

A journal of the Institute of Corrosion

# Corrosion

## Management

Issue 183 January/February 2025

**Raising Awareness of Corrosion  
for a More Sustainable World**

Page 34

**Mentoring the Next  
Generation Towards Better  
Corrosion Prevention**

Page 40



**Parliamentary Special Issue**



### Institute News

Younger ICorr Members Make Historic Debut at Smeatonian Discussion Dinner.

Page 12



### Institute News

ICorr NE Branch, January Evening Event – Tour of Newcastle Castle Keep.

Page 23

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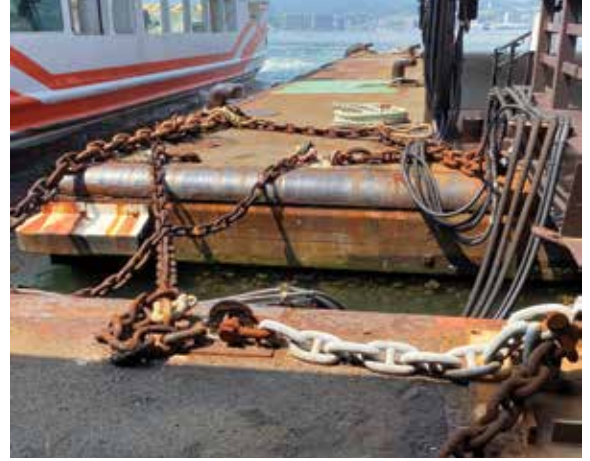
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# Contents

Issue 183 January/February 2025



4

The President Writes.

5

CORREX Updates.

5

Announcements:

- Chair Vacancy for BSI committee GEL/603.
- Welcoming Kathleen Purnell as the New Young ICorr Chair.
- ICorr Signed Agreement to be a Supporting Partner for the 3rd Oman Corrosion and Materials Innovation Summit 2025.
- Obituary - Brian A Martin.
- CEOCOR - Calls for Papers.
- Retirement – Dr Carol Devine.

11

Divisional Updates:

- CEng Direct Updates.
- Corrosion Engineering Division Working Day.
- Science Council: Elevating The Science Workforce.
- Younger Young ICorr Members Make Historic Debut at Smeatonian Discussion Dinner.
- PAC Updates.

13

Corrosion Around Us.

14

ICorr Branch Updates:

- New Year - New Branch: ICorr India.
- ICorr Aberdeen Updates Joint Event with IOM3/MIS.
- ICorr Central Scotland Updates.
- ICorr London Updates.
- ICorr Midlands Updates.
- ICorr North-East Updates.
- ICorr North-West Updates.
- ICorr Wales and South-West Updates.

26

Training Updates:

- ICorr Training: About TÜV Rheinland.
- ICorr Training: The Important Role of our ICorr Tutors - Tony Rizk.

28

Industry News.

31

Ask the Expert.

34

Technical Article 1:

Raising Awareness of Corrosion for a More Sustainable World by Prof. Gareth Hinds.

37

Technical Article 2:

Value Retention Processes – Valuable Contributors to Product Longevity, Net Zero, and the Circular Economy by David Parker.

40

Technical Article 3:

Mentoring the Next Generation Towards Better Corrosion Prevention by Izabela Gajewska.

43

Technical Article 4:

Advanced Corrosion Management Techniques to Reduce Cost and Risk in Our Built Environment. By Christian Stone.

46

Company Members Directory.

48

Diary Dates 2025.

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# The President Writes



Photo: Dr Yunnan Gao.

Dear Members,

Welcome to our first Corrosion Management Journal of 2025. This is also my first "The President Writes" since I took over ICorr Presidency from my predecessor, Stephen Tate, on 13<sup>th</sup> November 2024.

As I write up this article as the New President of ICorr, I am both humbled and inspired by the responsibility entrusted to me. First and foremost, I would like to extend my heartfelt gratitude to my predecessors for their steadfast dedication and impactful leadership. Their tireless efforts have laid a strong foundation that continues to empower ICorr as a beacon of excellence in the global fight against corrosion. It is with immense respect for their work that I take on this role, commit to building upon their achievements and advancing the mission of ICorr.

As we navigate the evolving landscape of corrosion management, my vision for the Institute is focusing on simplifying and proceduralising of our practices. We can enhance the efficiency and effectiveness of our activities, reduce barriers to engagement, and provide greater clarity for all our members and the whole community. A key priority for me from the onset of the new year is to foster greater collaboration and knowledge sharing between our existing branches in the UK. By increasing engagement and dialogue, we can ensure that members from every corner of the UK feel connected and empowered to contribute.

The Institute of Corrosion has valued the importance of international collaboration. ICorr has successfully signed off the MoU with AMPP (Association for Materials Protection and Performance) in the US and CSCP (Chinese Society for Corrosion and Protection) in China in September 2024. This year, ICorr are set to organise the First UK-China Corrosion Summit in the UK in September 2025, bringing together leading minds from around the globe to share knowledge, ideas, and best practices. This event can also represent a unique opportunity to

position the UK as a global hub for corrosion management excellence while fostering deeper connections between international experts and organisations.

Another exciting development for the Institute is the establishment of new international branches. I am thrilled to announce that our India Branch has been successfully launched, with its inaugural event of 28th January. This marks a significant milestone for the Institute, and I am confident that the branch will play a vital role in strengthening our presence and influence in the region, which is already home to our Journal Editor. Beyond India, we are making active and positive progress in other regions, including China, Qatar, Saudi Arabia, and the UAE. These developments highlight ICorr's growing role as a global leader in corrosion management and training provision. I look forward to supporting these efforts as we continue to expand our reach and impact and will keep you updated with the latest developments in my future "The President Writes". The year ahead is filled with promise, and I am eager to work alongside all of you - our members, branches, and partners - to achieve our shared goals. Together, we will promote the vital importance of corrosion management in safeguarding the future of our infrastructure and environment.

As we embark on this journey, I invite you to share your ideas, insights, and aspirations for the Institute via my email address as **president@icorr.org**. Your voices and contributions are invaluable to our success, and I am committed to ensuring that they are heard and acted upon. Please do get involved in our upcoming activities and keep an eye on the ICorr Events Calendar at **<https://www.icorr.org/events/>**

Thank you for your trust and support. Let us work together to make 2025 a year of growth, collaboration, and achievement for the Institute of Corrosion.

**With best regards,**

**Dr. Yunnan Gao, President: Institute of Corrosion**  
email: **president@icorr.org**

## From the Editor

Dear Members,

*Best wishes for a wonderful 2025, and a warm welcome to the first issue of the year.*

The overall theme for this issue is our Science in Parliament (Special Edition) Reuse, Renew or Replace? The first technical article entitled "Raising awareness of corrosion for a more sustainable world" is contributed by Prof. Gareth Hinds. It emphasises the importance of corrosion management strategies in reducing maintenance costs, improving asset longevity, and supporting sustainability goals such as the UN Sustainable Development Goals (SDGs). The article also discusses efforts by the Institute of Corrosion (ICorr) and the World Corrosion Organisation (WCO) to increase public awareness and influence policy decisions to incorporate corrosion prevention in infrastructure projects.

David Parker has written technical article the "Value retention processes – valuable contributors to product longevity, net zero, and the circular economy" This article explores Value Retention Processes (VRPs), such as reuse, repair, refurbishment, and

remanufacturing, as sustainable alternatives to traditional manufacturing and recycling. The study underscores the need for policy interventions, skills development, and industry collaboration to enhance the adoption of VRPs in various sectors, contributing to a circular economy and net-zero goals.

Third technical article, "Mentoring the next generation towards better corrosion prevention" is contributed by our YICorr member Izabela Gajewska. This article explains the critical role of knowledge transfer in combating corrosion-related challenges. The article advocates for structured mentoring programmes, university education to bridge the skills gap in corrosion engineering. It also highlights effective learning models and strategies to ensure that industry expertise is passed on to future generations, enhancing corrosion prevention practices.

Christian Stone has contributed "Advanced corrosion management techniques to reduce cost and risk in our built environment". Focusing on reinforced concrete structures, this article discusses the role of corrosion management and



the adoption of specialist technologies in extending infrastructure lifespan and minimising costs.

We warmly invite you to contribute to our upcoming issues and share your knowledge with the community. Whether it's industry news, technical articles, or striking images for our "Corrosion Around Us" feature, your submissions are always welcome. Additionally, we would be delighted to receive entries for our "Corrosion Morphologies" column and "Fellow's Corner." Your contributions play a vital role in enriching our publication, and we truly appreciate your support.

**With kindest regards,**

**Dr Shagufta Khan, FICorr**  
**Consulting Editor, editor@icorr.org**

# CORREX Updates



## From the CORREX Managing Director - Kevin Harold

2024 saw a very successful year for CORREX, with each person playing their part in the running and implementation of ICATS (Industrial Coating Applicator Training Scheme) courses.

We were able to assist people and companies using social value principles, which will have positive effects as we go into 2025.

At the end of 2024, past president Bill Hedges retired from ICorr and CORREX as a CORREX board member. Bill has been an amazing person to work with. His enthusiasm and ideas will be very much missed as he will be. I have been lucky enough to work with Bill for the last 6 years during his presidential journey.

The CORREX board also lost Stephen Barke (Steve) in 2024 as he also retired from the board.

Steve was the CORREX Managing Director before me and instrumental in its development for many years. His hard work and dedication were an inspiration to us all. Steve was also instrumental in engaging me as the ICATS courses creator, demonstrating his trust and faith in me at every turn. We will miss Steve very much from our discussions during the year.

We also lost Anthony Collins due to retirement from the CORREX board in 2024. Tony was our most fantastic honorary treasurer, working tirelessly on the CORREX and ICorr accounts for more than 30 years.

Although a hard act to follow, we were lucky enough to have George Winning of WOOD plc step into the role seamlessly.

It is the CORREX boards intention to add to the board during 2025.

With 2025 now very much in progress our suite of courses remains strong and now feature in every industry.

There will be some additions to our ICATS courses during 2025, updates where needed, guidance that may have changed, and some re vamping of photos and videos.

Work has also started on additional courses for 2025, so watch this space.

### The ICATS courses currently include:

- **ICA, Industrial Coating Applicator**
- **Specialist Blast**
- **Specialist Spray**
- **Supervisor**
- **Trainer**
- **Technical Managers Course**

Visit: [www.icats-training.org](http://www.icats-training.org)

If anyone requires any further information regarding our courses, please contact us at head office in Northampton on [correx@icorr.org](mailto:correx@icorr.org)

Good luck for the year ahead.  
Kevin Harold



## Announcement

### Leading on Cathodic Protection Standards

BSI committee GEL/603 help create and influence standards in the field of cathodic protection in the UK, Europe and internationally. Our present GEL/603 standards chair has reached the end of his third term, and we need to find a suitable replacement.

- Do you have technical knowledge in the application of cathodic protection?
- Perhaps you work in building and civil engineering or specialise in onshore/offshore structure protection, are an engineer or designer of structures that require cathodic protection such as buried pipelines and vessels, maybe you're knowledgeable in dc power supplies or anodes or are involved in

## Chair Vacancy for BSI Committee GEL/603

installations, surveys, inspection or maintenance of CP systems.

- The current Chair has reached the end of his term and BSI are looking for a suitable candidate to help lead the committee in its future work.
- GEL/603 is highly influential, not just in the UK but also in Europe. It is BSI's mirror committee of CEN/TC 219 and ISO/TC 67/SC 2/WG 11, which are responsible for setting European and international standards for cathodic protection.
- The committee's work covers a wide remit of cathodic protection in onshore and pipeline systems, offshore and marine uses, and other specialist areas including measurement techniques, influence of coatings and/or stray currents (AC and DC) on the

performance of cathodic protection systems, and competence levels of cathodic protection persons.

- The committee usually meets twice a year and meetings are held virtually. There is the opportunity to be invited as a guest to see the work of the committee before committing.

If you are interested in finding out more about the chair role or perhaps becoming a member of GEL/603, please contact Katherine by emailing [csc@bsigroup.com](mailto:csc@bsigroup.com), or to apply please visit <https://www.surveymonkey.co.uk/r/BSI-Chair-App> or <https://www.surveymonkey.co.uk/r/BSI-Standards-Maker-App>

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## Announcement

# Welcoming Kathleen Purnell as the New Young ICorr Chair

On 17<sup>th</sup> January 2025, following a successful handover meeting led by Dr Danny Burkle and Izabela Gajewska, we are thrilled to introduce Kathy as the new Young ICorr Chair.



Photo: Kathleen Purnell - New Young ICorr Chair.

**Kathy brings a wealth of experience and enthusiasm to the role. Her background includes:**

- **A MSc in Chemistry, from the University of Hull.**
- **Industry experience as a Technical Service Manager at Teal & Mackrill, specialising in protective coatings.**
- **Becoming an ICorr qualified Coating Inspector.**
- **Completing a PhD in Corrosion at The University of Manchester, where she initiated a student lecture series.**
- **Currently working as a Research Fellow in Corrosion at the University of Leeds.**

Both Danny and Izabela have dedicated significant effort to advancing Young ICorr initiatives, and while they now step back from the leadership role, they will remain supportive members of the new committee. This collaborative approach promises a seamless transition and continued progress for the group. Kathy brings an impressive background and lots of enthusiasm to this role. Here's a bit about her in her own words:

*"Hi, I'm Kathy, and I've been in the corrosion field for several years now. After completing a Master's in Chemistry at the University of Hull, I worked as a Technical Service Manager at Teal and Mackrill, a specialist coatings manufacturer, while also working as an ICorr-qualified Coating Inspector. After several years in this role, I pursued a PhD in Corrosion at The University of Manchester, where I became more involved in ICorr activities, joining the Northwest Committee and initiating a student lecture series. I now work at the University of Leeds as a research fellow in Corrosion. I'm excited and looking forward to developing more opportunities and activities for the Young Members of ICorr, and I'm incredibly grateful for this opportunity."*

Kathy's vision for Young ICorr focuses on fostering engagement and creating opportunities that empower young professionals in the field of corrosion. Her leadership is guided by enthusiasm, collaboration, and a strong commitment to developing initiatives that support career development.

The Young ICorr Committee is actively seeking further proactive and enthusiastic individuals to join and contribute to the future of ICorr's young members. If you're looking for an opportunity to make a difference, now is the perfect time to get involved!

Let's all join in welcoming Kathy to her new role and look forward to the exciting journey ahead for Young ICorr!

**Please contact Kathy on [youngicorrchair@icorr.org](mailto:youngicorrchair@icorr.org) to register your interest in joining the Young ICorr committee.**

Visit the ICorr website for all the latest news  
[www.icorr.org](http://www.icorr.org)



# ICorr Signs Agreement to be a Supporting Partner for the 3<sup>rd</sup> Oman Corrosion and Materials Innovation Summit 2025

The Institute of Corrosion (ICorr) is pleased to announce its role as a supporting partner for the upcoming 3<sup>rd</sup> Oman Corrosion and Materials Innovation Summit 2025, which will take place from 15-17<sup>th</sup> September 2025 in Muscat, Oman. This event is set to serve as a catalyst and a central platform for technological transformation and scientific collaboration by uniting industry leaders and innovative thinkers in the fields of materials science, engineering, industrial innovation, and corrosion management. This edition will delve into corrosion mechanisms, innovative materials, advanced coatings, and mitigation strategies that significantly extend the lifespan of critical assets across various industries. This event is also an invaluable opportunity for professionals to network, share insights,

and explore cutting-edge solutions within the industry. For more details about the event, visit [www.omcorr.com](http://www.omcorr.com)

Renowned for advancing knowledge and innovation in corrosion science and engineering, ICorr exemplifies the principles of expertise, collaboration, and excellence that are at the core of this landmark event.

As part of the support agreement, ICorr will actively promote the event to its community by sending email notifications to our members, featuring it in ICorr's social media channels, and listing it on ICorr's website.

ICorr looks forward to supporting this important initiative and encouraging participation from its members and the wider corrosion management community.



Photo: September 2025 – Oman Event Banner.

## Obituary - Brian A Martin



It is with great sadness that we announce the untimely death of Brian A. Martin in Sydney from mesothelioma on Monday, 2<sup>nd</sup> September 2024. Brian had been a member of ICorr since 1972 and was made an Honorary Member in 2017, whereby the presentation made to him in Australia read as follows:

*"The Institute of Corrosion (ICorr) recognises the considerable contribution that Brian A. Martin has made to the science and practice of cathodic protection, in particular to buried pipelines, both in Australia and internationally. Brian has been a long-term professional member and then Fellow of ICorr in the UK; we know that he has been a strong supporter of the ACA and a strong contributor to Standards Australia, to International Standards and to the Training and Professional Development of Cathodic Protection Engineers in Australasia. He has pushed our practice of CP forward and he has given back his time and his enthusiasm and has fully shared his knowledge with others to the benefit of the entire corrosion protection community. He has earned this Honorary Fellowship of ICorr."*

Brian came to the UK in 1970 to study at Sir John Cass for his MSc under Prof. Lionel Shrier, who had just moved from Battersea/Surrey to Cass. Brian worked part-time at 'Spencers' during his MSc studies, with a desk in a dimensionally challenged office with a tiny window overlooking the Buckingham Palace gardens.

His contributions to Australian and International Standards will not be forgotten. Brian Wyatt and Markus Buchler much appreciated his contribution to the European supposed controversy over the impacts of concentration polarisation on CP (in all environments). This is still rumbling along in Germany due to folk who manage to misread some of the wonderful work done there in the 1960s and 1970s. Brian participated in the wide and open discussion on this in the CEOCOR Congress in Stockholm in 2016 and was a coauthor of the paper 'Cathodic protection of soil-buried steel pipelines—a critical discussion



of protection criteria and threshold values,' which resulted from this. Despite one of the authors being H.-G. Schöneich, considered the leading pipeline CP specialist in Germany at that time, this paper still offends a segment of the German CP fraternity. Brian had been a member of the Australasian Corrosion Association (ACA) since 1969 and was an Honorary Life member, holder of the Corrosion Medal, Australasian President as well as active in the Electrolysis Committee as President and Secretary for over 30 years. In addition, Brian was a P. F. Thompson lecturer as well as an internationally recognised expert in cathodic protection of pipelines.

He was passionate and intense about his profession, martial arts and very fast cars. Few people who have been a passenger in a Brian Martin driven car would forget

the experience. Or wish to repeat it. More than that, he was a warm and engaging friend who will be sorely missed. Typical of Brian, he held a farewell Wake a few days before his demise to which all invited could see that, despite his illness, he had lost none of his essential spirit. Anecdotes about Brian are endless. from driving up an English motorway shoulder on a motorbike at 160 km/hour to see if it could be done, to surfing inadvertently on a Nudist beach. He really did land by helicopter in remote Papua New Guinea for a week's unaccompanied trek to do a resistivity survey.

He was a lovable mad bugger in cars, boats, and sports. Always striving for excellence and pushing boundaries. These attributes carried over more safely into his professional life.

Brian is survived by his wife of nearly 50 years, Cheryl, and daughter Tara and grandchildren. In his memory, his friends have suggested that the first paper delivered to the Cathodic protection stream of each Annual ACA Conference be named 'The Brian Martin Lecture', and that it ought to contain some controversial issues! That will be a perfect memorial.

**Brian Wyatt and Warren Green**



# CEOCOR - Call for Papers



## Papers and Presentations for CEOCOR Congress

**Guidance to Authors** A Review Committee will carefully study all papers submitted. However, they will not act as "Editor". It is the responsibility of the Author to keep to the standard format (see below) and to ensure that the grammar, spelling and punctuation are correct. The Review Committee may make suggestions for changes to ensure compliance with the objective of the Technical Session at which the paper is to be presented. Commercial or advertising references in the paper and presentation are not permitted. Papers and presentations shall be unlocked (no password).

The papers will be downloadable for participants to the Congress and later will be placed on the CEOCOR website for general access.

### 1. GENERAL

All texts, abstracts, papers and presentations shall be sent to the presidents of the relevant commissions:

– Commission 1: Angelika Becker at [a.becker@iwwo-online.de](mailto:a.becker@iwwo-online.de) and Timo Jentzsch at [t.jentzsch@iwwo-online.de](mailto:t.jentzsch@iwwo-online.de)

– Commission 2: Ricardo Gutierrez at [ricardo.gutierrez.m@exolum.com](mailto:ricardo.gutierrez.m@exolum.com)

before the final dates as indicated in the call for papers with copy to the Secretariat of CEOCOR at [info@ceocor.lu](mailto:info@ceocor.lu).

### 2. COMPANY APPROVAL

To ensure that delays do not occur, the author must obtain official company authorisation and release for publication when submitting the paper. This should be confirmed as in place at the time of the submittal of the paper and the presentation.

### 3. LANGUAGES

Texts, abstracts, papers and presentations shall be in the English language only to allow for as large as possible distribution and transmission of the information throughout all countries.

### 4. FORMATS

Texts, abstracts and papers shall be in colour WORD or PDF format. Presentations shall be in colour PPS/PPT.

### 5. ABSTRACTS

Authors shall prepare an abstract of their paper in the English language in approximately 10 lines of text. These abstracts will be published on the website to inform the interested participants about the subjects of the conference. Abstracts should also be used as the introduction part of the papers.

### 6. PAPERS

In order to ensure uniformity, it is essential that all papers are prepared in accordance with the following guidance.

#### 6.1 Length

A typical paper will be 10 – 15 pages in length (including tables, diagrams and photographs) with a minimum of 5 pages and a maximum of 20 pages.

#### 6.2 Page Size and Electronic Format

The page size shall be A4 (297mm x 210mm). Format shall be in Word, Pdf or similar Format.

#### 6.3 Layout

All pages must be in black characters, 10 or 12 characters per inch at 12 dots per inch. Letter Arial 12 is preferred.

All pages shall have a 25mm margin on both sides and at the top and bottom.

#### 6.4 Title Page

The title page shall have the format and text sizes as the final page of these Guidance.

(Location of the Conference, title, list of Author(s) (the presenting Author first), followed by qualifications, designations and Company name(s) and address(es)).

#### 6.5 Numbering

Number each page on the bottom right of each page.

### 6.6 References

Number references in the order in which they appear in the text. In-text references should be in normal size type, on the line, in square [ ] brackets.

### 6.7 Diagrams

Diagrams should preferably be in colour for the presentations and for download from the web site.

## 7. PRESENTATIONS

### 7.1 Length

According to the programme of the Conference (see web site), Speakers have 25 minutes of time, question time included. Speakers shall assure not to over-run the allowed speaking time. Number of slides should therefore be between 20 and 25.

### 7.2 Format

Slides shall be in Power Point PPS/PPT format.

### 7.3 Layout

Slides must be clearly seen at normal viewing distances and readily scanned and understood in less than one minute by the audience. Use two or more slides if necessary. Character size should not be smaller than 16. Do not use more than 6-7 words per line, 10-11 lines per slide. Use graphs, bar charts or curves because they are easier to follow. Tabulated data should not show more than 4 columns and 10 rows per table.

Each slide shall mention "CEOCOR 2025" in the Footer.

CEOCOR permits company slide templates with a logo for the conference, however, the presentation should be a corrosion technical/scientific message and not a commercial one. The CEOCOR audience will not be impressed by any strong commercial message.

### 7.4 Practical information and advice

Authors will be invited to upload the presentations.

Presentations shall also be sent by e-mail to the president of the relevant commission, with copy to the secretariat of CEOCOR.

Authors should not "read" the information on the slides but add value to the slides by explaining.

Speak loudly, clearly and quite slowly to give participants with another mother language the opportunity to follow the presentation.

Do not forget that the paper is intended for readers and the presentation is intended for listeners, so do not use the paper for presentation.

## 8. FINAL CONSIDERATION

The Congresses of CEOCOR are an ideal opportunity to meet experts and to exchange latest information, research results and experiences in the field of corrosion and corrosion protection. If you have not attended before, expect a very friendly, open and free exchange of knowledge and expertise with all who you meet. Do participate in the Work Group meetings that will take place before and after the two presentation days.

**Your papers and your presentations are the basis for making the CEOCOR Congresses successful. Thank you for being an Author at our Congress!**

**CEOCOR**

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### Example of Title page

#### CEOCOR Ancona (ITALY) May 26<sup>th</sup> – May 28<sup>th</sup>, 2025

#### Assessment of isolation between a metallic casing and a pipeline by means of remote monitoring and coupon

By I. Magnifico (AUTOMA S.r.l., Ancona, Italy)

A. Bonetti (Cathodic Protection Co, Grantham, United Kingdom)

R. Gutiérrez (EXOLUM, Madrid, Spain)

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# Dr Carol Devine, NCIMB / MIC Specialist Aberdeen – Retirement

On **28<sup>th</sup> January 2025** at the annual Joint ICorr EI Event in Aberdeen, Dr Carol Devine announced her retirement from the Corrosion World as an **MIC Specialist with NCIMB Aberdeen**.

Carol has a BSc in Microbiology from the University of Aberdeen and a PhD in Subsurface Molecular Microbial Ecology, also from Aberdeen, with a special interest in sulphate-reducing bacteria (SRB) and microbiologically influenced corrosion (MIC) and in the contamination of gas oil storage and distribution systems.

She worked for many well-known Corrosion and Integrity companies operating in the Energy Sector, including: Commercial Microbiology, Intertek, NECE, ICR and most recently NCIMB.

Carol has been a regular ICorr Presenter and a huge long-time supporter of the Aberdeen Branch who has contributed enthusiastically to numerous Aberdeen Corrosion Forum Events on the topic of MIC management, held in August of each year.

Her company **NCIMB have also twice hosted** the Aberdeen Branch Industrial Visit.

On behalf of the Aberdeen Committee and ICorr nationally, we wish her every success with her future plans and good health in the years ahead.

**Stephen Tate**

**Immediate Past President - Institute of Corrosion**  
[past.president@icorr.org](mailto:past.president@icorr.org)



Photo: Dr Carol Devine Explaining Biofilm Growth and Dispersion.



Photo: Dr Carol Devine at Aberdeen ACF Event, Hosted by Emerson Process Systems in 2018.

## Divisional Update

### CEng Direct Updates

**The Engineering Council report to ICorr CEng direct application has previously recommended ICorr become a full licensee pending resolution of a few items. ICorr under guidance from David Harvey had reviewed and provided feedback to the Engineering Council in January, which will be taken forward to their ratification panel during Q1, and ICorr will await a successful outcome. We offer our many thanks to David for supporting this process over the last 18M.**

In the meantime, ICorr is setting up a registration committee including assessors and interviewers and their training requirements to ensure readiness when the full license is finally ratified. ICorr will still be working in close conjunction with our previous partner SOE (Society of Operational Engineers), who had been the main license holder with ICorr as an affiliate. SOE will be supporting our training needs and providing advisory support on our newly established processes in the initial period.

**Please feel free to contact our New Vice President – Anthony Setiadi, should you have any queries at all in relation to the ICorr CEng scheme:**  
[Vice.President@icorr.org](mailto:Vice.President@icorr.org)



Photo: Anthony Setiadi.

## U.R. Evans: A Visionary in Corrosion Science

Year 2024 marked a momentous milestone for the corrosion science community—the centenary of the publication of *The Corrosion of Metals* by Ulick Richardson Evans in 1924. This pioneering work laid the foundation for modern corrosion science, transforming it from a fragmented collection of empirical observations into a rigorous, quantitative discipline.

Ulick Richardson Evans was described in the Biographical Memoirs of Fellows of the Royal Society as the “Father of the modern science of corrosion and protection of metals”. Evans was born in Wimbledon. He dedicated his life to research and prolific writing on the corrosion and oxidation of metals. His keen intellect, innovative experiments, and commitment to advancing the field quickly earned him international recognition. Published at a time when the scientific understanding of corrosion was in its infancy.

*The Corrosion of Metals* was revolutionary. It was the first textbook to comprehensively explain the mechanisms of corrosion, with a particular focus on the electrochemical nature of metal deterioration. Evans’ insights provided engineers and scientists with the tools to address real-world corrosion challenges systematically, heralding a new era of research and practical applications.



Photo: U. R. Evans  
(Source: <https://www.npg.org.uk/>)

**Editor’s Note:** The complete article was previously published in the November/December 2024 issue of *Corrosion Management* on page 33. We apologise for the incorrect picture of U.R. Evans included in the publication. Readers are kindly requested to refer to the current article for the accurate image of U.R. Evans.

### Divisional Update

## Corrosion Engineering Division - Corrosion Awareness and Working Day 2025: Join Us at the Net Zero Centre in Teesside

The Corrosion Engineering Division (CED) is delighted to announce an exciting event for Corrosion Awareness Day 2025. Hosted at the prestigious Net Zero Centre in Teesside on **24<sup>th</sup> April 2025**, this event promises a day of insightful talks and collaboration focused on the theme of “**Innovations in Corrosion Engineering for Sustainable Energy Systems.**”

In addition to the day’s engaging content, we are offering sponsorship opportunities for organisations looking to showcase their commitment to corrosion engineering and sustainable energy solutions. Sponsors will gain visibility among industry professionals at this event. This event promises to deliver valuable insights, foster collaboration across sectors, and provide inspiration for tackling corrosion challenges in a sustainable world.

To register, learn more, or discuss sponsorship opportunities, please contact me at [danny.burkle@lbbcaskerville.co.uk](mailto:danny.burkle@lbbcaskerville.co.uk)



#### Connect with Danny on LinkedIn:

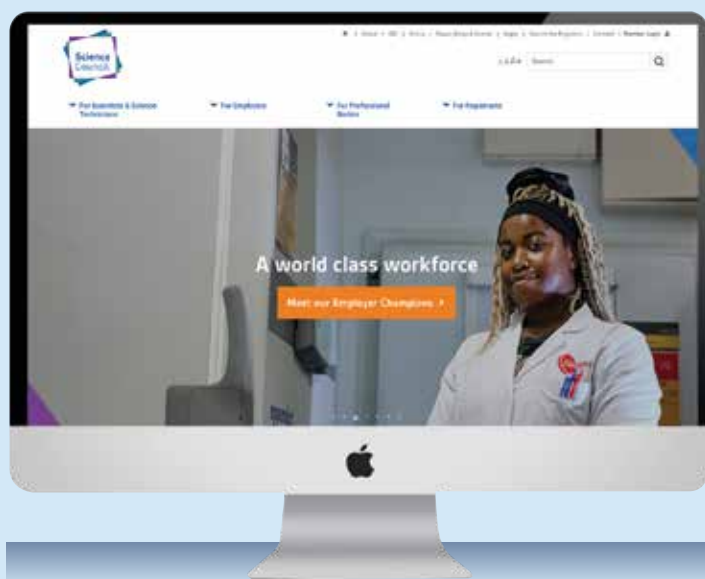
**Danny Burkle**  
Chair, ICorr Corrosion Engineering Division  
Telephone: +44(0)7734830749  
email: [danny.burkle@lbbcaskerville.co.uk](mailto:danny.burkle@lbbcaskerville.co.uk)

#### Highlights of the programme include:

- **Industry Talks** from leading experts in sectors such as **All Energy, Nuclear, Coatings, and Cathodic Protection.**
- **Insights from a Young ICorr Representative**, sharing fresh perspectives and emerging trends.
- **The Presentation of the 2024 Paul McIntyre Award Winner**, recognising excellence in corrosion engineering.
- **A Guided Tour of the Net Zero Centre**, providing a first-hand look at cutting-edge facilities supporting sustainable energy solutions.

# Science Council Updates: Elevating the Science Workforce – A New Initiative

**ICorr is a member of the Science Council, which means we can offer you the opportunity to become a Chartered Scientist (CSci). In this article, they explain what they do and what 2025 has in store.**



**Photo: An example of the Science Council website homepage.**

The Science Council was established by Royal Charter just over 20 years ago and registered as a charity in 2009. Its official purpose is 'to promote the advancement and dissemination of knowledge of and education in science, pure and applied.'

It does that by being a membership organisation for professional bodies and learnt societies across the breadth of science and by providing professional registration. This interdisciplinary community of over 30 organisations is mutually supportive and can amplify the achievements and concerns of the scientific disciplines where there is common interest.

The Science Council holds four professional registers: Registered Science Technician (RSciTech), Registered Scientist (RSci), Chartered Scientists (CSci) and Chartered Science Teacher (CSciTeach).

In order to join a register, you need to be a member of ICorr or another of its Licensed Members, hold a relevant qualification or demonstrate equivalent achievement, meet the standards of competence for the relevant register, and agree to follow the code of conduct and undertake continuing professional development (CPD).

They help potential Registrants by holding a free online *Introduction to Professional Registration workshop* every month. Last year they also introduced Application Sprint: A Masterclass in Professional Registration. This intensive one-day workshop supports you to prepare a first draft of your competence report, the main part of your application. Dates for this year will be announced soon.

The Science Council is run by a small but effective team, led and supported by chief executive Professor Della Freeth. Della took up the role in August 2023, bringing significant experience of

education, training and leadership developed in secondary school teaching, several senior roles in universities and the Royal College of Physicians.

Over the past 18 months, Della has worked with the team to make sure the Science Council is focused on bringing its members together and supporting its current and future Registrants. Key work has included making sure professional registration is accessible, continuing the technical education project in partnership with the Gatsby Foundation, and championing equity, diversity and inclusion through its Progression Framework in collaboration with the Royal Academy of Engineering.

Last year, Della worked with Science Council Members, staff and the Board of Trustees to develop the organisation's strategy for 2025-2028. It will be published in spring this year, but Della was happy to give us a taste of what is to come.

"We are excited about working with our Members, Registrants and partners on the next stage of our journey," she said. "We always start with our vision and purpose, as they remind us why we are here in the first place. We aim for a diverse and growing science profession that is trusted, respected, innovative and equipped to meet regional, national and global challenges. And our role in that is to connect the science professions and offer professional recognition for scientists, science technicians and science teachers.

"Over the next three years, we will focus on delivering our core business as effectively as possible. We'll keep reviewing our standards to make sure they inspire current and future Registrants. We'll bring our members together, amplifying their achievements and views in areas of common interest. We'll work to increase the number and diversity of Registrants and volunteers, and to enhance their sense of belonging to our community.

"We're also going to develop relationships with more employers, supporting them to invest in and support their staff. We'll make sure our work on apprenticeships, T Levels and other technical qualifications is embedded in what we do for the long term. And we're going to make sure that our website and other elements of our digital architecture are fit for purpose."

## Interested?

**Read more information about professional registration with the Science Council and applying via ICorr or visit the Science Council website:**  
[www.sciencecouncil.org](http://www.sciencecouncil.org)



# Younger ICorr Members Make Historic Debut at Smeatonian Discussion Dinner



By Izabela Gajewska

On behalf of the Institute of Corrosion, Izabela Gajewska, MICorr, and Eilidh MacDonald, MICorr, had the privilege of attending the Smeatonian Society of Civil Engineers' Discussion Dinner on **27<sup>th</sup> November 2024** at the iconic One Great George Street, headquarters of the Institution of Civil Engineers (ICE).

This marked the first time in history that younger members of ICorr participated in the Smeatonian Discussion Dinner. It is hoped that this will be the beginning of a lasting relationship between the Institute of Corrosion and the Smeatonian Society.



Photo: Izabela Gajewska (Left) and Eilidh MacDonald (Right) Pictured at the Dinner in the Smeaton Room of the Institution of Civil Engineers (ICE), One Great George Street, Westminster, London.

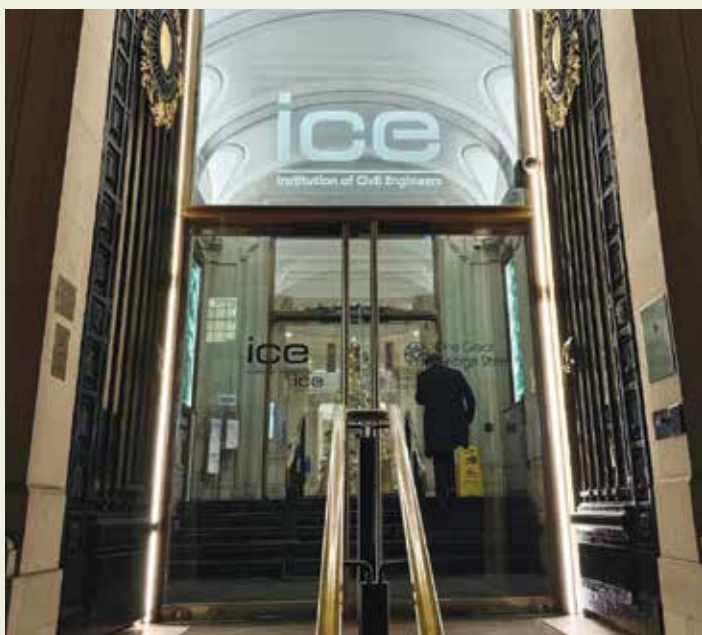


Photo: The Entrance to Institution of Civil Engineers (ICE), One Great George Street, Westminster, London.

Founded in 1771, the Smeatonian Society remains a key hub for regular insightful engineering discussions, generally over a meal.

These discussions take the form of an introductory presentation followed by group discussions which are summarised to the gathering by rapporteurs. Traditionally, meetings take place on the last Wednesday of January, March, April, October, and November, with adjustments to avoid holiday conflicts. The October meeting is normally a lunch; all other meetings are dinners with a variety of formats.

At Discussion Dinner, a member or guest is invited to speak on a topical subject and lead a discussion under the Chatham House Rule. The Society's meetings do not seek to replicate meetings of the Royal Academy of Engineering or those of the engineering institutions. Topics for discussions are normally on matters of general engineering interest or wider societal subjects.

The recent discussion evening focused on the challenges and opportunities facing engineering today, with a strong emphasis on Materials Engineering, a topic less familiar to many Smeatonians, introduced by Stephen Shapcott, the recipient of this year's prestigious Smeaton Medal.

The discussions highlighted how materials engineering plays a vital but often underappreciated role in solving today's pressing issues. A key takeaway was the need to move beyond simply sharing ideas across disciplines and industries, and instead fully integrate them to create more cohesive and impactful solutions. There was also a significant focus on inspiring future engineers through modernised education, including updates to programmes that incorporate cutting-edge materials science and sustainability topics to better reflect current industry needs, and promoting sustainability through smarter, more efficient materials.

Lastly, the discussion focused on how industries can better leverage advances in materials science, particularly in the context of urgent climate action. This includes investing in innovative corrosion resistant materials like graphene for energy storage and fostering stronger collaboration with research institutions to stay at the forefront of developments. However, even commonly used materials require continuous innovation, especially in areas like reuse and recycling, to create a more sustainable future.

Rod Muttram, Honorary Treasurer of The Smeatonian Society of Civil Engineers, expressed his gratitude to Stephen Shapcott for expanding and sharing knowledge, a tradition that has been central to the Society for over 250 years!

**For more information about the Smeatonian Society, you can watch the YouTube video they commissioned for the 300th anniversary of Smeaton at [www.youtube.com/watch?v=rhfzCcPuofY](https://www.youtube.com/watch?v=rhfzCcPuofY) and visit their official website at [www.smeatonians.org](http://www.smeatonians.org)**



# PAC Updates: ICorr Overseas Membership Expansion

by Stephen Tate, Immediate Past President

The Institute is continuing its drive started in 2024 to expand its membership overseas and to increase its Branch Profile.

We have set up country-specific working agreements for the provision of member services and collaboration, especially in the area of training provision, reported elsewhere in the magazine.

Local branch committees are currently being established in India and Saudi Arabia.

There are also a number of joint events starting to emerge, such as the ICorr-China Summit in Manchester to be held on the 3<sup>rd</sup> and 4<sup>th</sup> of September this year.

These initiatives are starting to bear fruit, as readers will have seen from our recent announcements, and we are now well placed to better serve our significant overseas membership going forward.

Our HQ ICorr office team, managed by Geraldine Blomley, has kindly provided us with a breakdown (by country of applicant) for the most recent 52x ICorr membership applications (for the period ending 20<sup>th</sup> December 2024).

**This is very significant for our membership direction and future branches. We shall monitor these trends closely.**

- 30% UK (15)
- 70% Overseas (37)

There are of course some additional applications expected for China from the recent President / Vice President visits to that country that are pending, and these will be processed soon for approval and ratification by ICorr Council.

The Institute welcomes all suggestions for improvement to its membership services. Please send any suggestions for improvement to: [president@ICorr.org](mailto:president@ICorr.org)

Members are also invited to represent their country via submission of good quality technical articles. Please send these to [editor@ICorr.org](mailto:editor@ICorr.org) for consideration for publication.

**Breakdown by Country for the most recent 52x ICorr Membership Applications (Period ending 20<sup>th</sup> December 2024).**

- United Kingdom – 15
- Saudi Arabia – 7
- India – 6
- Pakistan – 4
- Egypt – 4
- Malaysia – 2
- Kuwait – 2
- USA – 2
- Oman – 1
- Canada – 1
- Venezuela -1
- Republic of Ireland – 1
- United Arab Emirates -1
- Australia – 1
- South Africa - 1

## Corrosion Around Us:

Submitted by: Stephen Tate, Immediate Past President.



Photo: Atmospheric Corrosion Observed to Hotel Balcony Fixing in Suzhou Anhui, China.



Visit us on our website or on social media for all the latest news

- [www.icorr.org](http://www.icorr.org)
- [x.com/instofcorrosion](https://x.com/instofcorrosion)
- [www.linkedin.com/company/6321450](https://www.linkedin.com/company/6321450)
- [www.facebook.com/icorradmin/](https://www.facebook.com/icorradmin/)
- [www.instagram.com/institute\\_of\\_corrosion/](https://www.instagram.com/institute_of_corrosion/)

# ICorr Branch Updates



## New Year New Branch: ICorr India

By Dr. Shagufta Khan

The Institute of Corrosion (ICorr) is glad to formally launch the 'ICorr India Branch' effective from **28<sup>th</sup> January 2025**.

### Meet the ICorr India Team

#### Dr. Arpit Goyal

Dr. Arpit is **Chair** of the ICorr India branch. He is serving as an Assistant Professor in the Civil Engineering Department at the Thapar Institute of Technology. He has extensive research experience in the area of the durability of concrete, novel cementitious materials, corrosion protection, electrochemical techniques, and cathodic protection of steel in concrete. He has successfully patented a new conductive anode paint for impressed current cathodic protection of reinforced concrete structures during his Ph.D. and post-doctoral fellowship.



He has also worked on various consultancy projects related to the testing of corrosion inhibitors and conductive paints for preventing corrosion of steel in concrete. At present, he has published more than 12 journal articles, various national and international conference papers and book chapters.

#### Dr. Shweta Goyal



Dr. Shweta Goyal is **Vice-Chair** of the ICorr India Branch. She is a professor in the Civil Engineering Department at the Thapar Institute of Technology. She earned an M.E. and PhD in Structures and Civil Engineering from Thapar University, Patiala, India. She was awarded Gold Medal during B.E. (Civil Engineering) and M.E. (Structural Engineering). She has handled various research projects sponsored by Govt. of India agencies like DST (Department of Science and Technology) and UGC (University Grants Commission) and industry-sponsored

research projects amounting to more than INR 400 lakhs. Her research is oriented towards sustainability of reinforced concrete structures. She is the co-convenor of the working group for revision of BIS 12594. She has more than 100 publications to her credit.

#### Dr Shagufta Khan, Editor CMJ

Dr. Shagufta Khan is **Secretary – External** of ICorr India branch. She holds a PhD from Homi Bhabha National Institute, DAE (Department of Atomic Energy), India. She is a Fellow of the Institute of Corrosion and an AMPP-certified Corrosion Specialist, with 17 years of experience in research, academia, and training. Dr. Khan has published 18 research papers in international journals and conference proceedings and has presented her work at numerous international conferences.

14 January/February 2025 [www.icorr.org](http://www.icorr.org)

She is the Guest Editor for MDPI's Sustainability Special Issue, "Sustainable Materials, Manufacturing and Design," and the Technical Editor of the Corrosion Management Magazine, published by the UK Institute of Corrosion. She specialises in electrochemical corrosion, stress corrosion cracking, corrosion failure analysis, corrosion protection techniques (Inhibitors and coatings).



#### Dr. Prasanna Kumar Behera



Dr. Prasanna Kumar Behera is currently working as Assistant Professor in the Civil and Environmental Engineering at IIT Tirupati. He is **Secretary Internal** of ICorr India branch. He holds a PhD, M. Tech., and B. Tech. in Civil Engineering. His primary research interest is durability and condition assessment of concrete structures, and he works in reinforcement corrosion in concrete. He worked on understanding the importance of government schemes in promoting urban

infrastructure and economic growth, and as part of this, he worked in the ministry of road transport and highways (MoRTH)-funded project titled "Employment creating effects of highway construction" at IIT Kanpur. Dr. Prasanna has academic merit awards like 'Outstanding PhD thesis award from IIT Kanpur', and also has regularity awards in his credit, and is an active reviewer in international Journals of ACI, ASCE etc.

#### J N Agrawal

J. N. Agrawal holds B. Tech in Electrical Engineering and MBA in Marketing Management. He has a long and varied experience of 40 years in oil and gas industry in pipeline projects and operation and maintenance. He specialises in corrosion management of oil and gas pipelines including Cathodic Protection. He superannuated from service in 2015 after an active engagement of 33 years. Presently he is doing independent work in the field of corrosion management of pipeline. He is CEO of Corrsol Tech. He has presented several papers on different topics on corrosion control in AMPP and ASME conferences. He has been awarded in 2023 for his contribution in the field of corrosion science and technology in industrial organisation by AMPP India Chapter. He is CP4 from ICorr UK. He is **event coordinator** of ICorr India. He is author of books on Cathodic Protection and pipeline integrity management. He conducts training on Cathodic Protection and pipeline integrity management as well.



## Amarjeet Singh

Amarjeet Singh is a Research Scholar in the Metallurgical and Materials Engineering Department at Punjab Engineering College, Chandigarh, the current research focus involves investigating the development of magnesium alloy for both orthopaedic and structural applications utilising casting methods. Furthermore, heat treatment is conducted on magnesium-based alloys to enhance their serviceability. Mg and its alloys are known to exhibit early corrosion resistance issues, and as part of this research, the surface modification of Mg alloys using both organic and inorganic materials is explored to improve their corrosion resistance. He is **University Liaison and CPD Officer at ICorr India**.



## ICorr India-Technical Event

With an intention to provide an academic-industry outlook to the researchers and other working professionals working on corrosion, an online lecture series by specialised subject experts is being organised by the Branch. The first lecture of the series "200 years of CP and OPC" was presented by Prof. Paul Lambert, on **January 28<sup>th</sup>, 2025**.

Prof. Paul Lambert has over 40 years of experience in the investigation of structural durability and degradation and in the development of novel remedial techniques for civil and building structures, most recently as Head of Materials and Corrosion at Mott MacDonald. He became one of the three inaugural Mott MacDonald Fellows in 2023. Paul is Visiting Professor at the Centre for Infrastructure Management at Sheffield Hallam University where he carries out research into novel materials and repair technologies.



Photo: Prof. Paul Lambert.

### Additional Information

**For Continuing Professional Development (CPD) or to join ICorr India mailing list, request by Email to: [arpit.goyal@thapar.edu](mailto:arpit.goyal@thapar.edu)**



# ICorr Aberdeen Joint Event with IOM3/MIS

On **Tuesday, 26<sup>th</sup> November 2024**, at the Palm Court Hotel, the Institute of Corrosion (ICorr) Aberdeen Branch held its annual joint event with IOM3/MIS (The Mining Institute of Scotland). **Sarah Bagnall**, of R-TECH Materials and Branch Chair of Wales and South-West, gave an excellent presentation on **Failure Analysis—An Insight into Forensic Investigation, Failure Mechanisms and Prevention**.

### Presenter: Sarah Bagnall

Sarah is both a Materials Engineer and Chartered Engineer specialising in failure analysis, particularly for the petrochemical, oil & gas, and power generation industries. With over 700 failure investigations conducted to date. She has broad experience of a wide range of engineering components, metallic and non-metallic materials, and industries. Over the last 10 years, Sarah has developed specialist expertise in the corrosion and thermal degradation of austenitic stainless steels. She is also the Chair of the recently formed Wales and South-West England branch committee for the Institute of Corrosion.



Photo: Sarah Bagnall, of R-TECH Materials.

### Presentation Outline

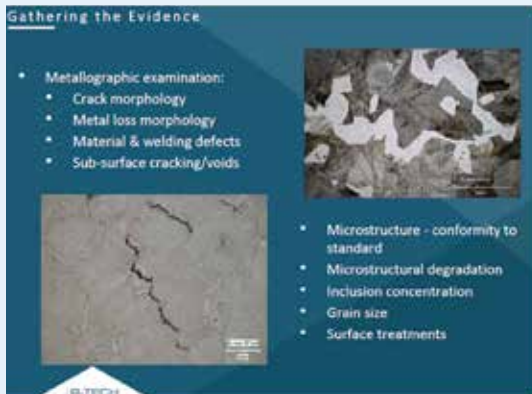
When engineering plant, equipment or components fail in service, the consequences can have the potential to be catastrophic for human safety and well-being, the environment and/or continuity of operations. On a lower level, the effect of such occurrences can include the requirement to reschedule production, the execution of emergency repairs, and missed customer deliveries. The impact of plant failures is undoubtedly negative for plant operators; however, determining the root cause of such failures presents an opportunity to learn from the experience. Adopting such a philosophy is critical to the continual improvement of global plant safety, performance, availability, and reliability while reducing maintenance costs.

Conducting an effective Root Cause Analysis (RCA) investigation provides the opportunity to understand and critically analyse all of the factors that have contributed towards a plant failure. Failure analysis is an essential tool that can be used within an RCA investigation to characterise defects that have caused or contributed to a plant failure event. Determining and understanding the failure mode and prevailing circumstances is critical to being able to deduce the root cause of the failure. When a material fails, it leaves behind a trail of evidence, which can be pieced together to determine the cause of failure. R-Tech Materials have a range of qualified experts, investigative equipment, and services for materials failure analysis which identify failure mechanisms encountered within the oil and gas industry. The range of study techniques and equipment required will be demonstrated through some case studies relevant to the industry.

*continues on page 16*

## Gathering the Evidence

To gather evidence for a failure investigation, it may be required to perform site visits if the components or structures are in situ. Detailed information would be gathered through dimensional checks, photography and sometimes it may be required to perform on-site testing such as cutting samples, NDT or replicates of fractures. Otherwise, if components are shipped to a laboratory more extensive analysis techniques can be used using chemical analysis, microscopy, sample sectioning or performing hardness testing and cutting tensile or other test samples from items for evaluation. In certain situations, it may be necessary to carry out corrosion testing, impact testing, or fatigue testing on prepared samples to establish site materials performance versus expected materials.



**Photos: Metallographic Examination of Materials by Sectioning for Grain Structure and Crack Presence. Fracture Surface Study by Stereographic and Scanning Electron Microscopy (SEM).**

A significant part of the failure analysis exercise is the gathering of information from site about the conditions of service' This involves studying:

- Type of plant and operational mode (e.g. continuous, cyclic, intermittent)
- Material grades used
- The process conditions (i.e. flow rates, temperature, pressure, process fluids composition and general operating environment)
- Any specific circumstances surrounding failure
- Inspection intervals and servicing
- Service length of component vs expected life

Materials failure can be due to one of a range of factors, some basic, such as overloading or incorrect specification of materials, and others more complex, such as stress corrosion cracking (SCC), which involves loading in combination with surrounding media or environment.



**Photo: The Most Common Root Causes of Failure.**

## Specific Case Studies

Failures investigations were demonstrated through a series of 5 most interesting case studies.

### Case 1 - Fractured flange of 304 Grade Stainless Steel bolts on oil tanker fuel transfer line.



**Photos: 304 SS Bolts, Cleaned Fracture Profiles, with Metallographic Section of Cracking and Grain Boundary Structure.**

The failure mechanism was identified as polythionic acid stress corrosion cracking. This occurs due to the formation of sulphide scales in the presence of sulphur compounds, which then react with air and moisture during start-up and shutdown to form sulphur acids (polythionic acid). The sulphur is thought to have formed due to exposure to an environment containing hydrogen sulphide. In the presence of a tensile stress within the bolts, the acid attacked the sensitised austenitic stainless steels adjacent to the chromium-depleted grain boundaries, producing intergranular cracking.

### Case Study 2 - Investigation was conducted on a failed propeller shaft from a Pilot Vessel made of duplex stainless steel.

In this instance, Zinc anodes in form of shaft bracelets had been employed as cathodic protection (CP) system.



**Photo: Duplex SS Propeller Shaft in-Situ with Zinc Bracelet Anode.**



**Photos: Stereographic Image of Fracture, SEM Image for Surface with XRF Analysis and a Metallographic Section Showing Crack Character.**

The shaft fracture showed river lines radiating from the Keyway this being a brittle fracture mechanism with advancing crack-front and multiple cracks radiating. Deposits from within the cracking zone contained significant levels of chlorine and sulphur.

Further analysis of the mechanism showed fatigue crack growth, but the fracture was mainly put down to hydrogen-induced stress cracking (HISC) due to the presence of over-protection of the duplex stainless with localised zinc anodes.

Hydrogen atoms can often form as a consequence of CP over-protection voltage of -1050 mV vs. the lower required ~ -550 mV for DSS against a Silver/Silver Chloride reference electrode. Protection limits for duplex stainless steels (DSS) had therefore been considerably exceeded, and atomic hydrogen had been absorbed in the metal matrix, leading to hydrogen cracking.

Detail of the 3 other case studies can be found in the slide upload to members site <https://sites.google.com/site/icorrbz/resource-center>

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

Further information about the Aberdeen Branch and other past presentations may be found on their website page: Aberdeen Branch - Institute of Corrosion. <https://www.icorr.org/aberdeen/> under Local Technical Programme and to join the Aberdeen Branch mailing list, please contact: [icorrbz@gmail.com](mailto:icorrbz@gmail.com)

# Special Event - ICorr Aberdeen Hosted CSCP Webinars



In early **November 2024**, ICorr Aberdeen was pleased to announce the very first Joint Webinar Week between ICorr and CSCP (Chinese Society for Corrosion and Protection) which consisted of five lunchtime presentations held over an eight-day period.

Summaries of the webinars are shown in the table below, which included five individual presentations from members of CSCP. The CSCP/ ICorr Webinar series was arranged by ICorr President-elect Dr Yunnan Gao and President Stephen Tate, after the signing of a Memorandum of Understanding (MoU) at the 22<sup>nd</sup> International Corrosion Congress held in Xi'an, China.

No	Date	Speaker Name	Job Title	Organisation	Presentation Title
1	Monday 11 <sup>th</sup> November 2024	<b>Dr Anqing Fu</b>	Director of corrosion research team	CNPC Tubular Goods Research Institute	Corrosion research progress in oil and gas and new energy industry.
2	Tuesday 12 <sup>th</sup> November 2024	<b>Professor Yong Xiang</b>	Professor and doctoral supervisor	China University of Petroleum, Beijing	Spontaneous inhibition phenomena of corrosion in CCUS system and their mechanisms.
3	Thursday 21 <sup>st</sup> November 2024	<b>Dr Di Wang</b>	Associate professor of material science and engineering	Northeastern University, Shenyang	The mechanism and protection of microbial corrosion in oil and gas field.
4	Friday 22 <sup>nd</sup> November 2024	<b>Dr Mindong Chen</b>	Associate Research Fellow	SINOPEC Research Institute of Safety Engineering, Qingdao	Optimising corrosion resistance of low-alloy steel for the refining industry by corrosion big data methods.
5	Monday 25 <sup>th</sup> November 2024	<b>Dr Xinpeng Lu</b>	CEO	Corrosion X Technology Co., Ltd.	Progress in the application of generative artificial intelligence in the cathodic protection industry.

- The five sets slides have all now been uploaded to ICorr website with the link as <https://www.icorr.org/aberdeen/> Refer to local technical programme.
- Meeting Recordings: All the five meeting recordings have also been uploaded to ICorr YouTube channel at **ICorr YouTube Channel**.
- Summary Post on LinkedIn: The summary of this event has been posted on linkedIn. The link to the post is **LinkedIn Post for ICorr-CSCP Webinar Week**.

*continues on page 18*

## Presentation 1 - Corrosion Research Progress in Oil & Gas and New Energy Industry by Dr Anqing Fu

**Dr Anqing (Andy) Fu** is the Director of Corrosion and Protection Research Center of CNPC TGRI (Tubular Goods Research Institute of China National Petroleum Corporation). Dr. Fu graduated from University of Calgary in 2010 and obtained PhD degree in energy and environment. Andy has more than 14 years of working experience in corrosion and protection of the oil & gas industry, and he specialises in electrochemical corrosion, stress corrosion cracking, corrosion failure analysis of OCTG, anti-corrosion techniques (inhibitor, organic/metallic coating, and clad pipe) R&D, and pipeline and wellbore integrity management.

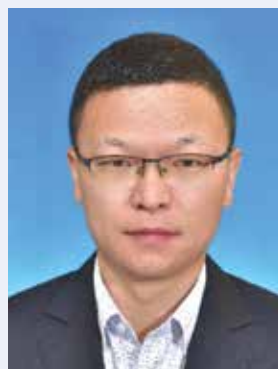


Photo: Dr Anqing Fu.

**Abstract:** Corrosion is a great threat in the oil and gas industry, including upstream oil and gas fields, middle-stream transmission pipelines, and downstream refineries. Much more attention needs to be paid to corrosion not merely due to the economic issue in terms of oil and gas loss but also to safety and environmental considerations. Firstly, several typical case studies of downhole tubing and gathering pipeline corrosion collected from the field were analysed. Secondly, microbiologically influenced corrosion (MIC) in the shale gas production system was investigated. MIC is prevalent in the shale gas production system due to the bacteria generation in recycled fracture fluid. Thirdly, Carbon Capture, Utilisation, and Storage (CCUS) is a substantial measure to realise carbon neutrality, while CO<sub>2</sub>-induced corrosion is nonnegligible. Typical failures in terms of supercritical CO<sub>2</sub> corrosion, sour impurity gas-induced stress corrosion cracking, and packer rubber sealing failure were analysed in CCUS-CO<sub>2</sub> injection and production wells. Fourthly, hydrogen is regarded as the ultimate clean energy; pipelines are regarded as the most economical and effective means for transporting H<sub>2</sub> in a gaseous state. The difference between gaseous hydrogen and ionic (cathodic) hydrogen-induced damage to pipelines was compared, and three typical facilities for gaseous hydrogen-mechanical interaction, gaseous hydrogen permeation, and content tests by TDS were introduced. Finally, corrosion protection technologies developed by CNPC TGRI, including inhibitors, organic coatings, and metallurgically clad pipes, were introduced; moreover, several challenges for corrosion and protection research in the oil and gas and new energy industries were summarised.

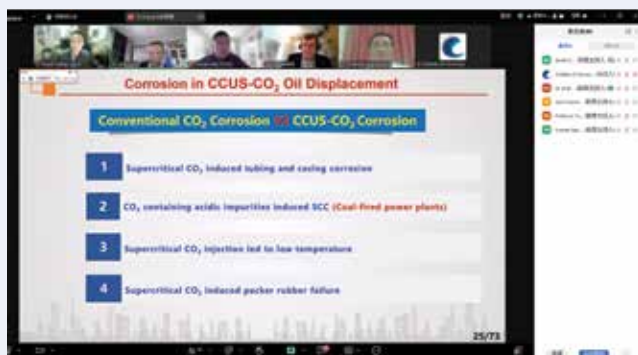


Figure 1: Dr Anqing Fu. in the Opening Presentation at the CSCP/ICorr Webinar Series.

## Presentation 2 - Spontaneous Inhibition Phenomena of Corrosion in CCUS System and Their Mechanisms by Professor Yong Xiang

**Yong Xiang** serves as a professor and doctoral supervisor at the College of Mechanical and Transportation Engineering, China University of Petroleum, Beijing. He is the director of the Laboratory for Low Carbon Energy Equipment and Materials Protection and the deputy dean of the Ocean Engineering Institute. He received both his bachelor's and doctoral degrees from Tsinghua University, and he was also the post-doctoral researcher of Ohio University. Yong Xiang is an active member of several committees under the China Society for Corrosion and Protection, including the Corrosion Inhibitors and Water Treatment, Oil and Gas Field and Pipeline Corrosion and Safety, and Non-metallic Corrosion-Resistant Materials committees.

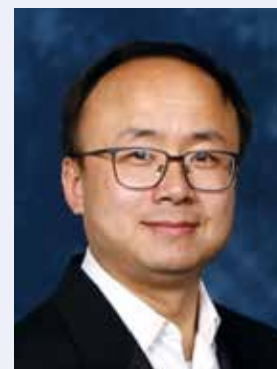


Photo: Professor Yong Xiang.

**Abstract:** Carbon capture, utilisation, and storage (CCUS) technology has been considered for reducing CO<sub>2</sub> emissions and improving energy efficiency. However, during the capture process, impurities such as O<sub>2</sub>, SO<sub>2</sub>, and NO<sub>2</sub> are present, which accelerate corrosion of transportation pipelines and wells. Nevertheless, research also found several interesting corrosion inhibition phenomena in the system. This study summarised the spontaneous corrosion inhibition phenomena during the capture and transportation process and outlined the corresponding inhibition mechanisms. These included the corrosion inhibition mechanisms of the degradation products of organic amines and the inhibition behaviour of SO<sub>2</sub> on CO<sub>2</sub> corrosion processes. Additionally, this study also proposed several corrosion inhibition methods in CCUS system. Understanding these corrosion inhibition mechanisms is considered crucial for corrosion control of CCUS facilities.

## Presentation 3 - The Mechanism and Protection of Microbial Corrosion in Oil and Gas Field by Dr Di Wang.

**Di Wang** is an associate professor of material science and engineering at Northeastern University in Shenyang, China. He focuses on the mechanism and mitigation research of microbiologically influenced corrosion in the oil and gas industry. His research activities are aimed at deciphering the electron transfer mechanism of classic corrosive microbes of sulphate-reducing bacteria, investigating eco-friendly natural D-amino acids as green biocide enhancers combined with commercial biocides to kill the bacteria, and modifying the microbial sample methods in the oil and gas field.

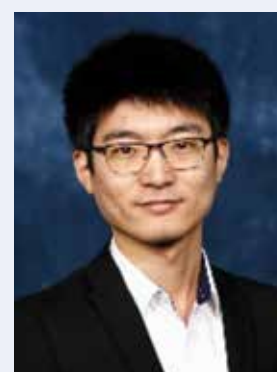


Photo: Dr Di Wang.

Di Wang obtained his doctorate degree at Ohio University in Athens, United States, in 2022. From June 2022, he continued his research of MIC in the oil and gas industry at Northeastern University. He has published 27 peer-reviewed research papers, including 16 first-author papers. He also joined the working group—AMPP Standard 21495 of Laboratory Evaluation of the Effect of Biocides on Biofilms.

**Abstract:** Microbial corrosion of metal materials in the oil and gas field industry causes serious economic losses and threatens energy security. For the mechanism research of microbial corrosion, deciphering the electron transfer mechanism of microbes in a complicated oil and gas environment is a critical point to having a better understanding of microbial corrosion. Electron mediators like riboflavin and magnetite nanoparticles promote the indirect electron transfer and distinguish electron transfer microbial corrosion from other corrosion. Both could be useful tools in a microbial corrosion sensor to distinguish the corrosion mechanism. The indirect electron transfer mediated by hydrogenase genes plays a role in promoting sulphate-reducing bacteria corrosion, but it was not found to be a dominant role in the corrosion process, which denied the previous classical theory of Cathodic Depolarisation Theory coming out in 1934. For the protection research of microbial corrosion, physical methods like pigging and chemical treatments such as biocide dosing are used to mitigate microbial corrosion in the oil and gas industry, but they lead to problems like environmental concerns, high operational costs, and low efficacy in the same system after prolonged applications. Alternatively, eco-friendly natural D-amino acids as green biocide enhancers combined with commercial biocides to kill the bacteria can be used to block the electron transfer between bacteria and metal surfaces and disperse the sessile cells from the metal surfaces.

#### **Presentation 4 - Optimising Corrosion Resistance of Low-Alloy Steel for the Refining Industry by Corrosion 'Big Data' Methods by Dr Mindong Chen**

**Dr Mindong Chen** is an associate research fellow at the Department of Equipment Safety at the SINOPEC Research Institute of Safety Engineering, Qingdao, China. Mindong undertakes technical R&D in the field of equipment safety at the SINOPEC Research Institute of Safety Engineering and the National Institute of Hazardous Chemicals Safety (Qingdao). His primary research areas include material corrosion and protection, equipment condition monitoring, and equipment integrity management. He has published over twenty SCI papers, including two ESI Hot Papers, and holds more than thirty patents. Chen serves as a reviewer for multiple international journals and has led projects funded by the National Key R&D Program of China, SINOPEC Corporation, and the National Natural Science Foundation of China. His achievements include a First Prize in Science and Technology Progress from the Chinese Society for Corrosion and Protection, a Second Prize in Management and Technological Innovation from the China Association of Plant Engineering, a Third Prize in Technological Invention from SINOPEC Corporation, and a Second Prize in Management Innovation from the SINOPEC Corporation.



**Photo: Dr Mindong Chen.**

**Abstract:** The refining and chemical industry plays a crucial role in national economic development and is integral to national industry. Among materials used in this industry, steel is predominant, facing complex corrosive media and environmental loads. Mindong Chen has focused on the corrosion mechanisms within typical environments, aiming to improve the corrosion resistance of metal materials by leveraging corrosion big data and addressing the material requirements for crude oil refining equipment. Key areas of focus have included: Interface-diffusion behaviour in corrosion of

low-alloy steel: Chen's research has investigated the electrochemical corrosion behaviours of low-alloy steel under the kinetic and diffusion-controlled phases. Mechanisms and correlation rules of alloy elements in inhibiting corrosion diffusion: For long-term service materials, specific corrosion resistance indicators, such as corrosion product film thickness and FeO OH content, have been analysed. Chen has correlated these indicators with alloy composition using methods like Spearman and Pearson correlations, as well as non-linear mutual information, achieving high consistency with traditional theories. The optimisation theory of corrosion resistance for low-alloy steel in corrosive environments has been utilised: In complex, multi-factor environments, a complex relationship exists between alloy components and corrosion resistance. By applying neural networks, Chen has established quantitative relationships between environmental factors, alloy elements, and corrosion resistance indicators. Through high-throughput time-scale correlation, this work has provided an optimised alloy composition formula tailored for multi-factor coupled corrosion environments, based on microalloying strategies. His report presented in detail Chen's work in advancing the theoretical and practical understanding of corrosion resistance in steel alloys within the refining and chemical industry.

#### **Presentation 5 - Progress in the Application of Generative Artificial Intelligence in the Cathodic Protection Industry by Dr Xinpeng Lu.**

**Dr Xinpeng Lu** is CEO of Corrosion X Technology Co., Ltd., based in Shenzhen, China. Dr. Lu has 18 years of experience in the field of corrosion and protection of oil and gas facilities, integrity management, and artificial intelligence. Dr. Lu is a Director of the Chinese Society of Corrosion and Protection (CSCP), a member of the specialised Society on Cathodic Protection Technology, and a member of the specialised Committee on Intelligent Diagnosis of Facility Health. Additionally:



**Photo: Dr Xinpeng Lu.**

- A member of International Gas Union (IGU) Transmission and Distribution Committee.
- An AMPP Cathodic Protection specialist (CP4), Integrity Management Technologist (PCIM).
- A Manager-level member of British Gas Association (IGEM).
- A Member of Standardisation Committee of China City Gas Association.

Dr Lu has directed and implemented the cathodic protection gas and storage support project, which won the highest award for civil engineering in China, the Tien-yow Jeme Civil Engineering Prize, twice, in 2021 and 2022.

**Abstract:** This paper reviewed the application status and development trend of generative artificial intelligence technology in the cathodic protection industry. As an important technical means for metal corrosion protection, cathodic protection has particular problems such as complex data analysis and high experience dependence in its design, monitoring, and maintenance. With the rapid development of generative AI technologies such as large language models (LLM) and diffusion models, new ideas have been provided to solve these industry problems. This paper introduced the application of generative AI in cathodic protection design optimisation, including parameter configuration optimisation and protection potential distribution prediction; secondly, it analysed the application cases in cathodic protection system operation monitoring, such as anomaly detection and life prediction; and discussed the practice in the field of maintenance decision support, including

*continues on page 20*

fault diagnosis and maintenance suggestion generation. Studies have shown that generative AI technology can effectively improve the design efficiency and operational reliability of cathodic protection systems and has broad application prospects. However, in practical applications, it still faces challenges such as model accuracy, generalisation ability, and knowledge updating. In the future, it is considered necessary to further strengthen algorithm innovation, data accumulation, and industrial practice to promote the in-depth application of generative AI technology in the field of cathodic protection.

The Aberdeen branch was very proud to be asked to host these prestigious presentations for which there were extensive question and answer sessions, documented in the five meeting recordings uploaded to the ICorr YouTube Channel at **ICorr YouTube Channel**. Feedback to date has been extremely favourable, and a further series of ICorr-CSCP joint webinars will take place later in 2025. Please contact the Aberdeen Branch Chair **meiling.cheah@gmail.com** if you wish to present, or for any further information on upcoming events and check **www.icorr.org/events/**



# ICorr Central Scotland Updates

By Philip Enegela

Following its launch earlier in 2024, the new Central Scotland Branch had an eventful and productive 2024, marked by significant growth in membership and excellent technical meetings. The number of companies and academic institutions represented in our meetings continues to grow. Sponsorship engagement sponsors has been remarkable—3 new companies have indicated interest in becoming branch sponsors, in addition to our two existing sponsors. The Chair, Dr. Philip Enegela, welcomes all enquiries on this matter.

On **27<sup>th</sup> November 2024**, Graham Murray (Head of Metallurgy, Manufacturing Test and Equipment Qualification at Altrad Babcock) provided a seminal presentation on “Refurbishment and Improvement of Operating Assets” to close out the branch’s 2024 activities. It was a very stimulating talk that elucidated challenging modifications and repairs on long-lead, high-criticality fixed equipment that are safety critical in industrial assets. Case studies were presented covering intricate valves in power plants and pressure equipment in petrochemical facilities. Graham demonstrated how innovative thinking

and novel solutions are being used to help enhance asset longevity. Flyers and registration links will be issued in due course to members.

Interested presenters can contact **cschair@icorr.org** to supply abstracts for consideration for the 2025-2026 technical programme.

The Central Scotland Branch remains committed to collaborating with other Institutes of repute. Discussions are underway with the Institution of Engineers in Scotland (IES) for a joint meeting in 2025.

## The Branch has a full and very varied programme up to Summer 2025. Presentation topics include:

Topic	Month	Presenter / Company
Deep optimisation for cathodic protection: advanced technology for transformer rectifiers output current optimisation.	January	Nicolas Rossi, Automa srl
Cost-effective corrosion protection using two-pack epoxy coatings in an aerosol and protecting nozzles and flange faces, using alternatives to hand coating.	February	Graham Greenwood-Sole, Corrocoat
Linings and PFP (Cementitious or Epoxy).	March	Robert Allan, Carboline
Selection of internal coatings for pressure vessels.	April	Simon Daly, Safinah Energy & Infrastructure
Enhancing spot-welding efficiency: assessing the precision of response surface methodology in predicting optimal parameters.	May	Ahmed Elgahani, Brega Petroleum Marketing Co.
Catching the IR-free potential: an overview of the remaining IR components in off measurements and the importance of the design for PRE with integrated coupon.	June	Ivano Magnifico, Automa srl
Composite repairs for pipework—standard and advanced.	July	Stuart McKay



Photo: Graham Murray (Head of Metallurgy, Manufacturing Test & Equipment Qualification at Altrad Babcock), November 2024 Presentation.



Photo: Delegates for the November 2024 Presentation.

Summaries of recent presentations to the Branch may be found at: **www.icorr.org/central-scotland/** please scroll down to Local Technical Programme.

The Branch hosted its AGM in January 2025 attended by the new President and Immediate Past President, where the new Branch Committee was inaugurated, and this will be reported separately in the Mar-Apr Journal.

# ICorr London Updates



By Brian Goldie

The branch held its 35<sup>th</sup> Luncheon on **5<sup>th</sup> December 2024** at the Royal Overseas League Club, St James's, when 150 guests enjoyed a four-course Christmas themed meal, before being entertained by an invited speaker. The event was hosted by Paul Brooks, the branch chair.



Photo: Guests Enjoying Christmas Themed Meal.

Before sitting down for the meal there were pre-lunch refreshments, and time for the guests to meet each other.

After the lunch, the guests were entertained by Gary Richardson. Garry presented the Sunday morning sports programme, Sportsweek on BBC Radio 5 Live until 2019, although he remained a sports presenter on the weekday morning Today show on BBC Radio 4 until September 2024. He gave a very interesting insight into his interviewing of sports stars over the years, after which the President, Yunnan Gao, gave a brief update on the Institute, before a raffle and time for networking. The branch would also like to thank the sponsors, Akzo Nobel, Carboline, Concrete Repairs Ltd, Corrodere, Corrpro Europe, Owens Corning, and Winn and Coales (Denso) Ltd., for supporting this event.



Photo: Gary Richardson Sharing Insights into His Interviewing of Sports Stars Over the Years.

The first technical meeting of 2025 was held on **9<sup>th</sup> January**, when **Esteban Amirante** of Beasy Ltd. presented "Implementation of a Digital Twin for an Offshore Structure." Esteban has a degree in mechanical engineering and a master's in business administration and is the International Business Development Manager at CM BEASY Ltd.



Photo: Esteban Amirante Delivering His Presentation.

Esteban started by describing the concept of a "Digital Twin" and moved on to how this could be implemented for an offshore structure to revolutionise asset management far beyond simple 3D digitalisation. This innovation promises to transform how assets are managed and decisions are made. The "Digital Twin" provides a digital replica of an offshore asset, enhancing clarity and efficiency in managing corrosion control systems.

He explained that the current corrosion data management is plagued by fragmented data and time-consuming processes, but the "Digital Twin" concept can address these issues by offering a comprehensive, colour-coded visual representation of the asset, where green indicates expected conditions and red signals the need for attention. This tool goes beyond visualisation; it can integrate survey data and predict future performance, ensuring timely intervention and maintenance.

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Key features include monitoring sacrificial anode depletion, remaining life, and mass. The “Digital Twin” can plan anode replacements, and predict protection potentials across the entire structure, moving beyond limited survey locations. It aligns with the asset’s lifespan, requiring minimal updates and providing systematic monitoring.

Additionally, the “Digital Twin” serves as an early warning system, predicting anomalies before they occur. It can simulate and explore various scenarios, empowering departments to make informed decisions based on predicted outcomes. This not only streamlines workflows but also unleashes significant cost savings and time efficiency.

In essence, the “Digital Twin” can be an innovative partner, enhancing decision-making and mitigating risks. Esteban concluded by stressing that the concept is not just a tool; it’s way to the future, where decisions are bold, operations are optimised, and risks are identified early.

After a very interesting Q&A session, the Chair thanked Esteban for his presentation, and presented him with an ICorr pen, in appreciation of his talk.

The branch AGM will be held on 13<sup>th</sup> March, at the slightly earlier time of 6.15 pm and will be followed by a presentation from the Chair, Paul Brooks.

Paul would be pleased to answer any queries on the Branch activities: Please contact him at [Londonchair@icorr.org](mailto:Londonchair@icorr.org)



Photo: Paul Brooks Presenting ICorr Pen to Esteban.

# ICorr Midlands Updates:

## Webinar on “CUI and its Predictive Management”

On **December 15<sup>th</sup>, 2024**, we hosted a webinar with experts Rene Goderie (Dow Chemicals) and Phil Yule (AMPP). It attracted 200+ registrants, 85 attendees globally, with strong engagement from ICorr members and industry professionals.

**Formation of Volunteer Committee** A volunteer committee is being formed, with 12+ members expressing interest. The first meeting is scheduled for February 20<sup>th</sup>, 2025.

### Upcoming Events and Initiatives

**Midlands Corrosion Forum (MCF) Joint Event** A joint event with MCF is planned for April 2025, focusing on innovations in corrosion monitoring.

### Seeking Experts for Future Webinars on:

- Corrosion and use of advanced analytics including AI
- Industrial IOT and remote monitoring, digital twin
- Applied practices in corrosion and cathodic protection

### Regional Engagement

We are strengthening relationships with Cranfield University, Cambridge University, and other institutions to involve students in ICorr activities through technical talks and industry collaborations.

**Prafull Sharma - Interim Chair, Midlands Branch, Institute of Corrosion**



# ICorr North-East Updates: ICorr NE Branch, AGM and Conference

On **Wednesday, 13<sup>th</sup> November 2024**, the North-East (NE) Branch of the Institute of Corrosion hosted the Institute of Corrosion 2024 AGM at Neville Hall in Newcastle upon Tyne.

The day commenced with a technical offshore wind programme, followed by the AGM and concluding with an evening dinner. Almost 70 people from all over the UK attended the Technical Program, and 60 attended the evening dinner. Attendees included the ICorr Council, Sustaining Members, Professional Members, General Members and potential future members. The day was a great success, with the variety of engaging content keeping the attendees entertained for almost 9 hours from start to finish.

## ICorr NE Branch, Christmas Dinner

After a busy year, the Branch committee got together, (minus a couple of late withdrawals due to heavy snow), to enjoy a well-earned Christmas Dinner and had time to discuss the success of 2024, in particular the ICorr AGM and Technical Wind Day.



Photo: AGM Delegates Gathered in the Neville Hall on 13<sup>th</sup> November 2024.

# ICorr NE Branch, January Evening Event – Tour of Newcastle Castle Keep

The Branch hosted a tour of 22 guests around the Newcastle Castle Keep on **30<sup>th</sup> January 2025**. The tour was most informative and enjoyed by the attendees, and afterwards a number went for some refreshments at the nearby Bridge Hotel.

Of the 22 attendees, a number had come to their first ICorr event at the November AGM and we now hope they will become regular attendees of the NE Branch events.

Photo (right): North-East Branch  
Tour of the Newcastle Castle Keep  
on 30<sup>th</sup> January 2025.



## Upcoming Events

### ICorr NE Branch supporting Annual CED Day and Corrosion Awareness Event in Teesside, 24<sup>th</sup> April 2025

ICorr NE Branch is currently in discussions with Danny Burkle to assist in the running of this event. The assistance might come in the form of helping recommend local presenters to cover relevant subject matter and also providing in-person assistance to help run the day.

The NE Branch aims to provide a very full technical programme of both in-person and online events. Abstracts of potential papers for the North-East Technical Programme are always

welcome for consideration, and anyone wishing to present should correspond soonest with the 2024/2025 Chair and Technical Programme Co-ordinator:  
Matt Fletcher at [nechair@icorr.org](mailto:nechair@icorr.org)

**To join the NE Branch Event mailing list, please also contact:** [nechair@icorr.org](mailto:nechair@icorr.org)

**Further information about the NE Branch and its past presentations may be found on their website page:**  
**North-East Branch – Institute of Corrosion** [www.icorr.org/northeast/](http://www.icorr.org/northeast/) under Local Technical Programme.

# ICorr North-West Updates



By Greg Brown

The North-West Branch continues to go from strength to strength under the skilful chairmanship of Greg Brown, recruiting new committee members and planning several exciting events for 2025.

## Young Engineer Event - 19<sup>th</sup> February 2025

The Young Engineer Programme is run by ICorr every two years and serves as a great opportunity for early-career engineers/students to gain valuable experience and problem-solving skills. Our 2024 programme has just been completed in London, and our YEP 24 winners will be off to AMPP25 in Nashville very soon: <https://ace.amp.org/home>

Last year's participants dealt with a power plant corrosion-related issue. The winning team designed a solution to the problem. Roger Francis, of RF Materials, implemented the real-life solution.

Our Young Engineer leadership team of Danny Burkle and Izabela Gajewska has confirmed the date of 19<sup>th</sup> February 2025 for a 'Follow-up' event at the University of Manchester to showcase presentations from the winning team and Roger Francis. As in previous North-West Branch events, it's also proposed that the event will showcase students' university research presentations. The event will also promote the next intake for YEP in Q4 2025.

The event will take place from 12:30 for lunch. The event is open to all ICorr members, not just Young ICorr participants.

**For further information or to confirm your place, please contact [nwchair@icorr.org](mailto:nwchair@icorr.org)**

## Asset Management Joint Event

The North-West Branch was approached to host a joint event with the Institute of Asset Management (IAM). A further meeting of the planning committee is taking place. The date and final arrangements are yet to be confirmed but will be available and circulated in due course, also being posted to the North-West Branch homepage: North-West Branch - Institute of Corrosion.

## UK-China Corrosion Summit Dates Confirmed as 3<sup>rd</sup>-4<sup>th</sup> September 2025

In a tremendously exciting development for the North-West Branch, ICorr and our Chinese counterpart, CSCP (Chinese Society for Corrosion Protection), are planning to hold the inaugural UK-China Corrosion Summit in Manchester in 2025, following the signing-off of our MoU in China in October 2024 and the successful ICorr (UK) - CSCP (China) Joint Webinar Week in November 2024.

The proposed format is as follows:

- The Summit will be a two-day event, consisting of: Day 1: Conference with evening dinner; Day 2: University and industrial visits.
- The size of China delegation will be approximately 20-30.
- The Technical Programme will be hosted by Manchester University, with an accompanying industrial visit also taking place to Intertek CAPCIS.

- ICorr North-West Branch will be organising the venue and associated facilities.

North-West Branch will continue to update Corrosion Management and all relevant communication channels. Anyone wishing to express an interest in attending the conference can contact [nwchair@icorr.org](mailto:nwchair@icorr.org) or [president@icorr.org](mailto:president@icorr.org)

## Committee Meetings

The NW Branch committee normally meets on the 2<sup>nd</sup> Tuesday on alternate months, at 18:00 (either in person or online, as advised by Chair: [nwchair@icorr.org](mailto:nwchair@icorr.org))

### Upcoming dates are:

- 8<sup>th</sup> April 2025
- 10<sup>th</sup> June 2025
- 12<sup>th</sup> August 2025
- 14<sup>th</sup> October 2025

## Branch New Year Get Together

The Committee met in Turtle Bay, NW Manchester, to celebrate their successful 2024 and share a lovely meal before getting down to the work for what promises to be a busy 2025!



Photo: North-West Committee, January 2025 at Turtle Bay, Manchester.

## Upcoming Events

**For more details of upcoming events please visit:** [www.icorr.org/events/](http://www.icorr.org/events/)

**If you wish to present, please contact:** [nwchair@icorr.org](mailto:nwchair@icorr.org)

# ICorr Wales and South West Updates



By Sarah Bagnall

In 2024, the Institute of Corrosion took a significant step toward expanding its reach and promoting the importance of corrosion prevention in the Wales and South-West region of the UK.

With the establishment of the Wales and South-West Regional Branch, ICorr aims to foster greater collaboration and knowledge sharing within this vital area of engineering.

The formation of this regional branch reflects a growing need to address corrosion-related challenges in industries such as petrochemical, manufacturing, energy, infrastructure, and marine, which are particularly prevalent in the coastal and industrial regions of Wales and the South-West. The new branch will provide a platform for professionals to gather, exchange ideas, and gain a deeper understanding of corrosion issues, as well as cutting-edge strategies for prevention.

## Key Events Held in 2024

Throughout 2024, the Wales and South-West Regional Branch hosted a series of events in cities such as Bristol, Port Talbot, Swansea, and Southampton. These gatherings served as key opportunities for local industry leaders, engineers, and academics to meet, learn, and discuss the latest advancements in corrosion science and technologies. Topics covered included innovative corrosion prevention methods, case studies, and industry best practices aimed at enhancing durability and reducing costs.

In addition to technical presentations and workshops, these events featured networking opportunities, allowing members to connect with peers and potential collaborators. This helped foster a sense of community within the region, strengthening relationships among professionals working in similar fields.

## Looking Ahead: Events in 2025

Building on the success of 2024, the Wales and South-West Regional Branch will continue its mission to promote the understanding and prevention of corrosion. With events planned across the region in locations such as Pembroke, Cardiff, Plymouth, Southampton, and Swansea, the branch will ensure its activities are accessible to a wide range of professionals. By rotating event locations, ICORR hopes to reach even more individuals and organisations that may benefit from greater awareness and understanding of corrosion issues and prevention techniques.

These upcoming events will also offer valuable opportunities for learning and collaboration, featuring expert speakers and interactive sessions. The regional branch is committed to addressing the diverse needs of the region.

## Strengthening Regional Collaboration

The Wales and South-West Regional Branch of ICORR also aims to work alongside other professional organisations in the region, such as the Southern Joint Branch of the Royal Institution of Naval Architects (RINA) and the Institute of Marine Engineering, Science & Technology (IMarEST), the Institute of Materials, Minerals and Mining (IOM3), and the Institution of Chemical Engineers (ICChemE).

By working together with these groups, ICORR seeks to broaden the scope of its events and initiatives, offering a more interdisciplinary approach to corrosion prevention and management. This collaboration will help facilitate knowledge transfer across industries, bringing together professionals from different sectors who may face similar corrosion-related challenges. Additionally, these partnerships will support the development of innovative solutions to complex problems, ultimately advancing the field as a whole.



Photo: Delegates at the 2024 Bristol Event.



Photo: Delegates at the 2024 Port Talbot Event that launched the Branch.

For more information, contact [swchair@icorr.org](mailto:swchair@icorr.org). You can also keep up to date on events by visiting our LinkedIn page; <https://www.linkedin.com/groups/12992293/> and our Website page [www.icorr.org/wales-and-south-west-branch/](http://www.icorr.org/wales-and-south-west-branch/); please scroll down to Local Technical Programme for Past presentations.

# ICorr Training: About TÜV Rheinland, ICorr and ARL Training Partner

TÜV Rheinland, founded in 1872, is a global leader in technical services, providing safe and sustainable solutions for the interaction between humans, the environment, and technology. Since 1996, they have offered training and personnel certification in China, being Europe’s largest independent education institute.

TÜV Rheinland Industrial Services Greater China, comprising world-leading experts, delivers technical inspection, testing, and certification for the oil, gas, chemical, petrochemical, energy, power, construction, and process industries worldwide. Their comprehensive services ensure products and equipment meet market requirements, supporting local industries in developing safely and sustainably.

Here is the training schedule in 2025 for information:

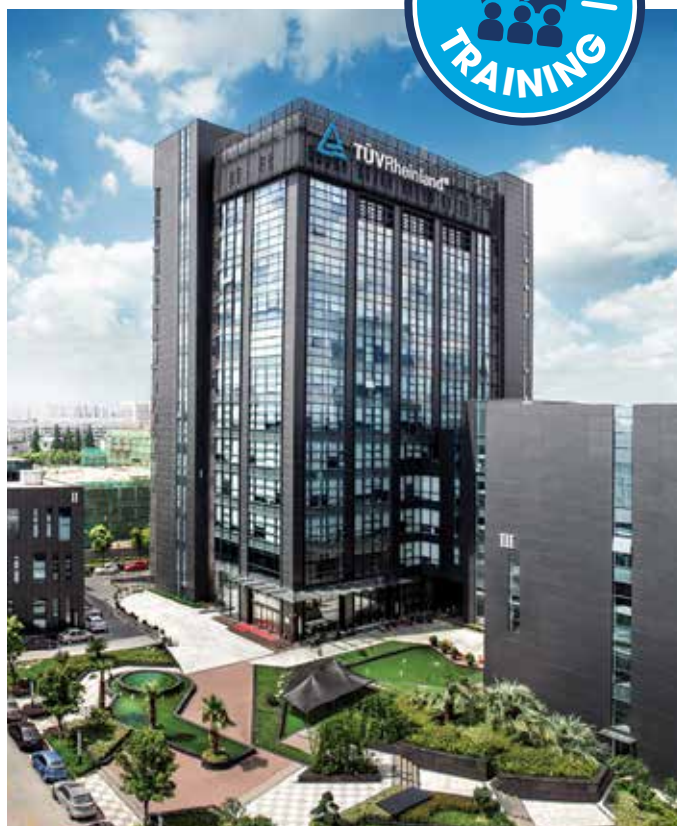
## 2025 Training Schedule:

Training Courses	Schedule
Protective Coating Inspector Level 2	7 <sup>th</sup> -20 <sup>th</sup> April 11 <sup>th</sup> -24 <sup>th</sup> August 20 <sup>th</sup> October- 2 <sup>nd</sup> November
Protective Coating Inspector Level 3	May / November
Passive Fireproofing (Epoxy) Inspector Level 2	15 <sup>th</sup> -16 <sup>th</sup> May 28 <sup>th</sup> -29 <sup>th</sup> June 6 <sup>th</sup> -7 <sup>th</sup> September 6 <sup>th</sup> -7 <sup>th</sup> December
Passive Fireproofing (Epoxy) Inspector Level 3	February / August
Insulation Inspector Level 2	28 <sup>th</sup> February - 2 <sup>nd</sup> March 16 <sup>th</sup> -18 <sup>th</sup> May 1 <sup>st</sup> - 3 <sup>rd</sup> August 17 <sup>th</sup> - 19 <sup>th</sup> October
Hot Dip Galvanizing Inspector Level 2	10 <sup>th</sup> -11 <sup>th</sup> May 27 <sup>th</sup> - 28 <sup>th</sup> Sep

### History with ICorr

In collaboration with Argyll Ruane, TÜV Rheinland has successfully introduced ICorr training to China, becoming the sole ICorr training provider in the country in 2018. On-site training can be conducted in coastal cities such as Shanghai, Tianjin, Qingdao, Zhuhai, Qidong, and Zhoushan, where numerous international offshore FSPO and LNG projects are active.

In 2024, ICorr, TÜV Rheinland (China) Ltd., and Argyll Ruane (Sheffield, UK) celebrated 7 years’ collaboration, and have achieved the 1000th Certificates in China. In the same year, Protective Coating Inspector Training Level II and Level III have been delivered by TÜV Rheinland, where all ICorr surface treatment courses are available for the candidates in China by now.



### Contact Details

Room 301, 3F and Room 1203, 12F,  
Building C, CATIC Plaza,  
No. 15, Ronghua South Road,  
Beijing Economic-Technological Development Area,  
Beijing, China



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# ICorr Training: The Important Role of our ICorr Tutors



This month we are profiling **Tony Rizk**, developer and tutor of ICorr MIC training course.



## Tony Rizk

- Chair of ICorr of new ETGB (Engineering Training Governing Board).
- PhD corrosion science.
- Fellow member of The Institute of Corrosion (ICorr).
- Developer and tutor of ICorr MIC training course.
- Trainer certification programme, Phases 1 and 2.

Tel: +44 7425 888 108

Email: [tony.1.rizk@gmail.com](mailto:tony.1.rizk@gmail.com)

Tony holds a PhD degree in Corrosion Science from the University of Manchester. Has over 30 years of international experience in both research and field investigations. After graduation career started with CAPCIS Ltd, followed by 11.5 years as a Science Specialist at Saudi Aramco Research and Development Centre, Dhahran, Saudi Arabia. Served as the company main contact point for microbiologically influenced corrosion (MIC) and led a number of technical committees, focus teams, and failure analyses. Honorary Reader at the University of Manchester between 2018 and 2021. Active member of the Institute of Corrosion (ICorr) and developed the only known certified MIC training course by a recognised professional organisation. Currently chairing ICorr Engineering Training Governing Board (ETGB).

Advocates the use of less toxic and environment friendly chemicals and led a number of classified JIPs and cross company projects. Directed the multi-phase research project to assess the effect of the non-toxic anti-SRB bio-competitive exclusion treatment and authored the reference document "The Effect of Nitrate Anti-Souring Treatment on Corrosion of Mild Steel" that was published by the Energy Institute, London, November 2006, ISBN 978 0 85293 458 6.

Career responsibilities involved the development of young engineers and scientists and the mentoring of employees' postgraduate students. Qualified trainer with extensive experience both in-house (Saudi Aramco) and at various technical events in Europe and the Middle East.



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# Industry News

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## Aramco, Linde, and SLB Collaborate on Development of Carbon Capture and Storage Hub in Jubail Saudi Arabia



Aramco, one of the world's leading integrated energy and chemicals companies, has signed a shareholders' agreement with Linde and SLB, paving the way for development of a Carbon Capture and Storage (CCS) hub that is expected to become one of the largest globally. Under the terms of the shareholders' agreement Aramco will take a 60% equity interest in the CCS hub, with Linde and SLB each owning a 20% stake. The project will support the company's ambition to achieve net-zero Scope 1 and Scope 2 greenhouse gas emissions across its wholly-owned operated assets by 2050.

It represents a significant milestone for the project and is a key component in Aramco's emission mitigation strategy. With the support of the Ministry of Energy, phase one of the new CCS hub in Jubail, in the Kingdom of Saudi Arabia's Eastern Province, is expected to capture and store up to nine million metric tons of CO<sub>2</sub> annually, and construction is expected to be completed by the end of 2027. Later phases are expected to further expand its capacity.

**For more information contact media inquiries@aramco.com**

**Source: <https://www.aramco.com>**

## Shell and Equinor to Create the UK's Largest Independent Oil and Gas Company



**London** – Equinor UK Ltd and Shell U.K. Limited are to combine their UK offshore oil and gas assets and expertise to form a new company which will be the UK North Sea's biggest independent producer. The incorporated joint venture (IJV) will be set up to sustain domestic oil and gas production and security of energy supply in the UK.

On deal completion, the new independent producer will be jointly owned by Equinor (50%) and Shell (50%), two leading global energy companies with decades of experience operating in the UK North

Sea. With the once prolific basin now maturing and production naturally declining, the combination of portfolios and expertise will allow continued economic recovery of this vital UK resource. The new company will be more agile, focused, cost-competitive, and strategically well positioned to maximise the value of its combined portfolios on the UK Continental Shelf.

**Source: <https://www.shell.com/>**

## bp and XRG Close Deal to Launch New Joint venture with Arcius Energy



bp, ICorr Corporate member and XRG today announced they have reached financial close and completed formation of their new joint venture and international natural gas production and marketing platform – Arcius Energy. Announced in February 2024, Arcius Energy is 51% owned by bp and 49% by XRG, ADNOC's transformative investment company. The new joint venture will combine the pair's deep technical capabilities and proven development track record.

ADNOC and bp are founding members of the Oil and Gas Decarbonisation Charter (OGDC). Launched during COP28 in Dubai, the OGDC is a global commitment to speed up climate action across the energy industry.

Together with its partners, bp currently produces around 70% of Egypt's gas through its gas development projects in the West and East Nile Delta.

XRG is a transformative international energy investment company, focused on lower-carbon energy and chemicals, and headquartered in Abu Dhabi. Wholly owned by ADNOC.

**For more information about Arcius Energy visit [www.arciusenergy.com](http://www.arciusenergy.com).**

**Source: bp Press Release**

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## New Best Practices for Corrosion Under Insulation (CUI) Monitoring Released – CUI RP 101

A new set of best practices created specifically for the Oil, Gas and Petrochemical industries has been released on **18<sup>th</sup> December 2024**, giving guidance on the deployment, usage, inspection strategies and maintenance of Corrosion Under Insulation (CUI) monitoring systems.



The Recommended Practice document, which is referred to as CUI RP 101 Issue 1 and includes contributions from experienced users throughout the industry, including Aramco, Dow, INEOS and Chevron, contains best practices from asset selection to the use of maintenance management systems, inspection strategies and economic justification principles. It has been developed to enable Asset Owners to optimise inspection and repair strategies and enhance CUI management processes with continuous monitoring systems in the arsenal.

CUI costs the industry billions of dollars every year to mitigate the risk and repair the damage it causes to assets. Unmanaged CUI can result in leaks, leading to process safety incidents, severe harm to the environment, high unexpected repair costs and operational downtime.

Continuous monitoring systems for CUI offer remote detection of localised corrosion and moisture on an asset, while also providing corrosion rates. This empowers Asset Owners to make informed decisions on where and when to conduct repairs, leading to significant cost savings, reduced safety hazards, and minimised environmental risks across the industry.

**The key principles outlined in the guidance include:**

- Asset selection criterion.
- Organisational recommendations.
- The process to be used for technical justification, validation and qualification.
- The technology behind a CUI monitoring system.
- Use of remote monitoring in different inspection strategies.

**For further information, visit [www.corrosionradar.com](http://www.corrosionradar.com) or email [info@corrosionradar.com](mailto:info@corrosionradar.com)**

**Source: Corrosion Radar Press Release**



# Solution for CUPS Corrosion: The RedLineIPS SmartPad System - Cogbill Construction of Texas U.S.A



The **RedLineIPS SmartPad System**, from Cogbill Construction of Texas U.S.A., is a patent-pending Fiber-Reinforced Plastic (FRP) solution specifically engineered to address Corrosion Under Pipe Supports (CUPS) at coastal and offshore facilities in the petrochemical and gas sectors. Designed for above-ground piping systems, the SmartPad System offers a revolutionary approach to external corrosion protection at pipe support points. The system combines tried-and-true materials and components, a saddle-shaped design, and an innovative watertight sealing mechanism to provide durable, efficient, and cost-effective protection for industrial pipes.

Unlike traditional solutions, the RedLineIPS SmartPad System eliminates the need for fixing methods such as epoxy or welding, allowing installation, removal, and reinstallation in minutes. This capability facilitates rapid visual corrosion inspections, reducing reliance on expensive methods such as radiography and ultrasound, and thus reducing the overall cost of ownership.

## The SmartPad System: An Alternative Solution to CUPS

The **RedLineIPS SmartPad System** is a potential breakthrough in external corrosion protection, offering the following key benefits:

- 1. Cost-Effective Maintenance:** SmartPads allow rapid visual inspections, reducing reliance on expensive and time-consuming methods like ultrasound or X-ray.
- 2. Moisture Barrier:** The integrated closed-cell Hydroseal gasket creates a NEMA-4-rated watertight seal when installed, preventing moisture accumulation.

**3. Non-Metallic Construction:** The FRP material eliminates metal-to-metal contact, preventing galvanic corrosion.

**4. Quick Installation:** The system can be installed, removed, and reinstalled in seconds without welding, epoxy, or line shutdowns.

**5. Saddle-Shaped Design:** This innovative shape evenly distributes stress, prevents point loading, and protects the pipe's coating.

## Benefits of the SmartPad System

- Allows rapid visual inspections, reducing operational costs.
- Dampens vibrations and noise for improved system stability.
- Eliminates metal-to-metal contact, preventing galvanic corrosion.
- Long-lasting, UV-resistant materials.
- No epoxy or welding required.
- Protects a pipe's protective coating from wear.
- Reusable components promote sustainability and green initiatives.
- Suitable for extreme temperatures (-60°F to 400°F). convert to Centigrade.

## Applications and Industry Adoption

The SmartPad System is suitable across industries, including:

- **Oil & Gas:** Offshore platforms, pipelines, and refineries.
- **Petrochemicals:** Chemical processing plants.
- **Power Generation:** High-pressure, high-temperature piping systems.
- **Water Treatment:** Corrosion protection for water and wastewater facilities.

Early adopters include major industry players such as Chevron, Formosa Plastics, and Nutrien - all at coastal facilities and offshore platforms at the Gulf of Mexico. They have successfully implemented the SmartPad System in challenging environments, achieving significant reductions in maintenance costs and improved pipeline longevity.

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# Ask the Expert



## Enhancing Corrosion Inspection through UAV technology

by Stephanie Okoye, B-Eng, MSc, CEng, AMPP, MICorr



INSTITUTE OF  
CORROSION

Meet the Author  
Stephanie Okoye



**Stephanie** is a Chartered Senior Corrosion Engineer with over 15 years of experience in the oil and gas sector. Currently with Vysus, her expertise lies in corrosion and integrity management of North Sea Oil & Gas assets, as well as Downstream Gas and Chemical Processing plants. She holds qualifications as a Senior Corrosion Technologist by AMPP (formerly NACE) and currently serves as an Executive member of the Institute of Corrosion (ICorr Aberdeen Branch Committee). Stephanie is also a project management professional with a proven record of leading teams, managing, and delivering several projects successfully.

### How Drones are Used for Corrosion Management?

#### Introduction

In the past, inspectors relied completely on manual methods to conduct corrosion-related inspections of assets prone to degradation. These traditional approaches involved visual assessments or the use of non-destructive testing (NDT) tools to quantify the extent of corrosion. While effective, these methods often proved to be time- and labour-intensive and prone to inherent safety risks where humans are involved. The introduction of drones, or Unmanned Aerial Vehicles (UAVs), has augmented and, in some applications, revolutionised this field by enabling inspections to be carried out more efficiently and with greater safety. Within industries such as oil and gas, UAVs have become indispensable for conducting corrosion-related inspections. These inspections predominantly involve the use of high-resolution optical sensors to obtain enhanced data more safely and efficiently. Drones can navigate vast, challenging environments to capture detailed imagery of inspected items.

With advancements in technology, the images collected by drones can be analysed using cutting-edge artificial intelligence (AI) algorithms and automated systems to assist with the identification of corrosion and other forms of deterioration. Drones not only pinpoint the presence of corrosion but also provide precise data on its location, allowing for accurate mapping and documentation. This capability facilitates future monitoring and creates visual records to track the progression of corrosion over time. Unlike traditional methods, which are manual and time-consuming, drone inspections offer a safer, more reliable alternative for maintaining the integrity of critical assets.

#### In Which Areas can UAVs be Utilised for Inspection?

UAVs are versatile tools that can be deployed across various industries and environments, including offshore platforms, onshore petrochemical plants, floating production storage and offloading units (FPSOs), underwater pipelines, bridges, and civil engineering projects. Their adaptability makes them particularly valuable for inspecting assets in hazardous or hard-to-reach locations.

In the UK, UAV operations are regulated by the Civil Aviation Authority (CAA), which mandates that operators obtain the necessary registration and authorisation. Each UAV operator is issued a registration number and a CAA reference number, ensuring compliance with safety and operational standards. Different UAV models cater to a range of inspection needs, each designed to address specific challenges, as may be required by specialist inspection companies. Notably, I have had the opportunity to engage with CAN Group in Aberdeen, who operate a range of UAV technologies through its inspection services business stream. CAN's fleet of UAVs operated by specially trained pilots is equipped to perform a range of visual, dimensional and thermal imaging inspections and emission surveys in hazardous environments and areas that are typically inaccessible during standard production operations, in support of structural and mechanical integrity condition assessments both onshore and offshore. The information they kindly provided was highly valuable in enhancing my understanding of the technology behind drones used for corrosion inspections.

**Flyability's ELOIS 3 Drone:** The ELOIS 3 drone is designed for confined space entry, eliminating the need for personnel to access hazardous locations, thereby reducing costs and manpower requirements. It features an integrated Ultrasonic Testing (UT) capability combined with aerial drone solutions, providing a safer and more efficient alternative to traditional UT inspection methods.

Conventional non-destructive testing (NDT) requires inspectors to be within arm's reach of the data collection point, which can be challenging when inspecting difficult-to-access areas of an asset. For larger components, such as stacks, ballast tanks, or pipe racks, inspectors often rely on mobile elevated work platforms, rope access, or scaffolding to reach measurement sites. These traditional approaches are typically slow, expensive, and pose significant safety risks due to working at height or in confined spaces necessitating specialist training courses and more extensive permit requirements. Drones offer NDT experts a unique aerial perspective, enabling quick and efficient access to remote or hard-to-reach areas without putting the pilot at risk and are frequently used for cross-country pipeline inspections. This approach significantly reduces operational costs and minimises safety hazards associated with traditional inspection methods.

*continues on page 32*



Photos: Vessel Inspection - Courtesy of Flyability.

### Underwater Applications

UAVs specifically designed for underwater tasks, known as Autonomous Underwater Vehicles (AUVs), have become essential tools for conducting underwater inspections, particularly in detecting corrosion in subsea pipelines. These vehicles are engineered for the unique challenges of underwater environments, which are often harsh and corrosive. Subsea pipelines, frequently exposed to seawater and strong currents, often face aggressive conditions due to their location and from the presence of chloride ions, high salinity, and bacteria, all of which can degrade materials over time together with erosional effects.

AUVs are equipped with advanced technology, including magnetic sensors, high-resolution cameras, and ultrasonic sensors. These tools allow them to accurately identify ongoing corrosion and measure metal thickness, enabling the detection of metal loss and other subsea-related issues. This technological advancement has significantly mitigated the risks previously associated with human divers and the use of Remotely Operated Vehicles (ROVs), which are more costly and time intensive.

By utilising AUVs, subsea inspections have become safer, more accurate, and more efficient. The ability to conduct detailed assessments without risking human safety or incurring excessive operational costs, has revolutionised the approach to maintaining and inspecting underwater infrastructure.

### Detection of Corrosion Under Insulation (CUI)

Corrosion under insulation (CUI) presents one of the most significant challenges in the oil and gas industry. Many pressure systems, including piping, pressure vessels, and tanks, are insulated for process optimisation or personnel safety. Traditionally, detecting CUI has required the removal of insulation to expose the metal substrate, allowing inspectors to identify visible signs of corrosion. However, in many cases, accessing these insulated components is difficult, particularly when water ingress compromises the integrity of the insulation.

UAVs equipped with advanced sensor technologies have emerged as a game-changing solution for inspecting insulated piping and components for early CUI indications. These drones can access areas that are otherwise unreachable from the ground and typically require scaffolding for manual inspection. The UAV sensors capture detailed video and thermal imagery, which are subsequently transmitted to a computer for analysis.

The visual images highlight the surface condition of the component, identifying trouble spots such as damage, degradation, or rust stains on cladding. Thermal infrared (IR) imaging, on the other hand, reveals temperature variations on the insulated surface. For example, IR images may predominantly display warmer tones, such as red, indicating hot fluid inside the pipe. If water or moisture infiltrates the insulation—a precursor to CUI—the affected areas will exhibit cooler temperatures, shown in distinct colour variations. These anomalies are characterised by unique thermal signatures, enabling precise identification of potential problem areas. The data collected is processed and analysed using specialised software, providing actionable insights for maintenance planning. This innovative approach not only eliminates

the need for labour-intensive and risky insulation removal but also ensures efficient and accurate CUI detection in hard-to-reach live process areas.

### Road Bridges Applications

Corrosion of steel components is a leading cause of deterioration and failure in road bridge infrastructure. Traditional inspection methods often struggle to accurately assess the thickness of steel in corroded areas, as determining the depth of corrosion poses significant challenges. Inspectors typically rely on visual checks to identify corrosion or use ultrasonic waves to measure severely affected areas. However, these approaches necessitate placing probes directly on the measurement sites, resulting in substantial operational expenses and logistical challenges when inspecting multiple locations or entire structures.

Drone technology has introduced a transformative approach to bridge inspections. For example, NTT e-Drone Technology Corporation is currently testing an advanced system that leverages drones and AI-powered image recognition to detect corrosion in steel materials and estimate corrosion depth. This innovative technology combines high-resolution imaging and AI analysis to enhance inspection efficiency while reducing maintenance costs. The testing of this technology is planned to be completed in 2025.

By automatically estimating the depth of corrosion, this technology aims to streamline the inspection process, allowing for rapid and accurate assessments without the need for invasive procedures. The integration of drones with image recognition AI represents a significant advancement in maintaining road bridge infrastructure, ensuring safety, and optimising maintenance efforts.

### What are the Examples of Applications of UAVs in Detecting Corrosion?

#### Inspection of Flare Stacks and Structural Components

The use of drones has proven invaluable for inspecting flare stacks, support lines, and associated structural components during pre-turnaround maintenance surveys. The primary objective of such inspections is to assess and document the condition of structural steelwork, piping, and cables in plant flare systems. During a recent survey, drones identified areas with minor coating breakdown and light corrosion, as well as some safety concerns. The drones used are equipped to perform 360-degree thermal imaging around flare tips, which helps identify hotspots or other potential concerns. However, in this instance, thermal imaging was not conducted. This technology highlights the versatility of UAVs in ensuring thorough and efficient inspections in complex and potentially hazardous environments.



Photos: Flare Stack Inspection - Image Courtesy of Vysus Group.

#### Inspection of Cargo Tanks Using UAVs

Marine Inspection Services recently deployed one of ScoutDI UAVs (Scout 137) to inspect the interior of a cargo tank on an oil tanker. Traditionally, such inspections would have required rope access inspectors working at height, utilising scaffolding or ladders. This approach often entails limited light and air access, creating potentially hazardous conditions for personnel.

In contrast, deploying a UAV equipped with high-quality video capabilities allowed the inspection to be conducted more quickly, safely, and efficiently. The drone's ability to navigate confined spaces and capture comprehensive footage significantly enhanced the overall inspection process while minimising risks to human workers.



Photos: Tank Inspection - Image Courtesy of ScoutDI.

## What Are the Benefits of UAV in Detection of Corrosion in Different Environments?

- **Safety, Confined Spaces and Hard-to-Reach Areas:** UAVs can easily access confined spaces or remote areas inaccessible to inspectors, like inside storage tanks, pipelines, or high-altitude structures (e.g., wind turbines) and hazardous environments like chemical plants or offshore oil platforms. This environment often presents hazardous conditions, such as toxic gases, high temperatures, lack of oxygen, or narrow passages. Use of UAVs eliminates the need for scaffolding, ropes, or cranes and inspectors to physically enter the hazardous environment, which significantly reduces the risk of accidents and injuries to human inspectors.
- **Visual Inspections:** The high-resolution cameras on UAVs capture detailed images of surfaces, allowing inspectors to identify visible signs of corrosion, such as rust, discolouration, or surface damage. These images can be analysed remotely and compared over time for monitoring corrosion progression.
- **Thermal Imaging:** Some UAVs are equipped with infrared or thermal cameras which have the potential to detect changes in surface temperature that may indicate underlying corrosion under the protective coatings, such as moisture accumulation or insulation failure or areas where the early stages of corrosion are occurring and hard to notice, without the need to interrupt production.
- **Non-Destructive Testing (NDT):** Some UAVs integrate NDT methods, such as eddy current sensors or magnetic flux leakage detection, to assess the integrity of materials without causing damage. These sensors can detect subsurface corrosion and assess metal loss or cracks. Additionally, some advanced UAVs carry specialised equipment like ultrasonic thickness gauges to measure the thickness of metal surfaces. LIDAR (Light Detection and Ranging) can be used to create detailed 3D models of structures, helping to identify areas where corrosion has led to structural deformation. It is not possible to transfer all NDT activities efficiently to UAVs at this time.
- **Data Analysis and Reporting:** UAVs collect immense amounts of data, which can be processed using Artificial Intelligence (AI) and machine learning to identify patterns of corrosion and predict future risks. This data is often presented in detailed reports with actionable insights for maintenance planning.
- **Cost and Time Efficiency:** UAVs significantly lower inspection costs by reducing the need for manual inspection and reduces assets downtime. They also reduce inspection times and the need for additional support services.

## What Are the Challenges and Limitations of Utilising UAVs for Inspection?

Despite their numerous advantages, UAVs face several limitations and still requires human intervention as follows:

- **Data Analysis Expertise:** The large volume of data collected requires skilled personnel or AI systems for effective analysis.

- **Weather Dependence:** Adverse conditions like heavy rain, fog, or high winds can impact UAV performance and data quality.
- **Operational Range:** Limited flight times and battery life can restrict UAV operations.
- **High Initial Costs:** Acquiring and maintaining UAV equipment, as well as training personnel, involves significant investment.
- **Regulatory Compliance:** UAV operators must adhere to strict regulations, which can vary between countries and impact deployment timelines.
- **Pixel Resolution Challenges:** Variations in pixel resolution during inspections can affect the accuracy of corrosion depth estimations, particularly in dynamic environments like road bridges.
- **Skill of the Pilot:** Requires many different skillsets e.g. piloting, data gathering and interpretation with a thorough understanding of onboard NDT technologies and must be able to multi-task quickly, effectively and safely.

## What Are the Challenges and Limitations of Utilising UAVs for Inspection?

- The field of UAV technology for corrosion inspection is evolving rapidly, driven by advancements in AI, sensor technologies, and robotics. Future developments include:
- **Enhanced AI Algorithms:** Improved machine learning models will enable faster and more accurate data analysis, minimising human intervention.
- **Longer Battery Life:** Innovations in energy storage will allow UAVs to operate for extended periods, enhancing efficiency for large-scale inspections.
- **Integration with IoT:** UAVs may later fully integrate with Internet of Things (IoT) systems, providing real-time data to centralised platforms for seamless asset management.
- **Autonomous Operations:** Fully autonomous UAVs capable of navigating complex environments without human guidance are on the horizon, reducing operational challenges further.
- **Advanced Materials:** The development of lightweight yet durable UAV components will increase resilience against harsh weather conditions and extend operational capabilities.

## Conclusions

The integration of UAV technology into corrosion inspections has revolutionised the Oil and Gas industry, providing unprecedented improvements in safety, efficiency, and accuracy. UAVs facilitate continuous monitoring and early detection of corrosion, minimising associated risks and enabling more informed asset management decisions. With further advancements in sensors, artificial intelligence (AI) and data analytics, the reliability and effectiveness of inspection data have significantly improved in many cases, making UAV-based inspections more precise and actionable. As UAV technology continues to advance, it opens new opportunities for innovation, job creation, and cost-effective maintenance strategies across other industries, ensuring the protection and longevity of critical infrastructure. Expanding the use of UAVs beyond traditional inspection methods will unlock even greater possibilities, allowing industries to achieve enhanced safety, precision, and operational efficiency, safeguarding vital assets worldwide, promoting sustainability and resilience in infrastructure management.

## Acknowledgments:

The author wishes to thank the following companies for their assistance with this article.

- [www.cangroup.net](http://www.cangroup.net)
- [www.flyability.com](http://www.flyability.com)
- [www.marineinspectionsservices.co.uk](http://www.marineinspectionsservices.co.uk)
- [www.nttedt.co.jp](http://www.nttedt.co.jp)
- [www.scoutdi.com](http://www.scoutdi.com)
- [www.vysusgroup.com](http://www.vysusgroup.com)

## Note for Readers

ICorr were privileged to be invited to Portcullis House in Westminster adjacent to the Houses of Parliament for a special themed event on the topic of 'Reuse, Renew, or Replace?' The following series of articles are presented in the same order as presented to the Parliamentary and Science Committee (P&SC) on the **15<sup>th</sup> October 2024** and are reproduced here with kind permission of SIP, the P&SC official Journal.

The Journal of the Parliamentary and Scientific Committee (All-Party Parliamentary Group). **SIP - SCIENCE IN PARLIAMENT** has two main objectives:

- 1. To inform the scientific and industrial communities of activities within Parliament of a scientific nature and of the progress of relevant legislation;**
- 2. To keep Members of Parliament abreast of scientific affairs.**

Visitors were welcomed to the discussion meeting by George Freeman MP, new Chair of the P&SC.

**Stephen Tate**, President of ICorr, introduced our Institute activities; and especially training, emphasising that improving the competency of corrosion engineers at all levels is a key objective of the Institute. Courses are run, qualifications awarded, specialised meetings held,

and financial support given to many including most recently for their YEP - Young Engineer Programme 2024, this time held in London.

Our four specialist presentations were kindly given by **Gareth Hinds**, Senior Fellow and Science Area Leader, Electrochemistry Group at the National Physical Laboratory, who provided his thoughts on 'Raising Awareness of Corrosion'; **David Parker**, Environmental Consultant, who spoke on 'The Potential of Value Retention Processes (VRPs)'; with **Izabela Gajewska**, Intertek CAPCIS Consultancy Services, giving us her ideas on 'Mentoring the Next Generation towards Corrosion Prevention'; and finally **Christian Stone** of Loughborough University and Concrete Preservation Technologies Ltd describing 'Advanced Corrosion Management Techniques to Reduce Cost and Risk in Our Built Environment.' This magnificent all-round event provided excellent exposure for our Institute.



# Raising Awareness of Corrosion for a More Sustainable World



By Prof. Gareth Hinds, FEng, FIMMM, FNACE, FICorr, Past President, Institute of Corrosion



## Meet the Author



Prof. Gareth Hinds

**Prof. Gareth Hinds** is Senior NPL Fellow and Fellow of the Institute of Corrosion. He is Science Area Leader in the Electrochemistry Group at the National Physical Laboratory in Teddington, United Kingdom. His primary expertise is in the development of novel in situ diagnostic techniques and standard test methods for assessment of corrosion and material degradation in energy applications. Gareth is a Fellow of the Royal Academy of Engineering and holds visiting professorships at UCL, the University of Strathclyde and Harbin Institute of Technology. He is the author of over 200 publications and is currently President of the European Federation of Corrosion.

Corrosion, the phenomenon whereby metallic components and structures lose their functionality due to the interaction with oxygen, water and salt in the surrounding environment, is something that most people think about very rarely, if at all. This is only natural, as, unless, for example, they happen to own a boat, the average person going about their everyday business won't tend to experience its impact.

At least not directly. The fact is that corrosion affects every single one of us far more than we realise. A range of detailed studies has shown that the average cost of corrosion to the global economy is around 3.4% of GDP, which is associated primarily with increased maintenance and inspection costs, replacement of failed components and unplanned operational downtime<sup>1</sup>.

For the UK, this translates to a total cost of around £90 billion per year. This huge financial drain is passed on to all of us in the form of higher prices for goods and services, not to mention the added inconvenience of transport

delays, supply interruptions, environmental pollution, and safety hazards. It's not all bad news. It's estimated that up to 35% of these costs could be saved by the application of existing corrosion control practices<sup>1</sup>. This would save the UK £32 billion every year. It's noteworthy that these potential savings are comparable in magnitude to the black hole in public finances recently cited by incoming Chancellor of the Exchequer Rachel Reeves<sup>ii</sup>.

So why is there such reluctance in both the public and private sectors to grasp these enormous savings? Firstly, there's a general lack of public awareness of the major economic impact of corrosion and the importance of sound corrosion management strategies. More often than not, those asset owners who are aware of the issue tend to view corrosion protection as an unavoidable cost rather than an investment.

<sup>i</sup>It should be noted that additional costs arising from environmental clean-up and financial compensation are typically not included so this should be regarded as a minimum cost.



**Photo: Site of the Union Carbide Disaster in Bhopal, India. It is considered by many to be the world's worst ever industrial tragedy. Corrosion was a significant contributing factor to an explosion at this insecticide plant in October 1984, which led to the release of a large cloud of toxic gas. The final death toll was estimated to be between 15,000 and 20,000.**

Secondly, there is the trade-off between short-term and long-term thinking. Major infrastructure projects tend to be divided into capital and operational teams. The former are incentivised to build the asset on time and as cheaply as possible, leaving the latter to struggle with the ensuing maintenance issues once the asset is in use. This often results in whole lifecycle costs that are significantly higher than would have been the case if an appropriate corrosion management strategy had been incorporated at the design stage.

Thirdly, most corrosion professionals tend to operate at a technical level in their organisation and are not effectively connected to broader financial and management systems. This disconnect means that senior management tends to have limited visibility of the direct benefits of implementing corrosion management strategies and little opportunity or incentive to make related business decisions.

The first step towards addressing this issue is to raise general awareness, which is one of the reasons that the Institute of Corrosion (ICorr)<sup>iii</sup> chose to table a discussion with the Parliamentary & Scientific Committee on this topic. I think it's fair to say that all those who attended were struck not only by the magnitude of the economic impact of corrosion, but by the fact that so many people are completely unaware of it.

Corrosion awareness is a global issue and as such it needs to be tackled at international level. One of the ways ICorr is approaching this is through its membership of the World Corrosion Organization (WCO)<sup>iv</sup>. From a personal perspective, I served as President of the WCO from April 2022 until December 2024.

The WCO is a non-governmental organisation of the United Nations, a non-profit charitable body whose mission is to promote education and best practice in corrosion control for the benefit of society, ensuring conservation of resources and protection of the environment. This mission is particularly relevant in the light of global challenges such as climate change, scarcity of natural resources and environmental pollution.

The membership of the WCO is made up of organisations from all over the world with an interest in corrosion, including professional societies such as ICorr, research institutes working on related technologies and companies from a range of industrial sectors.

The WCO has three main objectives:

- To communicate how the United Nations Sustainable Development Goals (SDGs)<sup>v</sup> can be advanced through best practice in corrosion protection.
- To enhance public awareness of the importance of corrosion control via the annual World Corrosion Awareness Day, held every year on April 24<sup>th</sup>, and through other activities.

- To facilitate influencing of policy makers with respect to consideration of sustainable use of materials in a circular economy.

The 17 United Nations SDGs represent a core part of the 2030 Agenda for Sustainable Development, which was adopted by all UN Member States in 2015. Corrosion protection will play a key role in achieving a number of these, in particular the following:

- SDG 6: Clean Water & Sanitation
- SDG 7: Affordable & Clean Energy
- SDG 9: Industry, Innovation & Infrastructure
- SDG 11: Sustainable Cities & Communities
- SDG 12: Responsible Consumption & Production
- SDG 13: Climate Action

For example, extension of asset lifetime via implementation of best practice in corrosion management can significantly reduce greenhouse gas emissions associated with material processing and component manufacturing, cut demand for critical raw materials, decrease the need for human intervention throughout asset life and ensure uninterrupted supply of clean water and energy. In this way, sustainability and corrosion protection are inextricably linked.

The WCO is strongly connected to the United Nations through its UN Youth Representatives<sup>vi</sup> who are based at Lehigh University in Pennsylvania, USA. These dedicated ambassadors help to advocate for best practice in corrosion control and to promote awareness of corrosion at the global level. The WCO is currently working on the publication of a UN White Paper on corrosion to support these objectives, with the participation of ICorr members.

Another key component of the WCO's mission is World Corrosion Awareness Day, which is an international UN-affiliated day celebrated annually on 24<sup>th</sup> April. To mark World Corrosion Awareness Day in 2024, the WCO, together with the Association for Materials Protection & Performance (AMPP)<sup>vii</sup> and the European Federation of Corrosion (EFC)<sup>ix</sup> coordinated a highly successful 24 hour 'round the world' social media campaign on 24<sup>th</sup> April.

Starting in New Zealand and ending in Hawaii, member societies from across the globe posted about corrosion on social media at 8 am in their local time zone. There was a general theme of iconic structures, and the use of related images was encouraged but people were free to post about anything related to corrosion. The posts were linked with the hashtag #CorrosionAroundTheClock and shared to boost publicity for World Corrosion Awareness Day, resulting in over 8 million social media impressions.

The aim of these activities is to take the message of the importance of corrosion protection outside of the traditional corrosion community and more towards the general public. Plans are already being discussed for an even bigger campaign for 2025 World Corrosion Awareness Day, this time including traditional media such as TV and newspapers.

Increasing general awareness of the importance of corrosion can play a role in shifting the mindset in infrastructure projects away from CAPEX and OPEX towards whole lifecycle costs. This would be timely as the world moves towards a circular economy in response to challenges with supply of raw materials, the greenhouse gas emissions associated with their processing and manufacturing, and the pressures of waste management. Incorporating corrosion protection more effectively at the design stage would lead to substantial savings over the lifetime of the asset.

From a practical perspective, this shift could be encouraged by incorporating best practices in corrosion protection more effectively into industry codes and standards. Options include, for example, specifying the implementation of whole lifecycle corrosion management strategies in building codes and mandating formal training and accreditation of coating applicators and cathodic protection engineers working on infrastructure projects.

*continues on page 36*



**Photo: Collapse of the Carola Bridge on the River Elbe in Dresden, Germany, in September 2024. There were no fatalities, but significant disruption occurred, including the loss of hot water supply for the entire city and halting of shipping on the river. a formal investigation is ongoing but local authorities have stated that corrosion of steel reinforcement due to ingress of salt is likely to have been the cause of the failure.**

Another critical issue is skills. The UK is a world leader in corrosion engineering, with a 200-year pedigree dating back to the pioneering work of Humphry Davy and Michael Faraday and more recently built on expertise developed during the exploitation of North Sea oil and gas. In order to maintain this position, there is an urgent need to attract more young people into the profession.

While ICorr offers a broad range of practically-oriented training programmes, e.g. for coating applicators, coating inspectors and cathodic protection engineers, there remains a gap in the UK's third level education offering. Corrosion has historically suffered from not being a stand-alone discipline, typically sitting somewhere in between chemistry, physics, materials science, and civil, structural or mechanical engineering. Changes to university curricula are required to ensure a sufficient supply of graduate corrosion engineers in the future.

Outreach in schools is another vital activity; this is something that ICorr has not really attempted in the past, mainly due to the fact that it is a volunteer organisation with limited resources. It would perhaps be beneficial for the Institute to partner with experienced practitioners in this area to bridge this important gap.

Looking forward, the importance of corrosion protection is set to increase even further in the coming decades as it plays a significant role in the energy transition. Corrosion is a key lifetime-limiting factor for many clean technologies, such as wind turbines, solar panels, batteries, water electrolyzers and CO<sub>2</sub> pipelines, where degradation mechanisms are not as well understood and managed as those in conventional fossil fuel technologies. Understanding and mitigating these degradation modes will facilitate the required cost reductions, accelerating the widespread deployment of these technologies.

The Institute of Corrosion would like to thank the Parliamentary and Scientific Committee for the opportunity to discuss this important topic with parliamentarians and others with an interest in the subject. We hope that the next time you stroll under a bridge, you will be far more likely to cast an eye over the structure to check for the tell-tale signs of corrosion!



**Photo: Institute of Corrosion attendees at the Parliamentary and Scientific Committee discussion meeting 'Reuse, Renew or Replace?' on 15<sup>th</sup> October 2024. Above (left to right): Yunnan Gao (ICorr Vice President), George Freeman MP (Past Minister of State in the Department for Science, Innovation and Technology), Gareth Hinds (Past ICorr President/Speaker), Christian Stone (ICorr Speaker), Stephen Tate (ICorr President/Speaker), Stephen Benn (3<sup>rd</sup> Viscount Stansgate), Izabela Gajewska (ICorr Speaker), David Parker (ICorr Speaker), David Mobbs (Coatings Specialist).**



**Photo: Below (left to right): Tony Rizk (Corrosion Specialist), Stephen Tate (ICorr President/Speaker), Douglas Mills (Past ICorr Technical Secretary and ICorr P&SC Representative).**

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# Value Retention Processes – Valuable Contributors to Product Longevity, Net Zero and the Circular Economy



By David Parker, MBA, MIChemE, CEnv



## Meet the Author



David Parker

**David** is an environmental consultant of 22 years standing. Prior to this and with a degree in chemical engineering, he spent 14 years working for ICI and Dupont. After gaining an MBA, he worked for Oakdene Hollins, lately as an associate. He is currently Director of Technical Projects with Metsims Consulting UK, a lifecycle analysis-based consultancy. His speciality is product reuse, having conducted the UK's first economic and policy assessment of UK remanufacturing activity, a report much quoted since.

## A Case for Value Retention Processes (VRPs)

VRPs aim to fulfil and extend product lifespan through a spectrum of processes ranging from simple reuse, through repair and refurbishment, to the most engineering-led approach—remanufacturing. VRPs should be contrasted with recycling, which reduces whole products to component materials with a consequent loss of the majority of labour, energy, time and materials invested. A simple statement of the rationale for VRPs is encapsulated in this statement.

**Recycling an iPhone generates \$5 of material value; refurbishing and reselling it generates \$500.**

As a proposition, VRPs offer benefits (over new manufacture) of: very large virgin material and carbon footprint reductions (70-90% typically); higher skill levels (such as diagnostic and remedial); lower dependence on critical raw materials; and potential for re-shoring by fostering domestic skill centres. In addition, manual input is higher per unit of GDP, thus boosting employment.

Studies of economic benefits suggest that the economic leverages of GDP per kg output are 50% higher for VRPs than manufacturing in general. GDP per kg and per person are orders of magnitude higher than for recycling.

The potential of remanufacturing alone is indicated by consideration of an expansion from the current 2% (average) to 20% - a level seen in aerospace. This would result in around a further £70bn in GDP and carbon avoidance equivalent to around 13% of the industrial emissions reduction target under the 2050 commitment.

## What are the Characteristics of Different VRPs?

Table 1 below visually differentiates the various approaches. In summary, to the right is reuse; reuse is simple, requires little input and has the major benefit of ensuring a full and productive **first life** of a product. If a product fails, repair may be possible, so some investment may again assist in achieving a full life. To the left, on the other hand, after terminal failure, remanufacturing can completely rejuvenate certain products back into **one or more cycles of reuse**, without compromising performance or guarantee. Remanufacturing is a high engineering, moderate input process but yields substantial whole-life energy and material benefits.

Remanufacturing	Comprehensive refurbishment	Refurbishment	Repair	Re-use
<< Adds whole new life			Maximises first life >>	
<< Fixes whole		Fixes a problem	Works fine >>	
<< Industrial process			No industrial process >>	
<< Higher		Skills	Lower >>	
<< Higher		Avoided CO <sub>2e</sub> per extra life	Lower >>	

Table 1. Various Approaches to VRP's.

continues on page 38

### What is the Scale and Relevance of VRPs?

A study of VRPs on behalf of Innovate UK in 2022 by the Parker D. et al:

- VRP activity in the UK in 2020 is estimated to have generated over £75 billion in revenue and supported over 500 thousand jobs.
- VRP activities in the UK in 2020 are estimated to have prevented at least 620 kt of waste and avoided at least 4.7 Mt CO2e.

Figure 1 (below) shows roughly the prevalence of VRPs in the UK economy across 10 sectors<sup>2</sup>. This mirrors similar benefits found in a prior study for the Canadian Government (Waugh, R. and Parker D. et) al, this also found that plastics savings tonnages were 25% of all plastics recycling with significantly higher value.

In both economies, remanufacturing represented only around 2% of all manufacturing GDP, but reduced industrial emissions by more than 2%, highlighting significant room for expansion.

Revenue Splits of VRP Total £75bn.

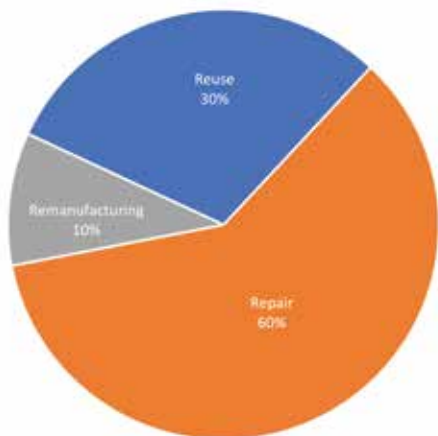


Figure 1. Revenue Splits of VRP's.

### How are VRPs Spread Across Sectors?

VRPs are much more prevalent in some sectors, with a different focus in the spectrum of reuse. This has implications for which sectors and activities might be targeted to maintain or boost.

The two-parts of Figure 2 given below illustrates:

- The scale and VRP splits for each sector examined.
- The current level of remanufacturing in the sector and the gap to a putative 20% level.

It can be seen that VRP actively is widely different across sectors, and at a broad range of scales.

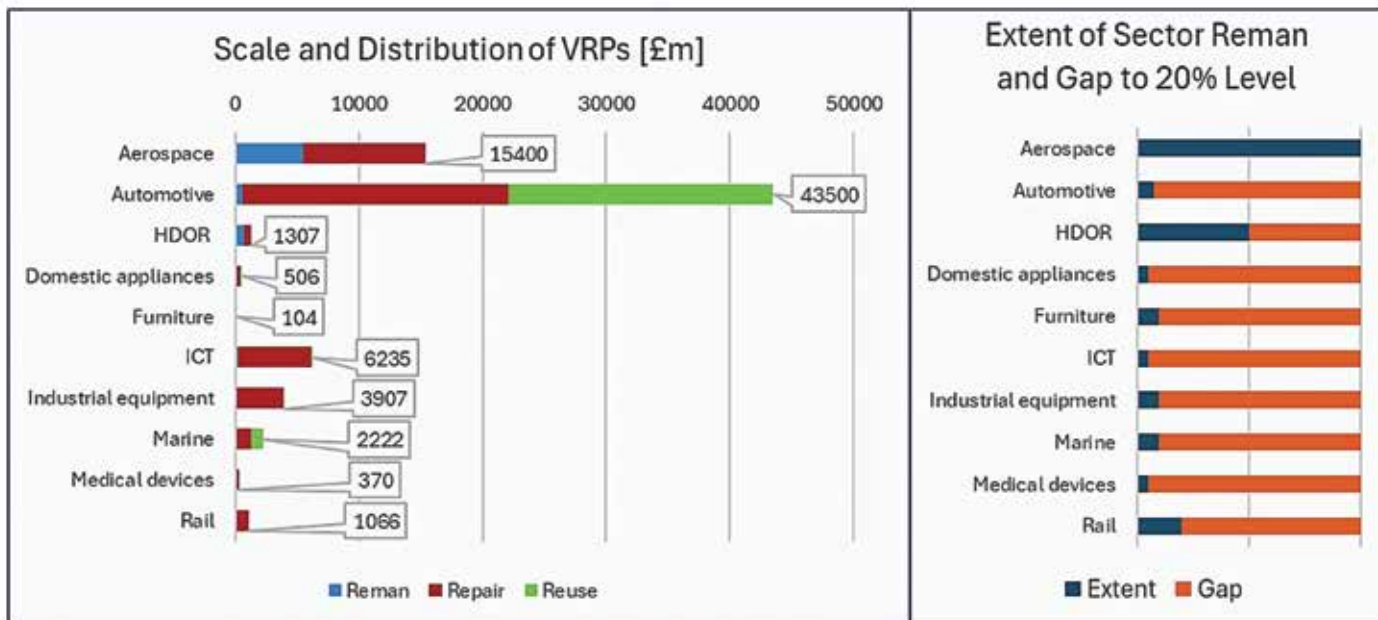


Figure 2: Scale and Distribution of VRP's.

### Where are VRP Promotional Efforts Best Placed?

There are numerous potential targets for consolidating or increasing the uptake of VRPs. However, with limited resources to intervene, efforts are better focused on certain VRP approaches within particular sectors. Figure 3 summarises selected targets for promotion and, importantly, which objective they can help to achieve (economic, competitive or carbon reduction).



Figure 3: Various Targets for Increasing the Uptake of VRP's (Source: Author's Work for Innovate UK Parker D and Waugh, R. et al., 2022).

For example, large environmental impacts (carbon reduction) can be achieved by promoting reuse, repair and refurbishment activities in domestic goods and IT, simply to maximise the intended life of these products, or somewhat rejuvenate them. This prevents unnecessary purchase of new products with all their burdens.

The 'heavy' engineering sectors fall more into the business-to-business service domain, are more amenable to remanufacturing for multiple use lives, and are proven money spinners. Note, this is not to say they don't have carbon benefits: they do and are large, but there is a clear profit motive in these sectors compared to 'domestic' sectors.

### What are the Barriers to Expansion?

A recent report for Innovate UK into VRPs (Parker, D. and Waugh, R. et al., 2022) identified the following sectoral issues (Table 4 - opposite page) hampering expansion or uptake. These are presented under broad categorisations of technical, economic, social and legislative.

<sup>2</sup>Aerospace, automotive, heavy duty & off-road vehicles, ICT, furniture, home appliances, rail, marine, medical and industrial equipment.

	Technical	Economic	Social	Legislative
Aerospace	MRO only for mechanical components			Limitations on the recycled content allowed in aircraft components
Automotive	Lack of access to software, original specifications, and tolerances (non-OEM)	Economics and logistics of core recovery. Low-cost 'copy' parts	Increased labour costs. Lack of skills in dealing with electrical components	Obtaining core from other European countries
Domestic appliances	Non-authorized repairs	Often cheaper to replace than repair/refurbish	Predicted skills shortage in the end of the decade	
ICT	Lack of access to software, original specifications, and tolerances	Economics and logistics of core recovery	Consumer perception on purchasing new	
HDOR	Limited component availability	Sale of single life tyres		
Industrial equipment	Limited information / original component drawings		Skills shortage in dealing with electrical components	
Furniture	Lack of understanding of material composition (independent actors)	Procurement processes favours new products	Consumer perception on what is in style and on trend	
Marine	Older ports do not have the right technology to retrofit shipping vessels	High cost for recertification of refurbished boats	Skills shortage for retrofitting large ships	
Medical devices	Accessing software and core (independent actors)	NHS procurement process favours new products		
Rail	Electrifying existing infrastructure	Low-cost financing options favour the purchasing of new stock		
Barriers across different sectors	Understanding software and material composition of components	Making value retention products economically competitive against low-cost imports	Training and upskilling programs	Importing of core

Table 2: Barriers to Expansion (Source: Innovate UK Parker, D. and Waugh, R. et al., 2022).

### What Steps Would Assist Uptake?

In common, previous studies indicate 5 core clusters comprising 10 priority actions (figure 4). These are more or less appropriate depending on the jurisdiction under examination.

1. Overall strategy, coordinate approaches
2. Sector focus groups
3. Terminology and standards
4. Rebalance EoL and purchasing tariffs
5. Update NAO metrics/reporting
6. Embed right to repair
7. Use public purchasing
8. Community reuse and repair
9. Public messaging and trust building
10. International VRP recognition protocols



Figure 4: Sector Opportunities.

More detail on sector opportunities and high-priority actions indicated in the figure can be found in the Environment and Climate Change Canada (ECCC) report (Waugh, R. & Parker, D. et al., 2021) Sections 13, 14 and 16; and Innovate UK report (Parker, D. & Waugh, R. et al., 2022).

A particularly persistent issue is that of Point 5, namely that there are no substantive national metrics to monitor reuse activity at a material or economic level. Without measurement, control is impossible, but measurement is problematic. Recycling is easy to monitor because wastes cross a notional material accounting boundary, namely waste consignment, collection and treatment coordinated through a limited number of operators. Reuse, however, does not cross-national accounting boundaries, only corporate ones, and there is no specific obligation to classify and report incomes and flows apart from a few NACE codes targeting e.g. vehicle repair.

The observant will note that VRPs comprise a core 'circular' activity. At the national level, there is widespread interest in measures of circularity. As described above, the effects of waste, recycling, stock-building and material pass-through can be measured and accounted for. Therefore, the only

existing national measure of VRP impact is its overall effect on reducing need for raw materials (per unit of GDP) and overall GWP reduction (per unit of GDP).

More detail on this topic can be found in the Zero Waste Scotland report on circular economy indicators (Parker, D. et al., 2023).

### What is the Linkage to UK Policy in Carbon and Manufacturing?

VRPs are core the delivery of the Circular economy. Specific policy vehicles where they are identified or supportive include: **The Climate Change Act 2008 (2050 Target Amendment) Order 2019** (H.M. Government, 2019); **Build Back Better – our plan for growth** (HM Treasury, 2021); **Ten point plan for a Green Industrial Revolution** (HM Government, 2020); **Industrial Decarbonisation Challenge** (HM Government, 2021); **Energy-Related Products Policy Framework** (Department for Business, Energy & Industrial Strategy, 2021); **UK Innovation Strategy** (Department for Business, Energy & Industrial Strategy, 2021); **Net-Zero Research and Innovation Framework** (HM Government, 2021).

### How Credible are These Results?

This article draws from work carried out by the author and colleagues for the EU, UK, Canadian and Malaysian governments, various trade bodies and during industrial assistance supported historically by DEFRA. The benefits, barriers, potentials and possible actions are remarkably consistent across time, geography and within sectors. This suggests there is universal learning on offer.

In terms of coverage, studies harmonised on 10 sectors evaluated, estimating that these covered around 70% of potential activity with a more detailed examination covering around 50% of potential activity (in 6 sectors).

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# Mentoring the Next Generation Towards Better Corrosion Prevention



By Izabela Gajewska, MSc (Eng), AMEI MICorr



## Meet the Author



Izabela Gajewska

**Izabela** is a Corrosion Engineer at Intertek CAPCIS with a master’s degree in chemical technology from Poznań University of Technology. She is a Professional Member of the Institute of Corrosion (ICorr), an Associate Member of the Energy Institute, and serves as Vice Chair of ICorr Northwest. A past winner of the ICorr Young Engineer Programme (YEP), she is currently the organiser of the 2024-2025 YEP. Izabela is committed to achieving Chartered Engineer status and making a global impact in the field of corrosion.

## Introduction

Corrosion – the deterioration of materials, usually metals, is due to chemical reactions with their environment and is one of industry’s costliest problems. Corrosion can occur in offshore wind farms, mineral extraction, chemical and petrochemical process plants, and public infrastructure such as bridges, buildings and may also pose a real threat to public health and the environment. Photo 1 shows shiny and corroded metal chains.



Photo 1: Shiny and Corroded Metal Chains (source: Private Collection).

## Financial, Safety and Environmental Impacts of Corrosion

According to the US Association for Materials Protection and Performance (AMPP), corrosion costs the global economy \$2.5 trillion per year, or approximately 3.4% of global GDP [1]. In 2023, the GDP in the United Kingdom (UK) was £2.27 trillion [2], and assuming 3 to 3.4% of this corresponds to the annual cost of corrosion in the country, corrosion costs the UK up to approximately £90 billion annually.

In addition, AMPP estimates that up to 35% of these costs could be avoided [1], and given that in 2022 the UK’s average income was £39,328 [3], the annual corrosion costs per the average UK household could be reduced from around £1,300 to approximately £850. In this context, it is also worth mentioning that the economic losses from corrosion in the UK each year are comparable to the annual education spending, as shown in Figure 1 [4].

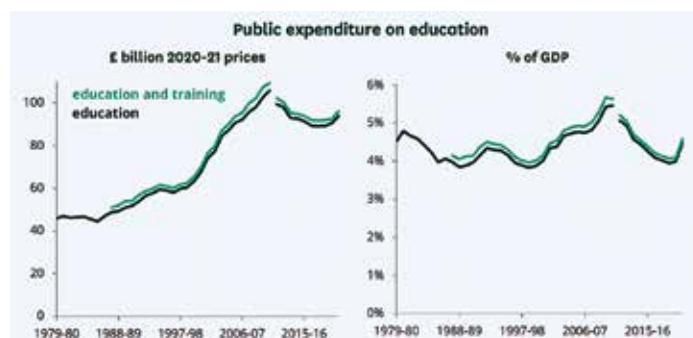


Figure 1: UK Education and Training Costs Over the Years [4].

Corrosion also has a significant impact on both society and the environment. For example, it poses a serious safety threat, as evidenced by major accidents such as the 1985 Swiss swimming pool collapse, where the concrete roof, supported by stainless steel rods, collapsed after just 13 years of service due to Chloride Stress Corrosion Cracking, killing 12 people [5].

Alongside the threat to public safety, corrosion can lead to environmental pollution through leaks and spills of hazardous chemicals into both water and the atmosphere. A spill from a pipeline transporting crude oil led to 4200 m3 of polluted water in the Kalamazoo River in 2010 in Michigan, USA [6]. Corrosion was also considered one of the main causes of the China

Donghuang oil pipeline leak and explosion tragedy in 2013, where 63 people lost their lives, 156 people were injured and environmental pollution was extensive. This accident also caused a direct economic loss of 750 million yuan [7].

An investigation into a railway safety incident in Berkshire, UK, [8] in 2014 established that a signal post fell onto railway lines due to corrosion at its base, causing a passenger train travelling at 110 mph (177 km/h) to collide with it. Fortunately, the train remained on track, but the Rail Accident Investigation Branch (RAIB) emphasised that the potential for a more serious outcome was considerable. This incident underscores the critical need for ongoing infrastructure maintenance and inspection to ensure passenger safety.

In addition, it has been estimated that steel replacement due to corrosion could account for as much as 4.1 to 9.1% of global carbon dioxide (CO<sub>2</sub>) emissions by 2030 if no action is taken [9], contributing to a significant sustainability challenge.

## Importance of Effective Corrosion Prevention

Much can be done to mitigate the effects of corrosion. Optimised prevention practices can:

- (i) Improve safety and prevent major accidents.
- (ii) Improve environmental protection.
- (iii) Reduce costs.
- (iv) Reduce inconvenience to the public, including:
  - Minimising water and gas leaks.
  - Ensure more reliable travel through well-maintained roadside and trackside infrastructure and,
  - Extend the life of public assets.

The amount spent on restoration of public structures can be substantial; corrosion of the cables of the Forth Road Bridge, Scotland (Photo 2), led to expensive repairs and eventually to the need to construct a replacement bridge at a cost of approximately £1.4 billion due to the weight limit imposed on the old road bridge [10][11][12]. Another example is the Tay Bridge in Dundee, Scotland, the longest rail structure in the UK, where the cost of restoration is estimated to £130 million [13].



Photo 2: Forth Road Bridge, Scotland (source: Private Collection).

## Solutions to Corrosion Problems

Potential solutions to corrosion problems include:

- (i) Safe, sustainable design through cost-effective material selection to match the asset's life cycle, thereby improving safety and structural reliability.
- (ii) Effective corrosion risk assessment to better forecast corrosion failures, thus extending the service life of structures.
- (iii) Collaboration between corrosion experts, government bodies, and communities to facilitate the provision of corrosion control expertise.

- (iv) Promoting knowledge transfer through education, training, and mentoring to enhance competency and raise corrosion awareness.

Corrosion professionals are needed in a variety of industry sectors, including:

- (i) Asset Integrity Management.
- (ii) Design.
- (iii) Development of Corrosion Prevention Products (e.g. alloys, coatings, corrosion inhibitors);
- (iv) Engineering.
- (v) Fundamental Research.
- (vi) Health and Safety Compliance – COMAH regulations and Safety Cases.
- (vii) Plant & Equipment Engineering, Inspection & Safety.

## Importance of Knowledge Transfer in Corrosion Prevention

As economies and businesses develop, knowledge is increasingly seen as a vital resource and as one of the most powerful competitive advantages in today's markets [14]. It is widely recognised there is a global engineering skills shortage, with an insufficient number of engineers available to complete large-scale investments locally and globally [15].

*EngineeringUK* [16] has tracked the annual demand for engineers and technicians needed to keep up with UK demand for infrastructure and other engineering projects and estimate the shortfall to be between 37,000 and 59,000.

Knowledge transfer is particularly important when more experienced staff approach retirement, as the loss of knowledge can be substantial with consequential risks to the business. While the UK's universities are training students from around the world, many of them supported by their governments, the UK is losing expertise due to an ageing population. It is vital to encourage more UK students to pursue Corrosion Science and Engineering to make up our shortfall. A good example to mention here is the Institute of Corrosion's (ICorr) 5-year funding for six student scholarships at the University of Manchester. STEM (Science Technology Engineering Mathematics) learning also has great potential for transferring corrosion engineering knowledge.

Because corrosion and degradation can affect most structures, other subject specialists such as mechanical, civil, structural, and electrical engineers, as well as architects, need to understand corrosion and corrosion prevention fundamentals, in order to help mitigate corrosion problems.

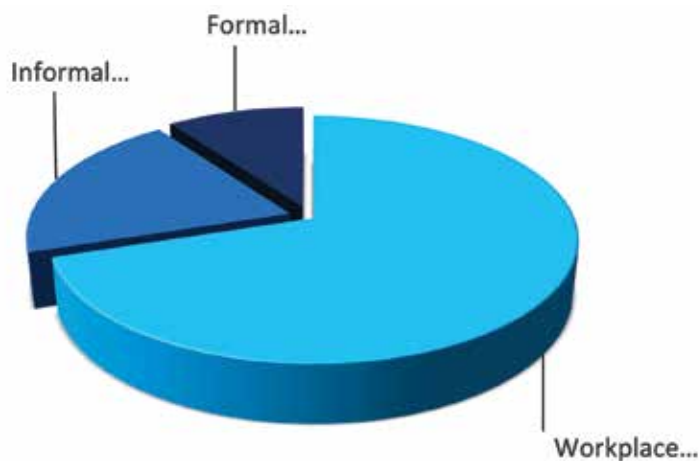
## Mentoring as a Knowledge Transfer Strategy

Over the years, many strategies and tools for knowledge transfer (KT) have been documented in knowledge and project management literature. Knowledge can be gained and communicated in many ways, including:

- (i) E-learning - Encouraging familiarisation with standards and technical guidebooks relevant to the job position and performed activities.
- (ii) Mentoring sessions.
- (iii) Site visits.
- (iv) Technical meetings, webinars and conferences.
- (v) Training courses.
- (vi) Work experience.

A popular learning model [17] developed in the mid-1990s by McCall, Eichinger, and Lombardo (Figure 2) suggests that 70% of skill development comes from learning in the workplace, 20% from social (informal) learning (e.g., mentoring), and that structured (formal) learning (e.g., training courses and technical meetings) constitutes 10% of the above-mentioned model.

continues on page 42



**Figure 2: 70:20:10 Model for Learning and Development [17].**

Effective KT requires a good planning, addressing:

- (i) What knowledge is to be transferred.
- (ii) What the available methods of sharing knowledge are and
- (iii) How an employee’s knowledge acquisition can be measured.

Consequently, mentoring the next generation of corrosion specialists is critical to successful corrosion management. Mentors should be matched with mentees’ goals and development needs, with a clearly defined schedule in place. Sessions can include presentations on fundamentals, problem-solving discussions, and site-based learning. A customised subject-based curriculum can be a great mentoring tool. Sharing knowledge from personal work experience is very important. Mentors should also provide support and opportunities to discuss issues related to ongoing projects. Presentations on agreed mentoring subjects, given to the company’s staff, as well as tests or exams, can help assess mentoring effectiveness.

## Conclusions

Corrosion presents serious safety and environmental challenges, significantly increases costs, and can indirectly raise the tax burden. In the UK alone, properly addressing corrosion could lead to annual savings of up to £32 billion. However, while competent specialists are essential for effectively managing corrosion and degradation issues, the UK faces a shortage of skilled corrosion professionals, compounded by limited educational training programmes in this field.

To combat this issue, it is important to build a bridge between young corrosion researchers and engineers, and senior experts to facilitate knowledge communication. Therefore, mentoring the next generation of corrosion professionals combined with fundamental academic research and development is critical for tackling corrosion and will, ultimately, lead to improved safety, significant cost savings, and enhanced sustainability. In conclusion, effective corrosion management extends beyond infrastructure, playing a crucial role in enhancing the durability and lifespan of vehicles as well. This progress not only supports environmental sustainability but also leads to meaningful cost savings for households, reflecting the widespread impact of innovations in corrosion control.

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# Advanced Corrosion Management Techniques to Reduce Cost and Risk in Our Built Environment

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## Meet the Author



**Christian Stone**

**Christian Stone** is the Lead Materials Scientist and Technical Expert at Concrete Preservation Technologies where he consults on the corrosion survey and corrosion management of structures all over the globe and develops solutions using galvanic, hybrid and ICCP technologies. Alongside this work, Christian has been overseeing and undertaking research and surveying as a part of the Loughborough University RAAC Research Group for 5 years, speaks at international conferences and is a member of many professional organisations relating to the corrosion of steel in structures.

## Introduction

According to UK government data from 2022, 15% of all carbon emissions can be accounted for by just the production of the construction materials of steel and cement [1]. Furthermore, 60% of waste in the UK is from the construction sector. It is important that, if emission targets are to be met, the world shifts from a mindset of demolition and new build to one of repair and conservation. In addition to the environmental cost, the monetary cost to the UK taxpayer of replacing essential infrastructure is usually far higher than the cost of preserving existing assets [2].

The main structural element of many buildings around us is reinforced concrete, and one of the major factors limiting its life and safety is corrosion of the embedded steel [3]. If left unchecked, corrosion can accelerate, and spread, causing a reduction in the steel cross-section as well as damage to the concrete such as cracking and spalling due to the expansive forces as seen in Figure 1, reducing structural integrity and serviceability until demolition is the only option [4]. In some extreme cases, without intervention, disaster can strike, and a structure collapses.



**Figure 1: Cracking and Spalling Due to the Expansive Force Created by Corrosion of the Reinforcement (CPT).**

## Routine Costs of Repair and Replacement

The remediation of concrete infrastructure commonly comprises localised patch repairs. However, such repairs can accelerate corrosion in the surrounding steel, the incipient anode effect, and cause substantial deterioration in the neighbouring concrete within 5 years [5]. This results in continued repairs and the chasing of corrosion through a structure. Many repairs, such as those required by the spalling of concrete surrounding half-joints in bridges, have become routine, necessitating road closures and replacement routes often in 4-6 year cycles. This is not uncommon in the UK, which has around 60,000 bridges where concrete is the main structural element and a further 40,000 other highway structures where concrete plays a major role [6]. Many of these structures are especially vulnerable due to their age and the annual exposure to aggressive de-icing salts.

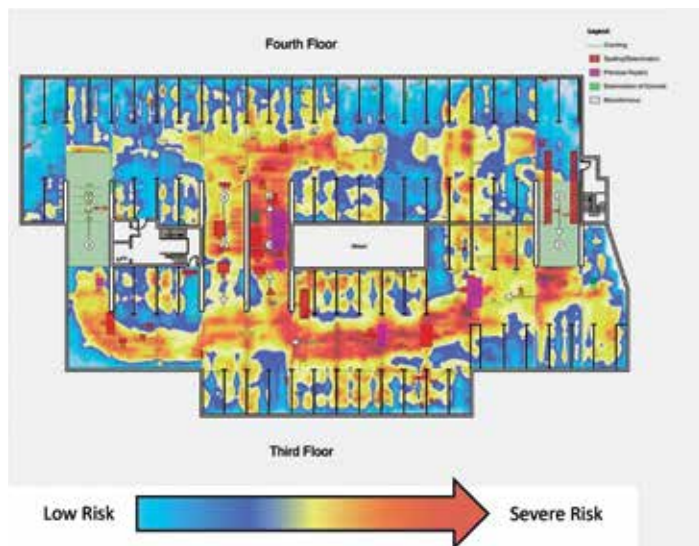
The cost of a concrete repair to a readily accessible bridge structure is approximately £11,000 per cubic metre, or around £1,000-£2,000 per square metre, as of April 2024 and is forecast to increase. Access and traffic management at many sites can be as much, or even more, than the cost of repair. Given the continued degradation of structures left unprotected, corrosion management systems, which often cost a fraction of the repair [5], remain an underutilised tool in limiting life-cycle expenditure and increasing the service life of buildings and infrastructure.

## Corrosion Surveying

Most surveys in the UK are not undertaken by personnel with dedicated training in corrosion. However, corrosion surveying is well understood within the UK, with many of the leaders in corrosion surveying, management, and technology working domestically and internationally to assess and protect structures.

Corrosion surveying looks beneath the surface of structures using techniques such as half-cell potential mapping, (Figure 2), and enables problems to be found early before issues such as substantial cracking can accelerate and become much more expensive to repair. A localised, tailored approach to corrosion management can be formulated that reduces further, more costly, issues and risk.

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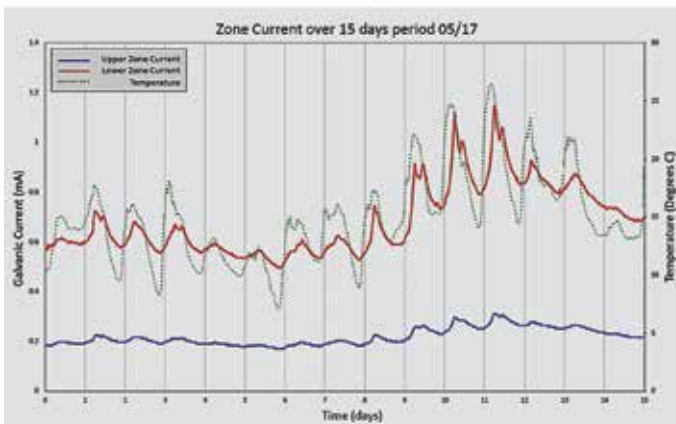
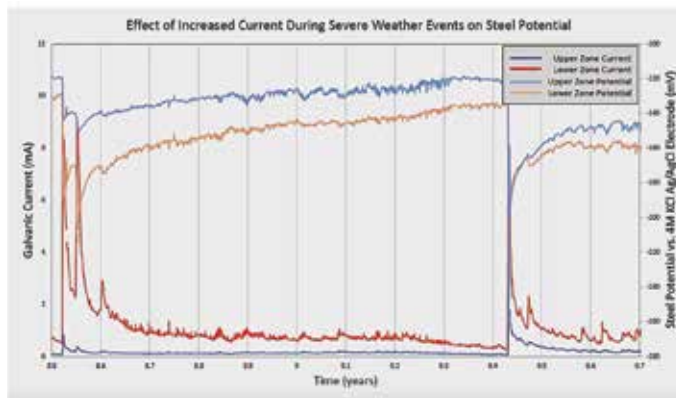
**Figure 2: Half-Cell Potential Map of Car-Park Deck Indicating Areas of Increased Corrosion Risk (McFarland Consulting Group).**

### Corrosion Management

Over the last 20 years, there has been significant progress in corrosion management, much of which has been led by UK-based research and development. Modern corrosion management systems need not be intrusive, complex, or have expensive maintenance. Long-term monitoring data gathered in the real world has given us confidence in the effectiveness of these systems [7]. Should this technology be more widely adopted, significant savings could be made in maintenance, repair, and replacement.

Galvanic and hybrid systems, both invented and produced within the UK, protect against corrosion by introducing zinc anodes that are attached to the steel. Like a battery, the zinc anodes corrode sacrificially, passing a current to the reinforcement. This current protects the steel from corrosion electrochemically by the charge held in the steel itself and the generation of alkaline ions on its surface [8]. Galvanic anodes have been used for 200 years since Humphrey Davy first applied zinc and iron anodes to the copper hulls of naval vessels. In infrastructure, zinc anodes were originally used to protect and extend the life of patch repairs, but as the technology progressed, they are now used to protect areas from small patches to whole structures [7]. Hybrid anodes use similar sacrificial technology but are suited to more severe corrosion risk, halting all ongoing corrosion in around 1 week [9].

Like all circuits, the current produced by the anodes depends on the resistivity of the material in which it flows, the concrete. Therefore, when corrosion risk increases, due to the concrete becoming wet, hot or full of aggressive ions, the path between the anodes and the steel becomes more conductive and larger protective currents flow to the steel as seen in Figures 3 and 4. This electrochemical responsive behaviour of zinc anodes allows the corrosion management system to give protection proportional to the corrosion risk without the risk of overprotection seen in externally powered systems [7].



**Figures 3 and 4 above: Both Graphs Show the Anode’s Characteristic Responsive Behaviour. 3 – The Galvanic Anodes Output Current Changes with daily Temperature fluctuations after 9 years. 4 - The Galvanic Anodes Current Output Responds to Increased Moisture Due to Flooding and Rainfall. (Whiteadder Bridge, CPT).**

Similarly, more recent advances allow vulnerable bridge half-joints to be protected using anodes inserted directly into the expansion joints [10]. These anodes are designed to work with the joint and move with the expansion and contraction of the concrete. The placement of these anodes within the joint void minimises future repairs, extends the life of the structure and reduces disruption and carbon emissions. Though sacrificial anodes have a limited design lifetime, an estimated 20-30 years, site monitoring has suggested that many anodes are projected to exceed this by many years. When insufficient anode remains, these systems can be replaced with fresh anodes, and the service life is further extended.

Zinc-based anodes are therefore especially well suited to the changing environment we and our structures are now subject to. An analysis by the think tank ‘Bright Blue’ states that the increase in flooding is due to the climate emergency requiring us to improve the resilience of our infrastructure [11]. One of the major drivers of corrosion in infrastructure is moisture ingress; extreme cycles of moisture and heat are becoming commonplace. Galvanic, self-powered, self-regulating systems are maintenance-free, require no power source and are proven effective during extreme weather events.



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One such structure protected by zinc anodes is Whiteadder Bridge near Berwick-upon-Tweed. The bridge, which is prone to frequent flooding, has been protected for almost 18 years. During this time over 10 million data points have been collected to monitor the corrosion rate of the steel in the structure and the performance of the anodes. The reinforcement has remained passive during the many floods and, despite the levels of aggressive ions present in the concrete, there has been no need for further maintenance and repair. It is currently on track to exceed its design life despite these events [10,12].

Externally powered, impressed current systems are also widely available and are well suited to some structures. Though these systems sometimes have lower initial costs, they can be vulnerable to vandalism of their expensive power supply and management system; they require frequent maintenance, costly to run and are often found unpowered within a few years of installation. Once unpowered the structure is no longer protected [13].

Impressed current systems are externally controlled rather than naturally responsive, leading to less flexibility to changes in climate or moisture. During extreme climate events, these systems may under-protect or potentially over-protect the steel within the concrete leading to acid buildup at the anodes and dangerous embrittlement of the reinforcement [14, 15].

### Corrosion in RAAC

Issues of corrosion in UK infrastructure are not limited to traditional reinforced concrete. The BRE, SCOSS, IStructE and Loughborough University, amongst others, have concluded that corrosion within RAAC concrete is of significant concern [16, 17, 18].

RAAC relies heavily on a coating applied to the reinforcement during manufacture to control corrosion. The aerated concrete acts like a sponge, able to stably retain around half its mass in moisture, so the impermeability of the coating is crucial. This coating, however, is susceptible to degradation and cracking, becoming more porous [19].

Corrosion of steel in RAAC is becoming a more common issue with substantial levels of corrosion hiding in the porous AAC before cracking and spalling occur, as seen in Figure 5.



**Figure 5: Corrosion in RAAC Seen After a Spall Due to Probable Moisture Ingress Due to a Humid Internal Environment (CPT).**

As a result of extensive UK research, RAAC-specific survey techniques and corrosion control technologies are now available and bespoke corrosion management systems are being installed within vulnerable elements in the NHS estate. These systems can extend the life of these structures using a bespoke development of the same galvanic principles [20].

### Further Thoughts

There is always more work to be done, however, we now have a clear understanding of the effectiveness of corrosion prevention techniques and the role that they can play in reducing costs and protecting our built environment well into the future. Much of our infrastructure is built using reinforced concrete and managed by local authorities which struggle with limited budgets to undertake the required work. However, without

appropriate repair and corrosion management, the issues will accelerate and spread, the costs skyrocket, and the risk to the public become ever greater. We hope that these technologies will be embraced more widely by an industry that can be slow to change and that the UK will continue to lead the world in corrosion management, infrastructure resilience and safety. Investment in corrosion management does take some initial funding, but over time pays great dividends in both structural safety, cost, and the environment.

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**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

**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: 07593 611577 Barry Crewick  
Email: barry.creswick@fountainsgroup.co.uk

**HANKINSON PAINTING GROUP**

Tel: 0870 7892020  
Email: stephen.hankinson@hankinson.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: 01724 851109 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: Craig.Constable@Nusteelstructures.com  
www.nusteelstructures.com

**OAG INTERNATIONAL UK LTD**

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

**PCS**

12, Eoloda Street from Gisir Elniile, Sekeel, Guza, Egypt  
12992 Tele: +2 01069083431 www.PCS.com  
Email: ali hassan\_804@hotmail.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

**STANDISH METAL TREATMENT LTD**

Tel: 01695 455977 Email: stuart.croft@standishmetal.co.uk

**SURFACE TECHNIK DUDLEY LIMITED**

Tel: 1384 457610 www.surfacetchnik.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.bbcbbaskerville.com

**MIDLAND CORROSION SERVICES LTD (NEW SUSTAINING MEMBER)**

Email: mschofield@midlandcorrosion.co.uk

**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

**R-TECH CONSULTANTS**

Email: sarah.bagnall@r-techmaterials.com

**SAFINAH LTD**

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

**SONOMATIC LTD**

Tel: 01925 414000 www.sonomatic.com

**STEEL & METALS INSTITUTE (SWANSEA) (NEW SUSTAINING MEMBER)**

Email: enquiries.sami@swansea.ac.uk

**STEEL PROTECTION CONSULTANCY LTD**

Email: wil.deacon@steel-protection.co.uk  
www.steel-protection.co.uk

**WOOD PLC (NEW SUSTAINING MEMBER)**

Email: george.winning@woodplc.com

**SUPPLIERS COATINGS****CHEMCO INTERNATIONAL LTD**

East Shawhead Industrial Estate, Coatbridge,  
Scotland ML5 4XD  
Tel: 01236 606060 Web: www.chemcoint.com

**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 732236 www.corroderere.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: dean.kenny@lakecm.co.uk

**LBBC BASKERVILLE**

Tel: 0113 2057423 www.bbcbbaskerville.com

**LLEWELYN RYLAND LTD**

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

**PRESSERV LTD**

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

**SCANGRIT**

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

**RECIPROCAL ORGANISATIONS****CEOCOR**

Website: www.ceocor.lu

**ELSEVIER SCIENCE LTD**

Tel: 01865 843000

**MARINE CORROSION FORUM**

Website: www.marinecorrosionforum.co.uk

**QUALITY CONTROL****ELCOMETER**

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

**TRAINING AFFILIATES****ARGYLL RUANE LTD**

(Bryan Ravenshear)  
Email: Bryan.Ravenshear@argyllruane.com

**CORRODERE ACADEMY**

Tel: 01252 732236 Web: www.corroderere.com

**ICATS**

(Kevin Harold) Email: kevin@paintel.com

# Institute Events

# DIARY DATES 2025



## BRANCH DATES

### 19<sup>th</sup> February, North West Branch

YEP Case Study Day. 3:00 pm - 6:00 pm.

Contact: nwchair@icorr.org

### 20<sup>th</sup> February, South Wales and South-West Branch

Contact: swchair@icorr.org

### 25<sup>th</sup> February, Aberdeen Branch

Joint Online Event with BINDT, Phased Array PA-CAT, 3:00 pm - 4:00 pm.

Speaker: Paul Holloway

### 13<sup>th</sup> March, London Branch

Chairman Talk from 6:30 pm to 9:00 pm  
More Information to follow.

Contact: londonchair@icorr.org

### 25<sup>th</sup> March, ICorr Online Technical Event

Digital Approaches to Enhance Integrity Management. Company: Sonomatics.

Speaker: Kevin McDonald

### 6<sup>th</sup> April-10<sup>th</sup> April

AMPP Annual Conference

Venue: Nashville, TN, more information to follow.

### 9<sup>th</sup> April, South Wales and South-West Branch

Contact: swchair@icorr.org

### 10<sup>th</sup> April, London Branch

Technical event, Coatings, Protection (or maintenance) of offshore wind towers, Sherwin Williams from 6:30 pm to 9:00 pm

Contact: londonchair@icorr.org

### 24<sup>th</sup> April, ICorr Event. Teesside

World Corrosion Awareness Day. ICorr CED Event.

Contact: danny.burkle@lbbcbaskerville.co.uk

### 29<sup>th</sup> April, Aberdeen Branch

In-Person Joint Meeting with MCF (All Day)

Venue: (in Aberdeen), Organiser: Marine Corrosion Forum.

Contact: ICorrABZ@gmail.com

### 8<sup>th</sup> May, London Branch

May Social Even, more Information to follow.

Contact: londonchair@icorr.org

### 26<sup>th</sup> May - 28<sup>th</sup> May

CEOCOR 2025 CONGRESS.

Venue: La Mole in ANCONA, ITALY

## COURSES AND EXAMS

### 3<sup>rd</sup> March to 7<sup>th</sup> March & 21<sup>st</sup> July to 25<sup>th</sup> July

Fundamentals of Corrosion for Engineers Course at Corrosion House, Northampton.

### 19<sup>th</sup> May to 23<sup>rd</sup> May

ICorr Certified MIC Technologist Training Course.

### CP Course and Exams Levels 1-3

24<sup>th</sup>-27<sup>th</sup> February Buried Level 2 - Sheffield  
Exam Date: 28<sup>th</sup> February.

3<sup>rd</sup>-6<sup>th</sup> March Marine Level 2 - Telford

Exam Date: 7<sup>th</sup> March

10<sup>th</sup>-11<sup>th</sup> March Buried Level 1 - Sheffield

Exam Date: 12<sup>th</sup> March

17<sup>th</sup>-20<sup>th</sup> March Buried Level 2 - Telford

Exam Date: 21<sup>st</sup> March

31<sup>st</sup> March-1<sup>st</sup> April Buried Level 1 - Sheffield

Exam Date: 2<sup>nd</sup> April

7<sup>th</sup>-10<sup>th</sup> April Marine Level 3 - Telford

Exam Date: 11<sup>th</sup> April

14<sup>th</sup>-15<sup>th</sup> April Buried Level 1 - Telford

Exam Date: 16<sup>th</sup> April

### CP Course and Exams Levels 4 at Northampton

Proposed dates for 2025 are:

- 27<sup>th</sup> February
- 5<sup>th</sup> June
- 11<sup>th</sup> September
- 27<sup>th</sup> November

### Schedule of Argyll Ruane Courses

#### Coatings Training Courses Available in 2025

#### Industrial Coatings Applicator Training Scheme (ICATS) Level 1 at Dunfermline

Available on Request.

#### Hot Dip Galvanising Inspector Level 2

Available on Request at Sheffield and Dunfermline. Sign Up Anytime for Online Course Recertification Exam.

#### Insulation Inspector Level 2 at Dunfermline

19<sup>th</sup>-21<sup>st</sup> April 2025

Sign Up Anytime for Online Course Recertification Exam.

#### Passive Fire Protection (PFP) Coatings Inspector (Epoxy) Level 2 at Sheffield and Dunfermline

Flexible course dates.

#### Passive Fire Protection (PFP) Coatings Inspector (Epoxy) Level 3 at Sheffield

Available on request.

Sign Up Anytime for Online Course Recertification Exam.

#### Pipeline Coatings Inspector Level 2 at Sheffield and Dunfermline

Available on request.

Sign Up Anytime for Online Course Recertification Exam.

#### ICorr Transition Programme Levels 1 and 2, Online

Sign Up Anytime.

#### Protective Coatings Inspector Level 1 at Sheffield

17<sup>th</sup>-24<sup>th</sup> March 2025

07<sup>th</sup>-14<sup>th</sup> April 2025

#### Protective Coatings Inspector Level 2 at Sheffield

3<sup>rd</sup>-10<sup>th</sup> March 2025

#### Protective Coatings Inspector Level 3 at Sheffield

12<sup>th</sup>-16<sup>th</sup> May 2025

Sign Up Anytime for Online Recertification Exam.

## BRANCH CONTACT DIRECTORY

### ABERDEEN:

ABERDEEN: Mei Ling Cheah (Chair)

Email: ICorrABZ@gmail.com

### CENTRAL SCOTLAND:

Philip Enegele (Chair)

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### LONDON:

Paul Brooks (Chair)

Email: londonchair@icorr.org

### MIDLANDS BRANCH:

Prafull Sharma (Interim Chair)

Email: midlandschair@icorr.org

### NORTH EAST:

Matt Fletcher (Chair)

Email: nechair@icorr.org

### NORTH WEST:

Greg Brown (Chair)

Email: nwchair@icorr.org

### WALES and SOUTH WEST:

Sarah Bagnall (Chair)

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Joshua Owen (Interim Chair)

Email: yorkshirechair@icorr.org

### OVERSEAS – India

Arpit Goyal (Chair)

Email: arpit.goyal@thapar.edu

### CSD DIVISION:

Julian Wharton (Chair)

Email: J.A.Wharton@soton.ac.uk

### CED DIVISION:

Danny Burkle (Chair)

Email: d.burkle@lbbcbaskerville.co.uk

### YICORR:

Kathleen Purnell (Chair)

Email: youngicorrchair@icorr.org

Visit the ICorr website for  
all the latest news [www.icorr.org](http://www.icorr.org)