duties.

Where areas have degraded to Condition ***6***, that is to say steel loss, decisions need to be made as to whether the damage requires steel replacement. Should this be deemed necessary, then the new steel must be prepared and coated correctly either from the fabricators or on the installation. It is preferable that any steel stock supplied for on-board fabrication is supplied blasted and primed rather than 'black', to help ensure that repair work is properly coated after installation. If the steel is not to be replaced, this area then needs to be carefully monitored as premature failure of the coatings may occur. Invariably these areas are typically hard to access and are not readily visible. Again, the need to do the walk round will heighten awareness of these problem areas and catch them early on.

Machinery for fabric maintenance and projects must be kept in working order with proper maintenance schedules observed and undertaken by competent, trained personnel. Breakdowns cost time and money so anything to reduce these is important. Any repetitive failures of equipment need to be rapidly addressed and the cause of the failure investigated to find out whether it is a manufacturing defect, operator error, or something that can be avoided by changes to maintenance schedules.

By setting up a working system on these guidelines, input comes from all personnel involved, but by the same token, there are rigid guidelines to ensure that priority is given to maintaining the field to a high uniform standard. When problems occur, they are picked up early- on allowing for less wastage of time and materials. The overall state of the field can be monitored so that budgets can be predicted more easily, and capital projects organised, to suit both budget and the individual platform's operating pattern. The system described does not only cover offshore installations, but can be readily applied to just about any coated structure.

This methodology does not only cover offshore installations but can be readily applied to just about any coated structure.

Data from process vessels, ballast and cargo tanks inspections can be added into the overall survey as part of the data base thus it will also be possible to predict when the level of breakdown will be such that the tank will require maintenance. The scope for the input information can be extended to include just about any item that comes under the auspices of fabric maintenance over and above just coating, these items can be scheduled in the same way as all other components to be maintained.

The maintenance system used also needs to be able to upgrade the materials and the equipment, when necessary, to ensure that most cost-effective solutions are used, along with complying with environmental legislation. Changes in coating legislation are some of the most rapid, and manufacturers are working hard to meet new requirements especially regarding VOC and anti-fouling. Because of the high research and development costs now being encountered, new generation coatings are becoming more expensive in comparison with the old traditional systems. Budgets need to be adjusted to reflect these changes as they come into effect.

Conclusions

There is a need to introduce a system of control for the normal fabric maintenance, which is easily applied, policed and enforced as a cross-field standard. It has to be analysed numerically as this will cause less misinterpretation and can generate a tangible series of reports from which it will be possible to see how an asset is either improving or degrading. This then leads to the generation of requirements and budgets as needed, along with the ability to predict into the future where and when major refurbishment will be needed. Overall, if correctly applied, this system will save money as it will optimise the maintenance intervals and thus ensure that the coatings give their maximum value.

Ultimately, fabric maintenance is intended for the protection of the owner's capital assets. The responsibility of this may not fall readily into one department within the structure of the Operating Duty Holder, therefore there needs to be a degree of co-operation to avoid conflicts of interest and achieve quality performance.

A system based on these concepts does not need to be highly complex and at times the KISS approach is often the best as it leads to lower levels of confusion. It also leads to lower set up and operating costs so that budgets can be used for actual maintenance rather than huge bills for highly expensive and unwieldy FM programmes that tend to try to justify not spending money to pay for their own upkeep.

It should also be noted that such a system does not only cover offshore installations but can be readily applied to just about any coated structure.

Corrosion Management and the Leak Register Database

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Correct corrosion management implementation can bring about various benefits, including a corrosion failure pre-emption capability. For such capability to materialise certain prerequisites are required, including a leak register database.

A leak register database is a list of identified leaks containing the relevant leak data. Such data can help create a more transparent and thorough picture of the asset integrity condition and the associated root causes. Once such root causes have been identified (using a created integrity condition picture) then more appropriate, relevant and effective integrity management measures can be determined and implemented. In this way deterioration rates can be further reduced and future leaks prevented or more accurately pre-empted.

The corrosion failure pre-emption capability

It is important for any oil and gas asset owner to maximise their uptime while simultaneously minimising any unplanned shutdown periods (due to corrosion failures). To accomplish this, the asset owner or operator has to continuously maintain and enhance their corrosion failure pre-emption capability.

In general, corrosion failure pre-emption can be defined as predicting where, when, and how, a failure is going to happen, and then to prevent the failure before it occurs.[1]

Hence, the two main components of a failure pre-emption process are, prediction and prevention (see Figure 1).

Prevention is achieved through one, or a combination of, the following three rectification strategies based on the asset condition, available resources and mitigation capabilities, and the nature and severity of the existing defects.

1) Initially through rectification, or an enhanced mitigation, intended to reduce the asset deterioration rates such as:

- Optimising an existing chemical treatment
- Improving the control of pertinent operation and process parameters (e.g., flow rates, temperatures, and pressures) per the required design specifications
- Enhancing the effectiveness of any dehydration process
- Increasing pipeline pigging frequency (to remove dropped-out water in the low points)

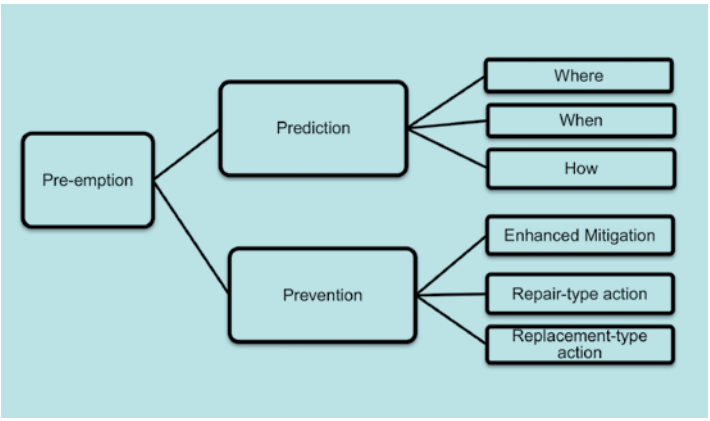

Figure 1- Main components of the corrosion failure pre-emption process.

- Improving cathodic protection system performance

2) If it is too late for any action to reduce the existing corrosion rate, or to lessen the corrosivity of the environment, then a repair to prolong the operating life of the affected component until the next planned operation shutdown, needs to be undertaken. Repair methods include, but are not limited to:

- Applying clamps
- Applying wraps
- Fitting sleeves

3) Finally, if it is too late to plan for and carry out a repair, then replacement, during an enforced operation shutdown, needs to be carried out. The shutdown might be only component-based or it could be a partial or total asset shutdown. However, this would be a controlled shutdown without any leaks compared to when a failure or leak has been identified, forcing the operations to carry out an immediate shutdown.

Through improved determination of probability of failure and deterioration rates, the asset corrosion engineer can establish a corrosion failure pre-emption capability, or (if it already existed) to improve it. [1] The corrosion failure pre-emption capability can then help the asset corrosion engineer to reduce the number of annual corrosion failures. Reducing leaks has a direct and significant effect on annual corrosion and integrity costs as well.

Examples of the types of failures which can occur.

Hence, a leak register database is considered as an indispensable prerequisite for an efficient and successful corrosion failure pre-emption capability. Therefore, maintaining a thorough and up-to-date leak register database is essential.

A leak register database should include relevant and useful fields as described below.

Minimum Requirements for a Leak Register Database

A leak register is a digital list or database for collating, storing, and processing any type of data or information relating to a leak or failure. The stored data should be used to analyse, filter, and trend the leak-related data in such a way that further leaks are prevented, or more precisely pre-empted. Such pre-emption is carried out via creating a transparent and thorough integrity picture through which the asset corrosion engineer can clearly identify the existing integrity issues (which have led to the leak or leaks) and determine their root causes so they can be rectified, removed, or resolved. To be able to do this using a leak register database, then it should have the following fields or sections as a minimum:

- Leak date
- Material (the type of metal or alloy that leaked)
- Mode of failure (pinhole, crack, or rupture)
- Orientation (or "clock position" of the leak)
- Location (with respect to the immediate upstream equipment or any upstream devices that cause any operational or process changes farther downstream)
- Vicinity to nearest weld
- Type of equipment suffering from the leak (e.g., piping, pressure vessel, tank)
- Design life versus actual life
- The last inspection date (prior to the occurrence of the leak)
- Inspection type (e.g., risk-based, time-based or consequence-based)
- Deterioration mechanism(s) contributing to the leak
- Estimated or calculated deterioration rate at the leak location
- Internal or external environment causing the leak (e.g., composition, pH, water cut or humidity, flow rate and presence of bacteria)
- Existing mitigation methods (which might have not performed well, leading to the leak)
- Identified non-corrosion engineering-based integrity management measure root cause(s) (e.g., lack of communication, lack of competency or inadequate procedures)

The significance of maintaining a leak register database is even greater for older or more mature hydrocarbon assets where failures or corrosion leaks are a more frequent occurrence.

Benefits Associated with a Leak Register

The following can be regarded as the most significant benefits associated with leak registers:

- A leak register can further facilitate failure data analysis and trending. This helps the asset corrosion engineer to better identify the associated failure root causes. Thereafter, they can devise solutions to rectify any existing asset integrity management system (AIMS) shortcomings or to improve the mitigation measures to further reduce the current deterioration rates; hence prolonging equipment lives.
- The leak register database can also be used as one of the inputs for a failure risk assessment (FRA) process (also called RBI), where a higher number of leaks (associated with a particular corrosion loop, equipment, or system) can be translated to a higher risk code for that particular loop, equipment, or system. Using the leak register data as the input source for the FRA process improves the accuracy of the risk codes and the inspection intervals determined, and makes the inspection scope more risk-based.
- Improved failure data analysis and trending along with more accurate risk codes and inspection intervals enhances a company's corrosion failure pre-emption capability. Such improved capability leads to less frequent corrosion leaks, thus gradually optimising corrosion and integrity costs.

Conclusions

An up-to-date and complete leak register database is one of the most important prerequisites of an efficient and successful corrosion failure pre-emption capability.

Recommendations

- Irrespective of the age of the asset a leak register database should be created (if it does not exist already), using the suggestions in this article.
- Use the existing leak data as input for the FRA process to obtain the risk codes and inspection intervals more accurately.

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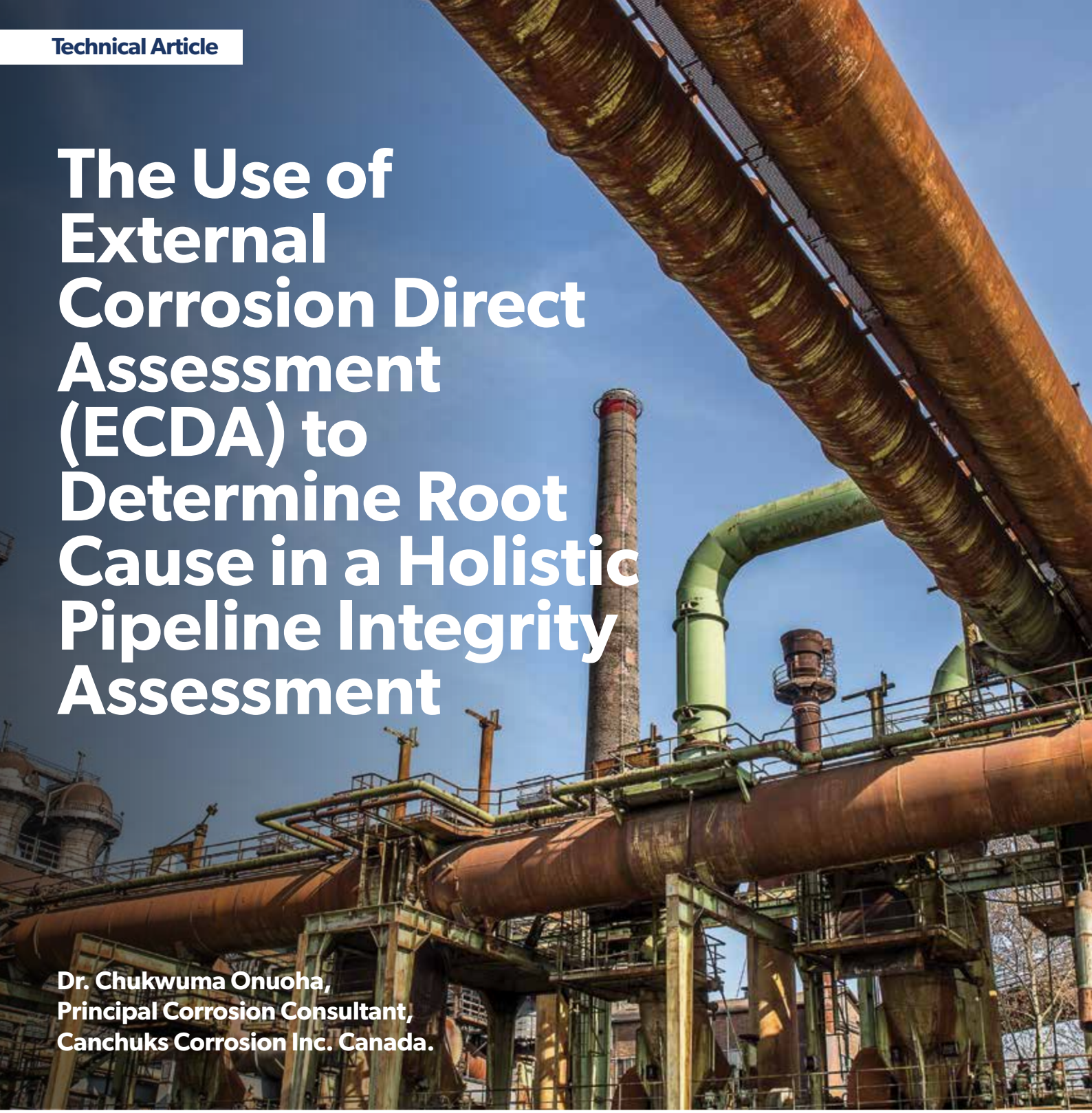
The Use of External Corrosion Direct Assessment (ECDA) to Determine Root Cause in a Holistic Pipeline Integrity Assessment



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To comprehensively assess the condition of critical metallic pipelines, inline inspection (ILI) and external corrosion direct assessment (ECDA) techniques are commonly used. ILI is one of the most effective pipeline integrity assessment techniques because of its ability to identify and qualify defects such as denting, corrosion and cracking. The inspection can be conducted with limited disruption to operations. However, one of the drawbacks of ILI is that it provides no insight into future pipeline conditions, it detects defects that have already formed, but cannot be used to predict what will happen in the future. There is also a threshold for anomaly detection, and only anomalies that exceed that threshold can be detected. On the other hand, ECDA is proactive and can detect coating faults and CP deficiencies before corrosion, wall loss or external cracking occur. It is also minimally invasive. One of the drawbacks of ECDA is its limited ability to accurately determine the location and extent of wall loss. That is, once the external corrosion's likely location on the buried metallic pipeline is predicted, the pipeline must be physically exposed for the actual pipeline condition to be assessed, and the extent of wall loss confirmed.

The key point remains the fact that every pipeline inspection technique has strengths and weaknesses, and more benefits can be derived when two inspection techniques are combined. For instance, Onuoha et al. conducted holistic stress corrosion cracking direct assessment (SCCDA), in which ILI was used to supplement the investigation.[1] In this investigation, ILI reported areas of coating disbondment, and SCCDA methodologies were employed with data from ILI to accurately pinpoint stress corrosion cracking locations. This demonstrated how a combined approach helps pipeline operators better manage their assets. The use of ILI and internal corrosion direct assessment methodologies were also investigated to effectively implement internal corrosion management best practices.[2]

With this combined approach, an ILI can detect time-dependent threats, and direct assessment (DA) methodologies are employed to accurately pinpoint the root cause. Once the root cause of the defect is known, appropriate preventive and mitigative actions can be implemented to prevent future failures.

The Power of Two (ECDA & ILI) Case Study: Employing ECDA to determine the root cause of external corrosion

This case study demonstrates how pipeline operators can leverage DA methodologies to complete a root cause investigation. This holistic approach was completed on 26-inch gas pipeline in service since 1955. The operator conducted an ILI to assess the health of the pipeline. The ILI reported clusters of external corrosion metal loss in a specific span.

Rather than implementing the usual "Pig, Dig, and Fix" approach normally employed by some passionate ILI practitioners and / or operators, this operator decided to do something different. He wanted to confirm the root cause of the external corrosion with DA methodologies within the specific span before implementing preventive measures.

To determine the root cause, ECDA methodologies were implemented, and the results are shown in Figures 1 and 2.

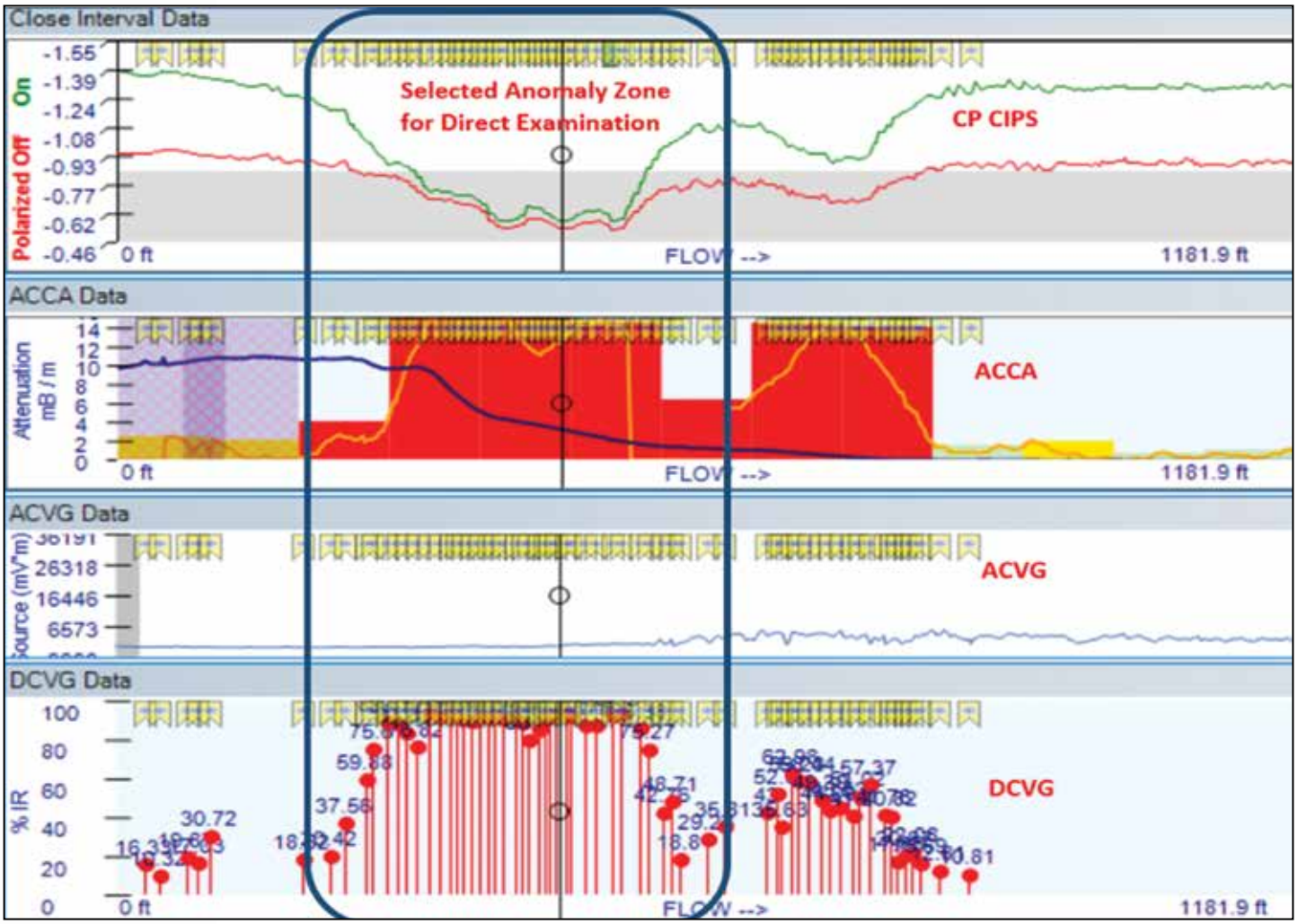

Figure 1: Selected anomaly zone for direct examination. [3]

Pipeline Integrity Data for Case Study	
Il T Results	**Integrity Data**
CP CIP S On Potential (mV/CSE)	-581
CP CIP S Inst Off Potential (mV/CSE)	-540
IR Drop (mV)	41
DCVG (%IR)	94
ACVG (dBµV)	60
ACCA (mB/m)	12
*Soil Susceptibility to Corrosion (SOSC)	High
*Reported ILI external corrosion wall loss (%)	>10% ≥20%
LSM Anomalies (Relative signal size)	Yes / large

**SOSC from United States of America, Department of Agriculture (USDA) Database
**LSM only detects stress concentration associated with the defect
*** **Predicted Dig Outcome:** High likelyhood of external corrosion and extensive coating damage

Figure 2: Indirect inspection data for the anomaly zone shown above. [4]

The indirect inspection result from a cathodic protection survey showed inadequate levels of cathodic protection per NACE SP0169-2013 standard. Indications from direct current voltage gradient, alternating current voltage gradient, and alternating current attenuation all showed a strong likelihood of coating damage. Large standoff magnetometry showed a large stress anomaly in the area inferring a potential stress concentration in the area [1]. In addition, the high soil susceptibility to corrosion infers highly corrosive and conductive soils.

To go one more step further to confirm the prediction of the indirect inspection tools, a direct examination was completed. The direct examination provided the opportunity to confirm the actual condition of the buried pipeline. Data from this direct examination (Figure 3) shows extensive coating damage as predicted during the indirect inspection stage.

Figure 3: Exposed selected anomaly zone Shown in Figure 1. [3]

The ultrasonic wall thickness non-destructive technique was employed to determine the wall loss as shown in Figure 2. Figure 4 presents the recoated section of the pipe.

Figure 4: Recoated section of the pipeline. [3]

This case study strongly demonstrates how ILI and robust overline techniques can be utilised to determine different threats and root causes. The ILI tool identified the external metal loss, and the pipeline operator supplemented proven ECDA overline inspection techniques to confirm the root cause so that appropriate preventive and mitigative actions could be implemented. The preventive and mitigative actions implemented by this operator included improving the CP system and implementing remote monitoring systems in locations with similar characteristics, and recoating the damaged section of the pipeline to reduce the likelihood of external corrosion.

Conclusions

This case study demonstrates how combined inline and ECDA overline inspection techniques can be employed to holistically assess and reduce risk on metallic pipelines. When the root cause of a problem is accurately identified, implementing preventive and mitigative actions becomes very easy. This is one of the benefits of supplementing DA techniques with ILI in a combined approach. DA can be used to identify where growth is occurring and why the issue is persisting; therefore, pipeline practitioners should embrace the combined approach to promote overall asset reliability and reduce safety risks.

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Tel: 01256 416010 Email: inquiry@aquatecgroup.com

CORRINTEC CATHELCO
Tel: +44 (0) 1246 457900 www.cathelco.com

CCSL
Tel: 01952 230900 www.corrosioncontrolservices.co.uk

CORROCONSULT UK LIMITED
Tel: 01952 740234 www.corroconsult.com

DEEPWATER EU LTD
Tel: +44 (0) 1483 600482 www.stoprust.com

DUVINE
Tel: +44 (0)1440 706777 www.duvine.co.uk

ICR INTEGRITY LTD
Tel: 01224 822822 www.icr.world.com

IMPALLOY LTD
Tel: 01922 714400 www.impalloy.com

METEC CATHODIC PROTECTION LIMITED
Tel: 0191 7316010 714411
Email: sales@metecgroup.com

OMNIFLEX UK LTD
Tel: 0161 491 4144 www.omniflex.com

PHOENIX CPC LTD
Tel: 07486076800 www.phoenixcpc.com

PMAC Inspection Ltd
Tel: 01224 703032

R&R CORROSION LTD
Tel: 01358 729644 www.rrcorrosion.com

SAITH LTD
Tel: 01425 207555 www.saithlimited.com

SILVION LIMITED
Tel: 01476 590932 www.silvion.co.uk

SPECIALIST CASTING LTD
Tel: 0191 5108843 www.specialistcastings.com

VECTOR CORROSION TECHNOLOGIES
Tel: 01384 671400 Email: davids@vector-corrosion.com

COATING APPLICATORS

ALFRED BAGNALL & SONS LTD
Tel: 01274 714800
Email: info@bagnalls.co.uk www.bagnalls.co.uk

APB GROUP LIMITED
Tel: 01538 755377 www.apbgroup.co.uk

AW RAIL SERVICES LTD
Tel: 01303 257462

BRIDGECOAT LTD
Tel: 02392 666161 Email: info@bridgecoat.co.uk

CC INFRASTRUCTURE SERVICES
Tel: 0845 685 01333 www.cc-is.co.uk

CORROSERVE
Tel: +44 (0) 113 2760 760 www.corroserve.com

DENHOLM INDUSTRIAL SERVICES
Tel: +44 (0)141 445 3939
Email: Damian.O'Brien@denholm-industrial.com

D.F. COATINGS LTD
Tel: 02380 445634 Email: info@dfcoatings.co.uk

DYER & BUTLER LTD
Tel: 02380 742222 www.dyerandbutler.co.uk

F A CLOVER & SON LTD
Tel: 020 89486321 Email: ian@cloverpainting.com

FIRESAFE SERVICES (NE) LIMITED
Tel: 01670 351666 Email: info@firesafelimited.com

FORWARD PROTECTIVE COATINGS LTD
Tel: 01623 748323 Email Pete@forwardpc.co.uk
www.forwardpc.co.uk

FOUNTAINS (PART OF THE OCS GROUP)
Tel: 07876 556197
Email: Donovan.gosher@fountainsgroup.co.uk

HANKINSON PAINTING GROUP
Tel: 0870 7892020
Email: Stephen.hankinson@hankinson.co.uk

HDM TUBES LTD
Tel: 07710080845 www.hdmtubes.co.uk

HERRINGTON INDUSTRIAL SERVICES LTD
Tel: 0191 516 0634 www.herringtonltd.co.uk

HRS RAIL LTD
Tel: 01797 329421 www.hrsrail.co.uk

JACK TIGHE LTD
Tel: 01652 640003 Email: sales@jacktighe.com

JPV (PAINTERS) LTD
Tel: 01277 201515 www.jpvpainters.co.uk

KUE GROUP LIMITED
Tel: +44 (0)1274 721188 www.kuegroup.com

NUSTEEL STRUCTURES
Email: scott.arnold@nusteelstructures.com
www.nusteelstructures.com

OAG INTERNATIONAL UK LTD
Tel: +44 (0) 151 318 6999 www.oag-group.com

PAINTEL LIMITED
Tel: 01752 719701 www.paintel.co.uk

PIPERCREST LTD T/A HALLS SPECIALISED SERVICES
Tel: 01375 361408 www.hallsspecialisedservices.co.uk

SAFINAH LTD
Tel: 01670 519900 Email: enquiries@safinah.co.uk

SCA GROUP LIMITED
Tel: 01202 820820 www.sca-group.com

SOLENT PROTECTIVE COATINGS LTD
Tel: 02380221480 Email: info@solentpc.co.uk
www.solentpc.co.uk

SPECIALIST PAINTING GROUP LTD
Tel: 01733 309500 www.specialistpaintinggroup.co.uk

SHUTDOWN MAINTENANCE SERVICES LIMITED
Tel: 01634 256969
www.shutdownmaintenanceservices.co.uk

STANDISH METAL TREATMENT LTD
Tel: 01695 455977 Email: stuart.croft@standishmetal.co.uk

SURFACE TECHNIK DUDLEY LIMITED
Tel: 1384 457610 www.surfacetechnik.co.uk

TAZIKER INDUSTRIAL
Tel: 0844 8800 385 www.ti.uk.com

WEDGE GROUP GALVANIZING LTD
Tel: 0845 271 6082 www.wedge-galv.co.uk

WESCOTT INDUSTRIAL SERVICES LTD
Tel: 0191 497 5550 www.wescottis.com

W G BEAUMONT & SON LTD
Tel: 01708 749202
Email: tom.costello@wgbeaumont.co.uk

CONSULTING TESTING AND INSPECTION

AW CORROSION SOLUTIONS LTD
Tel: 01732 700924
Email: enquiries@awcorrosion.co.uk

CAN
Tel: 01224 870100 Fax: 01224 870101 www.cangroup.net

EQUILIBRANT LTD
Tel: 02890 767227 www.equilibrant.co.uk

ERIMUS INSULATION
Tel: 07968828825 www.erimusi.com

HYDROCOMM LTD
Tel: 07779333781 Email: hydrocomm@btinternet.com

HYDROSAVE UK LTD
Tel: +44 (0) 1536 515110 www.hydrosave.co.uk

LBBC BASKERVILLE
Tel: 0113 2057423 www.bbcbaskerville.com

PAINT INSPECTION LIMITED
Tel: 0845 4638680 www.paint-inspection.co.uk

PLANT INTEGRITY MANAGEMENT LTD
Tel: 01224 798870
Email: info@pim-ltd.com www.pim-ltd.com

SAFINAH LTD
Tel: 01670 519900 Email: enquiries@safinah.co.uk

SONOMATIC LTD
Tel: 01925 414000 www.sonomatic.com

STEEL PROTECTION CONSULTANCY LTD
Email: Wil.deacon@steel-protection.co.uk
www.steel-protection.co.uk

SUPPLIERS COATINGS

CORROCOAT
Tel: +44 (0) 113 2760 760 www.corrocoat.com

HEXIGONE INHIBITORS LTD
Tel: 01792 606494 www.hexigone.com

INDESTRUCTIBLE PAINT LTD
Tel: 0121 7022485 www.indestructible.co.uk

SUPPLIERS GENERAL

ASCOTT ANALYTICAL EQUIPMENT LIMITED
Tel: 01827 318040 Email: hmorley@ascott-analytical.com

CORRODERE ACADEMY
Tel: 01252 732220 www.protectivecoatingseurope.com

FUTURE PIPE LIMITED
Tel: 0207 8388660 www.futurepipe.com

GMA GARNET (EUROPE) GMBH
Tel: 01606 836223

INFRASTRUCTURE ANALYTICS LTD
Tel: 028 9532 0131 Email: info@ infrastructureanalytics.co.uk

LAKE CHEMICALS & MATERIALS LTD
Tel: 01527 594630 Email: philip.collier@lakecm.co.uk

LBBC BASKERVILLE
Tel: 0113 2057423 www.bbcbaskerville.com

LLEWELLYN RYLAND LTD
Tel: 0121 4402284 Email: research@llewellyn-ryland.co.uk

PRESSERV LTD
Tel: 01224 772694 Email: stuart.rennie@presserv.com

RENTAJET GROUP LIMITED
Tel: 02380 817160 Email: sales@rglservices.co.uk

SCANGRIT
Tel: 01469 574715
Email: sales@scangrit.co.uk www.scangrit.co.uk

RECIPROCAL ORGANISATIONS

ELSEVIER SCIENCE LTD
Tel: 01865 843000

INSTITUTE OF METAL FINISHING
Tel: 0121 6227387 www.uk-finishing.org.uk

QUALITY CONTROL

ELCOMETER
Tel: +44 (0) 161 371 6000 www.elcometer.com

TRAINING AND COATING INSPECTORS

CORRODERE ACADEMY
Tel: 01252 732220 www.corrodere.com

Institute Events
DIARY DATES 2022

INSTITUTE OF CORROSION

BRANCH CONTACT DIRECTORY

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CED DIVISION:
Danny Burkle
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BRANCH DATES

30th August 2022
Aberdeen Branch
Annual Corrosion Forum.

22nd September 2022
Aberdeen Branch
"Repurposing of pipelines in the energy transition"
Neil Gallon, Rosen

13th October 2022
London Branch
"Corrosion protection considerations for Offshore wind foundations"
Anthony Setiadi, Wood Thilsted Partners

25th October 2022
Aberdeen Branch
"Flange face corrosion in seawater and hydrocarbon environments related to gasket material selection"
Dene Halkyard, Flexitallic

ADDITIONAL DIARY DATES

17th-18th November 2022
PDA Europe Conference and Exhibition, Porto, Portugal

IMechE courses at the Sheffield Training Centre

5th-9th September 2022
Painting Inspector, Level 2

12th-16th September 2022
Painting Inspector, Level 1

24th-28th October 2022
Painting Inspector, Level 2

CP courses at the ICorr Training Centre, Telford

12th-16th September 2022
Reinforced Concrete, Level 3

19th-23rd September 2022
Buried, Level 3

26th-30th September 2022
Marine, Level 3

10th-12th October 2022
Buried, Level 1

17th-19th October 2022
Concrete, Level 1

24th-27th October 2022
Buried, Level 1 & Marine, Level 1

Online Corrodere courses plus online assessments and practical workshops

27th September 2022
ICorr Coating Inspector, Level3, Mandatory Workshop Assessment