

A journal of the Institute of Corrosion

# Corrosion

## Management

Issue 189 January/February 2026

### THIS ISSUE: ATMOSPHERIC CORROSION

**Establishing Atmospheric Corrosion Test Sites in Alaska for Monitoring and Assessing Cold-Climate Infrastructure Degradation.**

Page 36



**INSTITUTE OF  
CORROSION**



**EFCE**  
EUROPEAN FEDERATION OF CORROSION

**Case Study:  
Investigating the Dynamics of Atmospheric Corrosion and the Impact of Climate Change in Mauritius.**

Page 40

**Atmospheric Corrosion Control for Exposed Bridge Structures – A Case Study of Tamar Bridge, UK.**

Page 43



#### International News

ICorr Strengthens UK-China Corrosion Collaboration at the 13<sup>th</sup> China Corrosion Conference.

Page 8



#### Branch News

ICorr London Updates

Page 18

**ARGYLL  
RUANE**



Approved Training Partner

## ADVANCE YOUR CAREER.

Trusted globally and accredited by the Institute of Corrosion (ICorr), our training supports professionals in developing their coating inspection expertise to the highest industry standards.

### Why choose us?

- Learn from industry professionals
- Build practical skills in assessment, protection, and application
- Train with the latest tools and technology
- Flexible delivery options, with in-person or online courses

### Available courses:

- Protective Coating Inspector Level 1, 2 and 3
- Insulation Inspector Level 2
- Passive Fire Protection (PFP) Coating Inspector (Epoxy) Level 2 and 3
- Pipeline Coating Inspector Level 2
- Hot Dip Galvanizing Inspector Level 2
- Recertification programme
- Transition to ICorr programme

Book today:



[argyllruane.com](http://argyllruane.com)



Study **all** ICorr coating inspection courses online with the

 **corrodere**  
academy

**including Coating Inspection  
Level 1, 2 and 3**

Trusted, affordable and flexible training  
in multiple languages

Thousands of students qualified globally

Multiple booking discounts available

ENROL TODAY



[info@corrodere.com](mailto:info@corrodere.com)  
+44 (0)1252 732 236  
[corrodere.com](http://corrodere.com)



Approved Training Partner



# Contents



Issue 189 January/February 2026

**4**

**The President Writes  
From the Editor**

**5**

**Corrosion Around Us  
By Stephen Tate**

**6**

**Announcement  
Corrosion Management Formally  
Approved as an Official Journal of the  
European Federation of Corrosion**

**7-14**

**Institute News  
International News  
ICorr Participated in the 19<sup>th</sup> Middle  
East Corrosion Conference, Highlighted  
by the Signing of a Landmark MoU  
with MEA**

**ICorr Strengthens UK-China Corrosion  
Collaboration at the 13<sup>th</sup> China Corrosion  
Conference in Xi'an, China**

**ICorr President Hosts CSCP President  
Professor Xiaogang Li for High-Level  
UK visit**

**Institute Activities in the UK**

**ICorr AGM 2025: A Day of Insight,  
Recognition and Forward Momentum  
ICorr Proudly Supports the Prestigious  
72<sup>nd</sup> Hatfield Memorial Lecture in  
Sheffield**

**15-22**

**Member and Branch News**

- ICorr Aberdeen Updates
- ICorr India Updates
- ICorr London Updates
- ICorr Midlands Updates
- ICorr Wales and South-West Host a  
Technical Event at Swansea University  
Focused on Corrosion Science and  
Emerging Coating Technologies
- ICorr Yorkshire and Humber Updates

**22-24**

**ICorr Division News  
CSD - Science Council Celebration of  
Science 2025**

**YICorr & YEP Updates  
YEP Journeys –Diary Reflections from  
AMPP Nashville**

**25**

**ICorr Training  
CPGB – A Year of Achievement  
ETGB – Connecting the Corrosion  
Community Through Training Excellence  
STGB – TUV China Training, a Continuing  
Success Story**

**28**

**Special Feature  
Corrosion in Infrastructure: A Critical  
Review of Cathodic Protection as a  
Repair Strategy for the Edinburgh  
North Bridge Refurbishment**

**32**

**Industry News**

**34**

**Fellow's Corner  
A Comparative Study of Indirect  
Inspection of Cross-Country Gas Pipeline  
for Internal Corrosion Through ILI and  
ICDA - J N Agrawal**

**36**

**Technical Article 1  
Establishing Atmospheric Corrosion  
Test Sites in Alaska for Monitoring and  
Assessing Cold – Climate Infrastructure  
Degradation – Dr Raghu Srinivasan**

**40**

**Technical Article 2  
Case Study - Investigating the Dynamics  
of Atmospheric Corrosion and the Impact  
of Climate Change in Mauritius  
- Dr Yashwantraj Seechurn**

**43**

**Technical Article 3  
Atmospheric Corrosion Control for  
Exposed Bridge Structures –  
A Case Study of Tamar Bridge, UK  
– Kevin Harold and Thomas Harold**

**46**

**Company Members Directory**

**48**

**Diary Dates 2026**

**Cover Page:** Image Courtesy of **Raghu Srinivasan, Ph.D.** | Associate Professor and Chair Department of Mechanical Engineering, Director-Environmental Degradation Lab (EDL), UAA CoEng Affiliate Member-Alaska Space Grant Program **College of Engineering | University of Alaska Anchorage.**

Published on behalf of the Institute of Corrosion  
Square One Advertising and Design Limited  
Neepsend Triangle Business Centre,  
Unit 8, 1 Burton Street, Sheffield S3 8BW

**Publisher and Managing Editor**

Debbie Hardwick  
Tel: 0114 273 0132  
Email: debbie@squareone.co.uk

**Consulting Editor**

Shagufta Khan  
Email: editor@icorr.org

**Design**

Square One Advertising & Design  
www.squareone.co.uk

**Advertising Manager**

Jonathan Phillips  
Tel: 0114 273 0132  
Email: jonathan@squareone.co.uk

**Editorial content for March/April 2026 Issue is:  
13<sup>th</sup> March 2026**

**Subscriptions**

UK	£70.00
Europe	£80.00
Outside Europe	£90.00 airmail £80.00 surface mail

Enquiries and subscriptions to the Institute of Corrosion at the address below:

The Institute of Corrosion

**President**

Yunnan Gao

**Immediate Past President**

Stephen Tate

**Hon. Secretary**

Brenda Peters

Institute of Corrosion, Corrosion House,  
5 St Peters Gardens, Marefair,  
Northampton NN1 1SX

Tel: 01604 438222

Email: admin@icorr.org

Website: www.icorr.org

All rights reserved. Reproduction without written permission from the Institute of Corrosion is prohibited. Views expressed in editorial text or advertising copy are the opinions of the contributors/advertisers and are not those of the Institute or the Publisher

ISSN: 13 55 52 43

This publication is Recyclable.



# The President Writes



Photo: Dr Yunnan Gao.

Dear Members,

Happy New Year 2026 to all readers of Corrosion Management Journal. This is the first President Writes of our new year and also marks the beginning of the second year of my presidency at the Institute of Corrosion. I would like to take this opportunity to wish all our members a healthy, successful, and fulfilling year ahead. I hope that 2026 brings you new opportunities, professional growth, and continued collaboration across our corrosion community.

Since my last column, ICorr activities have continued at a strong pace, reflecting the enthusiasm and commitment of our members, volunteers, and partners. In November 2025, I was pleased to attend the relaunch of the ICorr Yorkshire and Humber Branch at the University of Leeds. Hosted in collaboration with the Bragg Centre for Materials Research, the event attracted strong regional participation and focused on the corrosion behaviour of additively manufactured alloys, combining academic insight, industrial application, and engagement with early-career professionals. The relaunch represents a significant step forward for the branch, and I look forward to seeing its continued growth and activity throughout 2026. Also in November, I had the honour of hosting a high-level UK visit by Professor Xiaogang Li, President of the Chinese Society for Corrosion and Protection (CSCP). This visit built upon our long-standing collaboration and the successful delivery of the inaugural UK-China Corrosion Summit in Manchester in September 2025. I am pleased to report that both organisations are now actively working towards hosting the second China-UK Corrosion Summit in China in 2026, further strengthening our international cooperation.

In December, ICorr was proud to support the 72<sup>nd</sup> Hatfield Memorial Lecture in Sheffield, a prestigious event celebrating excellence in metallurgy and materials science, which I was delighted to attend. The festive period also provided an opportunity to celebrate the strength of our community through a number of

social gatherings. These included the prestigious 36<sup>th</sup> ICorr Christmas Luncheon at ROSL organised by the London Branch, the ICorr Headquarters Christmas Lunch in Northampton, and branch-level celebrations such as those held by the Northeast Branch in December and the Wales and our Southwest Branch in February 2026. These occasions are an important reminder that ICorr is not only a professional institute, but also a supportive and connected community. As we move into 2026, our regional branches have already begun delivering technical events, with recent and forthcoming activities from branches including London, India, Northwest, Aberdeen, and Central Scotland. Planning for the rest of the year is well underway, and I encourage all members to stay engaged and follow upcoming events via the ICorr Events Calendar at <https://www.icorr.org/events/>.

ICorr is also proud to continue its role as a Supporting Partner for major international corrosion conferences. In this capacity, we are very pleased to participate in the 5th Middle East Metallurgy, Corrosion & Coatings Expo (MECOC EXPO 2026), that took place from 26-29<sup>th</sup> January 2026 in Abu Dhabi, UAE. MECOC EXPO is a leading global platform covering corrosion prevention, coatings, metallurgy, and non-metallic materials, bringing together industry leaders, researchers, and decision-makers through specialist conferences and a major international exhibition. I strongly encourage ICorr members to attend our supported events and to take advantage of these excellent opportunities for technical learning and global networking. As we embark on our new year ahead, I would like to thank you once again for your unwavering support of the Institute. Your engagement, expertise, and enthusiasm are what enable ICorr to thrive and continue expanding its impact both in the UK and internationally.

As always, I warmly welcome your thoughts, insights, and aspirations for the Institute. Please feel free to contact me directly at [president@icorr.org](mailto:president@icorr.org) I look forward to meeting many of you at our events and activities throughout 2026.

With best regards, **Dr Yunnan Gao,**  
President, Institute of Corrosion, [president@icorr.org](mailto:president@icorr.org)

## From the Editor

Welcome to the January–February 2026 issue of *Corrosion Management*, the first edition of the new year. We begin 2026 with a theme of increasing global importance: Atmospheric Corrosion, a degradation mechanism that continues to pose significant challenges to infrastructure durability, public safety, and asset management across diverse climatic and environmental conditions. Atmospheric corrosion is inherently complex, governed by interactions between material properties, environmental exposure, pollutant deposition, and time-of-wetness. With accelerating urbanisation and the growing impacts of climate change, a deeper understanding of atmospheric corrosion processes—across both extreme and temperate environments—has become essential for informed materials selection, design, and maintenance strategies.

Our first technical article, “Establishing Atmospheric Corrosion Test Sites in Alaska for Monitoring and Assessing Cold-Climatic Infrastructure Degradation,” by Dr Raghu Srinivasan, presents an innovative contribution to the study of corrosion in Arctic and sub-Arctic environments. Through the deployment of multi-angle corrosion test racks across four distinct sites in Alaska, this work provides valuable insight into how exposure angle, marine influence, freeze–thaw cycles, and frost-dew conditions affect corrosion behaviour. The study highlights the importance of these regions as natural laboratories for developing predictive models and corrosion maps tailored to cold climates.

This is complemented by our second technical article, “Investigating the Dynamics of Atmospheric Corrosion and the Impact of Climate Change in Mauritius,” by Dr Yashwantraj Seechurn. Focusing on a tropical island environment, this detailed case study examines the influence of wind, rainfall, relative humidity, temperature, and pollutant transport on atmospheric corrosion rates. By comparing current field exposure data with results obtained a decade earlier, the article underscores the need to incorporate climate-driven variability into atmospheric corrosivity classifications and future corrosion management strategies.

Our third technical article—a UK case study, “Atmospheric Corrosion Control on Exposed Bridge Structures: The Tamar Bridge,” by Kevin Harold and Thomas Harold of Paintel Limited, offers a practical and experience-led perspective on long-term corrosion management of a major UK infrastructure asset. Drawing on decades of maintenance experience on the Tamar Bridge, the authors discuss the challenges posed by a high-corrosivity marine environment, complex structural geometry, and difficult access conditions. The article provides valuable insights into inspection, access strategies, surface preparation, and maintenance painting systems, demonstrating how targeted, well-executed and regular interventions can deliver durable corrosion protection without large-scale intrusive works. In our Fellow’s Corner, J N Agrawal, FICorr, presents a comparative study

on indirect inspection methods for detecting internal corrosion in cross-country gas pipelines. By evaluating In-Line Inspection (ILI) alongside Internal Corrosion Direct Assessment (ICDA), the article highlights the limitations of relying on a single technique and reinforces the importance of integrated inspection and monitoring strategies for effective pipeline integrity management. This issue also includes Part 2 of a Special Feature by Zaynah Khalil, Corrosion in Infrastructure: A Critical Review of Cathodic Protection as a Repair Strategy for the Edinburgh North Bridge Refurbishment. Through life-cycle cost and environmental analysis, the article provides a thoughtful evaluation of galvanic anode cathodic protection as a sustainable and practical alternative to more extensive structural interventions with some comparisons made to alternative ICCP systems. As we begin 2026, I thank our authors, and readers for their continued engagement and support. I hope this issue stimulates discussion, informs best practice, and inspires further progress in corrosion science and engineering. As always, I warmly welcome your feedback and contributions. Please feel free to contact me on any requirement, at [editor@icorr.org](mailto:editor@icorr.org)



With best wishes for the year ahead,  
**Dr Shagufta Khan, FICorr**  
Editor, *Corrosion Management Journal*

### By Stephen Tate, Immediate Past President

There appears to be increased news coverage of late, concerning major pieces of infrastructure affected by costly corrosion damage and weakening structures. On **5<sup>th</sup> December 2025**, Aberdeenshire Council provided an important update on the future of the recently closed Aboyne Bridge, following new findings which have raised fresh concerns about the condition of the structure.



Photo: Closed 'Aboyne Bridge' over the River Dee, Scotland.

Aboyne Bridge is a seven-span reinforced concrete arch structure that carries the B968 Bridgeview Road carriageway over the River Dee in Aboyne, Aberdeenshire. The structure was designed by FA Macdonald & Partner, Engineers, and George Bennett Mitchell, Architect, in 1937 and constructed between 1938 and 1940 to replace a previous suspension bridge. The structure also has a category B historic listing, which was designated on 30th March 2000. **Philip McKay, Head of Roads and Infrastructure, said:** "As part of the ongoing design work for remedial repairs to Aboyne Bridge, further planned invasive site investigations have been undertaken over the recent months. These further tests were required to confirm assumptions made earlier in the options considered during appraisal work.

### Assessment Outcomes

1. "Unfortunately, this work has confirmed that there are further anomalies in our understanding of the bridge design and several new significant structural issues.
2. It has now been established that the reinforcement in a critical part of the main bridge span, the hinge, is not what we had expected from the original design drawings. This compromises the original assumptions that were made regarding potential solutions to strengthen this element.
3. Due to the length of the bridge, the steel reinforcement bars are required to be joined. To achieve a structurally competent connection, in this case the joint is created with a device known as a coupler. Recent invasive investigations examined the condition of one of these couplers and found it to be suffering from significant corrosion, much worse than previously noted in the main reinforcement bars. While only one coupler was inspected, it is highly likely that the deterioration is repeated across the bridge. As a result, these elements cannot be repaired in the way we had planned.
4. Finally, the main deck is showing much more extensive corrosion assisted concrete deterioration in critical areas than anticipated, and this would mean that carrying out a reinstatement of the deck to re-establish a structurally sound reinforced concrete element would not be possible in the way we had planned. <https://www.aberdeenshire.gov.uk/news/2025/dec/aboyne-bridge-update-51225>
5. Bridge replacement costs were estimated as ~ £30M (Nov.24) for a 120 year life.

### Industry News

## TotalEnergies and NEO NEXT Create the UK's Largest Independent Oil and Gas Producer

**TotalEnergies has announced a significant restructuring of its UK upstream portfolio through an agreement to merge its UK Upstream business with NEO NEXT Energy Limited. The transaction will result in the formation of a new entity, to be known as NEO NEXT+, positioning it as the largest independent oil and gas producer in the UK once the deal is completed, expected in the first half of 2026.**

Under the agreed structure, TotalEnergies will hold a **47.5% shareholding** in NEO NEXT+, becoming its leading shareholder. The remaining ownership will be shared between HitecVision (28.875%) and Repsol UK (23.625%). The merger brings together a broad and strategically significant portfolio of UK Continental Shelf (UKCS) assets, combining NEO Energy's and Repsol UK's interests with those of TotalEnergies.

The expanded asset base will include major North Sea developments such as the **Elgin/Franklin complex, Culzean, Penguins, Mariner, Shearwater, Alwyn North, and Dunbar** fields. With a forecast production exceeding **250,000 barrels of oil equivalent per day by 2026**, NEO NEXT+ will have the scale and operational diversity to optimise late-life asset management, improve capital efficiency and sustain domestic energy supply. From an asset integrity and corrosion management perspective, the consolidation of mature offshore assets under

a single independent operator is expected to offer tangible benefits. Larger portfolios enable improved standardisation of inspection, maintenance and corrosion mitigation strategies, particularly for ageing infrastructure operating in harsh offshore environments. TotalEnergies' longstanding experience in the UK North Sea, spanning more than six decades, brings established expertise in low-cost operations, materials performance and emissions management. The transaction remains subject to customary regulatory approvals. Once completed, NEO NEXT+ will play a critical role in the UKCS at a time when operators face increasing pressure to balance production efficiency, asset life extension and decarbonisation objectives. For corrosion and materials engineers, the merger signals a renewed focus on optimised integrity management frameworks capable of supporting extended field life while meeting evolving regulatory and environmental requirements.

**Source: UK: TotalEnergies merges its Upstream business with NEO NEXT, creating the largest independent oil and gas producer in the UK | TotalEnergies.com**





# Corrosion Management Journal Formally Approved as an Official Journal of the European Federation of Corrosion

**Corrosion Management Journal is delighted to announce that it has been formally recognised as an Official Journal of the European Federation of Corrosion (EFC), marking a significant milestone in the journal’s continued development and international standing.**

Following a formal application submitted in June to the EFC Scientific Secretary, **Mr Roman Bender**, *Corrosion Management Journal (CMJ)* was reviewed by the EFC Board of Administrators. The application was approved at the Board’s meeting, held on **7<sup>th</sup> September in Stavanger, Norway**. As a result, Corrosion Management has now been included in the **EFC’s list of official journals**.

## EFC Journals

The journals listed below regularly publish information about the EFC and its activities. During 2026 and onwards they will carry the EFC logo on the front cover in order to reflect strong links with the EFC.

- **Materials and Corrosion**

Wiley-VCH, Weinheim, Germany

- **Corrosion Engineering, Science and Technology (CST)**

SAGE, on behalf of the the Institute of Materials, Minerals and Mining, United Kingdom

- **Matériaux et Technique**

EDP Sciences, France

- **Ochrona przed Korozją**

SIGMA-NOT Spółka z o.o, Poland

- **Koroze a ochrana materiálu (Corrosion and Material Protection)**

Association of Czech and Slovak Corrosion Engineers (AKI), Czech Republic and Slovakia



- **Oberflächen- POLYSURFACES**

Swiss Society for Surface Technology SGO/SST, Switzerland

- **Corrosion Management Journal (CMJ)**

Published by the Institute of Corrosion, United Kingdom.

The European Federation of Corrosion is a leading umbrella organisation representing corrosion societies, research institutions, and industry across Europe and beyond.

Recognition as an official EFC journal reflects the quality, relevance, and technical integrity of *Corrosion Management*, as well as its commitment to serving both the scientific and industrial corrosion communities. This approval further strengthens CMJ’s role as a platform for the dissemination of high-quality technical articles, case studies, expert opinion, and industry best practice covering all aspects of corrosion science, materials performance, asset integrity, and corrosion management strategies. It also enhances the journal’s visibility within the wider European and international corrosion community, creating new opportunities for collaboration, knowledge exchange, and engagement with EFC working parties, events, and member organisations.

*Corrosion Management* remains committed to supporting corrosion professionals, researchers, and engineers by delivering high-quality, accessible content that bridges the gap between research and practical application. Becoming an official EFC journal represents an important step forward in this mission and reinforces CMJ’s contribution to advancing corrosion knowledge and best practice globally. For more information login to [https://efcweb.org/News+\\_+Publications/Journals.html](https://efcweb.org/News+_+Publications/Journals.html) and to the ICorr Members Area CMJ archive at **Corrosion Management Archive New - Institute of Corrosion**



# ICorr Participated in the 19<sup>th</sup> Middle East Corrosion Conference, Highlighted by the Signing of a Landmark MoU with MEA

**The Institute of Corrosion (ICorr) was honoured to participate in the 19<sup>th</sup> Middle East Corrosion Conference (MECC), held on 11-13<sup>th</sup> November 2025 in Dhahran, Saudi Arabia, where ICorr President Dr Yunnan Gao attended as a VIP guest at the invitation of the Chairman of the Materials Engineering Association (MEA) of the Kingdom.**

Widely recognised as one of the region’s premier corrosion and materials engineering events, the biennial MECC event brought together industry leaders, technical experts, academics, and innovators from around the world. Dr Gao engaged in extensive discussions with global stakeholders and met with senior figures across the Middle East’s energy and industrial sectors.



**Photo: VIP Attendees of the 19<sup>th</sup> MECC, Held on 11-13<sup>th</sup> November 2025 in Dhahran, Saudi Arabia.**

A major highlight of the visit - both for ICorr and for the wider corrosion community - was the formal signing of a Memorandum of Understanding (MoU) between ICorr and MEA, held during the conference. This agreement, already published on the ICorr website, establishes a framework for enhanced cooperation, technical exchange, and joint initiatives between the two organisations.

The MoU marks an important milestone in strengthening international collaboration and supports ICorr’s strategic goal of deepening engagement with global partners.



**Photo: ICorr President, Dr Yunnan Gao (Right) and Chairman of MEA, Dr Tariq A. Alghamdi (Left), at the MoU Signing Ceremony on 12<sup>th</sup> November 2025 During The 19<sup>th</sup> MECC in Dhahran, Saudi Arabia.**



**Photo: L-R: Rashed Alhajri (MEA), George Winning (ICorr Treasurer), Muhsen Elhaddad (FICorr of Qatar Energy), Dr Tariq A. Alghamdi (MEA Chairman), and Dr Yunnan Gao (ICorr President) Attended the ICorr-MEA MoU Signing Ceremony on 12<sup>th</sup> November 2025 During the 19<sup>th</sup> MECC in Dhahran, Saudi Arabia.**

The conference also provided a valuable opportunity to reconnect with AMPP leadership, including the AMPP CEO, Alan Thomas, for Dr Gao to share insights on global trends and collaborative opportunities between ICorr and AMPP. In addition to high-level meetings, MECC offered an extensive technical programme showcasing leading-edge developments in corrosion science, inspection, and mitigation. Particularly notable were sessions focused on the integration of artificial intelligence (AI) into corrosion monitoring, predictive modelling, and asset integrity management. These developments demonstrate the accelerating role of digital technologies in shaping the future of corrosion engineering and management.



**Photo: ICorr President, Dr Yunnan Gao (Right), and AMPP CEO, Alan Thomas (Left), at the 19<sup>th</sup> MECC in Dhahran, Saudi Arabia.**

Reflecting on the conference, Dr Gao said: *“It was a great honour to attend MECC as a guest of the MEA and to experience the scale, depth, and technical excellence of this important regional event. The signing of the MoU between ICorr and MEA represents a significant step forward in our international collaboration efforts. The insights gained, especially in emerging areas such as AI-driven corrosion management, will help strengthen ICorr’s global outlook and create new opportunities for our members.”*

ICorr extends its appreciation to MEA for the invitation and hospitality and looks forward to developing this partnership through the initiatives set out in the newly signed MoU. Further updates, photos, and follow-up activities will be shared with members in due course via ICorr communication channels.

# ICorr Strengthens UK-China Corrosion Collaboration at the 13<sup>th</sup> China Corrosion Conference in Xi'an, China

**November 2025 marked another major step forward in international engagement for the Institute of Corrosion (ICorr), as President Dr Yunnan Gao was invited by the President of the Chinese Society for Corrosion and Protection (CSCP) to attend the 13<sup>th</sup> China Corrosion Conference, held from 8-9<sup>th</sup> November in Xi'an, China.**

The event, China's most significant national biennial corrosion conference, brought together more than 1,300 experts, researchers, and industry leaders to discuss developments across corrosion science and engineering, materials innovation, and emerging industrial corrosion challenges.



**Photo: Opening Ceremony of the 13<sup>th</sup> China Corrosion Conference on 8<sup>th</sup> November 2025 in Xi'an, China.**

## Recognition of Leadership in International Collaboration

During the conference's opening ceremony and awards session, Dr Yunnan Gao was honoured with the International Collaboration Award, presented by the president of CSCP, Professor Xiaogang Li, in recognition of his leadership in strengthening cooperation between the corrosion communities of the UK and China.

The award highlights intensified engagement between two organisations in the recent years, marked by high-level exchanges, jointly hosted events, and meaningful technical dialogues.



**Photo: CSCP President, Professor Xiaogang Li (Left) Presenting the International Collaboration Award to ICorr President, Dr Yunnan Gao (Right), During the Opening Ceremony of the 13<sup>th</sup> China Corrosion Conference on 8<sup>th</sup> November 2025 in Xi'an, China.**

## ICorr President's Presentation on ICorr, Young ICorr and YEP

A key moment of the conference occurred on 9<sup>th</sup> November, when Dr Gao delivered a presentation introducing the Institute of Corrosion, its global mission, and – of particular interest to the audience – its flagship programme, the Young Engineer Programme (YEP), organised by Young ICorr.

The session generated strong engagement from Chinese research students and early-career practitioners from universities, research institutes, and industry. Many expressed their enthusiasm for potential participation in future ICorr activities, signalling a promising new channel for nurturing the next generation of corrosion professionals across the UK and China.



**Photo: ICorr President, Dr Yunnan Gao, Giving A Presentation on Introduction of ICorr, Young ICorr and YEP on 9<sup>th</sup> November 2025 during the 13<sup>th</sup> China Corrosion Conference in Xi'an, China.**

## Building on the Momentum of the UK-China Corrosion Summit

In meetings with CSCP President Professor Li Xiaogang and senior CSCP representatives, both parties reflected on the success of the 1<sup>st</sup> UK-China Corrosion Summit, hosted by ICorr and CSCP in Manchester in September 2025. The summit, focused on "AI Impacts to Corrosion Management within the UK-China Energy Industry," showcased the value of collaborative thinking on shared industrial challenges.

Discussions in Xi'an reaffirmed a shared commitment to expand this cooperation, including future summits, technical workshops, research partnerships, and increased engagement between young professionals in both countries.



Photo: ICorr and CSCP Official Meeting Held During the 13<sup>th</sup> China Corrosion Conference in Xi'an, China.

### Welcoming Newly Elected ICorr Fellows

A highlight of Dr Gao's visit was the presentation of FICorr (Fellow of the Institute of Corrosion) certificates to newly elected Fellows based in China. Among them were:

- Professor Chaofang Dong
- Professor Anqing Fu

Their election as Fellows reflects ICorr's recognition of their significant contributions to corrosion science and their leadership within the global corrosion community.



Photo: ICorr President, Dr Yunnan Gao (Left) Presenting FICorr Certificate to Professor Chaofang Dong (Right).



Photo: ICorr President, Dr Yunnan Gao (Left) Presenting FICorr Certificate to Professor Anqing Fu (Right).

Dr Gao commented:

*"It was a privilege to welcome Professors Dong and Fu as Fellows of ICorr. Their achievements and influence extend far beyond China, and their fellowship strengthens ICorr's global network of excellence."*

### Strengthening a Shared Vision for the Future

The Xi'an Conference showcased the strong foundation of trust and collaboration between ICorr and CSCP. Dr Gao emphasised the importance of continuing this momentum:

*"Our communities face similar challenges and share the same ambition - to advance corrosion science and engineering for the benefit of society. This partnership between ICorr and CSCP is producing real impact. I look forward to deepening our collaboration and creating more opportunities for researchers, professionals, and students in both countries."*

Future initiatives currently under discussion include:

- Joint training programmes and career professional development activities
- Collaborative technical committees and research exchanges
- Co-hosted conferences and thematic workshops
- Greater mutual recognition of expertise and professional accreditation

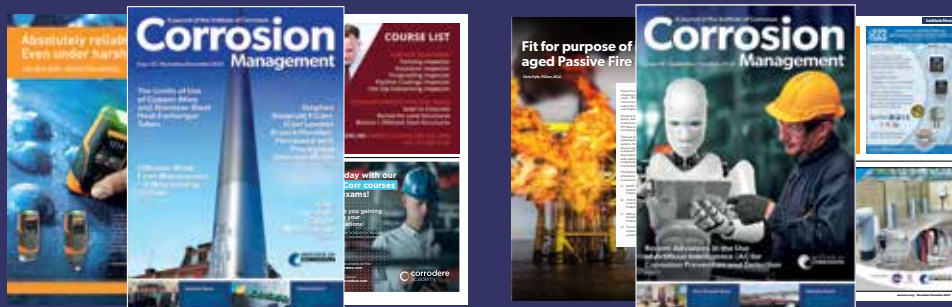
### A Growing Partnership with Global Impact

ICorr's participation in the 13<sup>th</sup> China Corrosion Conference reflects the Institute's long-standing commitment to international cooperation.

As the corrosion challenges facing industry become increasingly complex and interconnected, ICorr's engagement with organisations like CSCP ensures that knowledge, resources, and innovation flow freely across borders.

The success of the Xi'an conference marks not an endpoint but a further catalyst for collaboration - one that will strengthen corrosion science and engineering for both nations and for the global community.

# TO ADVERTISE IN CORROSION MANAGEMENT



Please contact Debbie Hardwick or Jonathan Phillips at:  
Square One Advertising & Design

+44 (0) 114 273 0132 enquiries@squareone.co.uk

# ICorr President Hosts CSCP President Professor Xiaogang Li for High-Level UK Visit

The President of the Institute of Corrosion (ICorr), Dr Yunnan Gao, was honoured to host Professor Xiaogang Li, President of the Chinese Society for Corrosion and Protection (CSCP) <https://www.cscp.org.cn/> during a significant multi-day visit to the United Kingdom in November 2025. This most welcome visit marked another historic milestone in UK-China cooperation in corrosion science and technology and reflects the growing international influence of Professor Li - one of the world's most distinguished leaders in corrosion science and engineering.

Professor Li, who also serves as Professor at the University of Science and Technology Beijing, Director of the National Materials Corrosion and Protection Data Centre, and Editor-in-Chief of npj Materials Degradation <https://www.nature.com/npjmatdeg/> travelled to the UK with a CSCP delegation to deepen academic, industrial, and institutional collaboration with ICorr and leading UK research organisations.

## Strategic Visit to The University of Manchester

The first stop of the visit was The University of Manchester (<https://www.materials.manchester.ac.uk/>) where the ICorr President, Dr Yunnan Gao, welcomed Professor Li and the CSCP delegation. Discussions centred on establishing structured pathways for knowledge exchange, joint workshops, and collaborative programmes in corrosion science, materials degradation, and advanced characterisation.



**Photo 1: Collaboration Meeting at The University of Manchester. Professor Dirk Engelberg of Manchester University Giving A Presentation.**

The delegation toured Manchester's world-class materials and corrosion research facilities, including advanced electron microscopy laboratories and the Henry Royce Institute hub (<https://www.royce.ac.uk/>) guided by Professor Xiaorong Zhou and Professor Dirk Engelberg, both internationally recognised leaders in corrosion and structural materials.



**Photo 2: CSCP President Professor Xiaogang Li (L3), ICorr President Dr Yunnan Gao (R2) and the Whole Delegation Hosted by Manchester University Professor Xiaorong Zhou (L2) and the Team at Henry Royce Institute, Manchester University.**

These engagements highlighted strong synergies between UK and Chinese research capabilities in environmental degradation, data-driven modelling, and materials genome methodologies—areas strongly aligned with Professor Li's pioneering work in corrosion big data.

## Visit to the University of Leeds

The delegation then travelled to the University of Leeds (<https://eps.leeds.ac.uk/mechanical-engineering-research-innovation>) where they were hosted by Professor Richard Barker and Dr Joshua Owen. A dedicated collaboration workshop focused on shared challenges across atmospheric corrosion, mechanical performance in complex environments, and infrastructure durability.



**Photo 3: Collaboration Meeting at the University of Leeds. Dr Joshua Owen During His Presentation.**

This was followed by technical tours of the University's corrosion laboratories and the Henry Royce Institute facilities in Leeds, where cutting-edge capabilities in electrochemical methods, advanced microscopy, and materials testing were showcased.



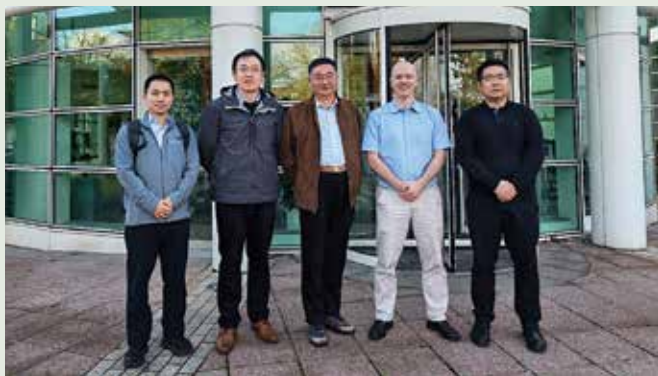
**Photo 4: Visit to the Corrosion Laboratory at The University of Leeds.**

ICorr and CSCP held productive discussions on joint collaborative initiatives, potential bilateral joint research programmes, and co-developed technical guidance for emerging technologies.

### Final Engagement at the National Physical Laboratory (NPL)

The final stage of the visit took place at the National Physical Laboratory (NPL) in London (<https://www.npl.co.uk/>) hosted by Professor Gareth Hinds, a globally respected figure in electrochemistry and corrosion measurement science.

A high-level meeting explored future cooperation on standards development, corrosion testing methodologies, and the potential for coordinated international research programmes that link the UK, China, and broader global partners.



**Photo 5: CSCP President Professor Xiaogang Li (L3), ICorr President Dr Yunnan Gao (Right) and China Delegation Hosted by Professor Gareth Hinds (R2) at NPL, London.**

A detailed tour of NPL’s corrosion labs followed, highlighting UK leadership in precision materials characterisation, CCS (Carbon Capture and Storage) corrosion testing, and corrosion-related metrology.



**Photo 6: Visit to the Corrosion Laboratory at NPL.**

The visit concluded with a symbolic and impactful moment – the ICorr president and Professor Li shaking hands at the end of the visit at NPL, reaffirming the commitment of both organisations to long-term partnership.



**Photo 7: ICorr President and CSCP President - Shaking Hands at the End of the Visit.**

### A Transformative Step for Global Corrosion Collaboration

Professor Li’s visit represents one of the most significant international engagements in ICorr’s recent history. His exceptional global standing – reflected in his pioneering contributions to corrosion big data, materials genome engineering, atmospheric corrosion mechanisms, and the development of advanced corrosion-resistant steels – amplifies the strategic importance of this collaboration. His leadership has had profound influence across China and the international corrosion community, and his engagements in the UK underscore the strong mutual interest in scientific cooperation, talent development, and harmonisation of methodologies across continents.

### ICorr Statement on the Visit

The ICorr President commented: *“This visit marks a new affirmative chapter of international cooperation. Professor Li is one of the most influential corrosion scientists in the world, and the strengthening of ties between ICorr and CSCP will accelerate innovation, unify global communities, and help tackle some of the most complex materials challenges facing society. We look forward to expanding this partnership for the benefit of both nations and the global corrosion community.”*

### Looking Ahead

ICorr and CSCP have agreed to continue developing:

- Bilateral research programmes
- Collaborative standards development
- Exchange opportunities for students and early-career corrosion practitioners
- Joint international webinars, workshops and conferences
- New awards schemes
- Shared initiatives in corrosion data science, materials design, and advanced testing

This landmark visit has not only reinforced the scientific bonds between the UK and China but has also set the stage for a new era of global cooperation in corrosion science and engineering.



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 AGM 2025: A Day of Insight, Recognition and Forward Momentum

The Institute of Corrosion gathered on **4<sup>th</sup> November 2025** for its Annual General Meeting (AGM), hosted this year by the Henry Royce Institute in Manchester. The North-West Branch ensured the day ran seamlessly from start to finish.

ICorr extends sincere thanks to the ICorr team and to all members who travelled – some from considerable distances – to contribute to a lively and well-attended event. The venue’s bright spaces and thoughtful catering choices set a warm tone for the day.



Photo: All Attendees of ICorr AGM in Manchester on 4<sup>th</sup> November 2025.

After a welcome lunch and time to reconnect, the programme opened with the presentation of two distinguished ICorr awards. Professor Damien Feron (as reported already on ICorr CED Announces Professor Damien Féron as the Winner of the 2025 Paul McIntyre Award – Institute of Corrosion) received the 2025 Paul McIntyre Award, recognising his longstanding impact on corrosion science, while the 2025 H.G. Cole Award was presented to ICorr Past President Brian Wyatt (as reported already on H.G. Cole Award 2025 – Institute of Corrosion) for his sustained contribution to corrosion engineering practice. ICorr President Dr Yunnan Gao presented the awards and congratulated both recipients for their work in advancing the field.



Photo: ICorr President, Dr Yunnan Gao (Left) Presenting 2025 Paul McIntyre Award to Professor Damien Feron (Right) at the ICorr AGM on 4<sup>th</sup> November 2025.



Photo: ICorr President, Dr Yunnan Gao (Left) Presenting H.G. Cole Award to Brian Wyatt (Right) at the ICorr AGM on 4<sup>th</sup> November 2025.

The technical programme supported the AGM with four talks spanning current research, industry experience, and lessons from challenging case studies.

- **Fabio Scenini** (University of Manchester) introduced attendees to the breadth of facilities and research capabilities at the Henry Royce Institute, offering a glimpse of the tools shaping the next generation of materials development.
- **Steve Hodges** (Johnson Matthey) explored contrasts and shared challenges between oil and gas and chemical process sectors, particularly in materials selection and corrosion control.
- **Dr Beatriz Mingo** (University of Manchester) presented research into innovative coating deposition methods with promising applications across medical, aerospace, and other high-performance industries.
- **Andrew Piercy** (Intertek CAPCIS) closed the session with an assessment of publicly available findings from the Kashagan oil field failure investigations—an unflinching look at the complexity corrosion engineers must navigate and the critical importance of identifying root causes.

Following the technical sessions, the formal 2025 ICorr AGM kicked off by ICorr President, Dr Yunnan Gao, gave a presentation on ICorr’s successes and achievements in 2025, including national and international growth, developments across the events programme, and the Institute’s newly awarded licence status with the Engineering Council – an important milestone in strengthening ICorr’s professional framework. After that, ICorr Treasurer George Winning updated the members with ICorr’s annual accounts and financial position.

During the 2025 ICorr AGM, members carried out the election of the 2025/2026 ICorr Trustees and Council. The vote was unanimous, confirming that all members serving in the 2024/2025 term have been re-elected to continue in their existing roles for the year ahead.

Before the close out the AGM, ICorr President, Dr Yunnan Gao officially recognised several individuals for exceptional service to ICorr. ICorr Presidents, Stuart Lyon, Brenda Peters, and Paul Lambert were awarded Honorary Life Fellow status for their enduring contributions in 2025. Special thanks were extended to John Fletcher, stepping down from Council, and to David Harvey, Raju Narayan, and Jane Lomas for their considerable work in shaping what has been an energetic and forward-looking year for ICorr. Appreciation is also due to Hempel for supporting the AGM, and to ICorr's Sustaining and Corporate Members for their continued commitment.

Members can find full minutes – covering proceedings, discussions, and formal votes-within the ICorr Members Area: [www.icorr.org/members-area/](http://www.icorr.org/members-area/)

The 2025 AGM closed with a sense of momentum, reflecting a community steadily building the future of corrosion science and engineering.



Photo: ICorr President, Dr Yunnan Gao, Giving A Presentation on ICorr Successes and Achievements in 2025 at the Formal ICorr AGM on 4th November 2025.

## ICorr Proudly Supports the Prestigious 72<sup>nd</sup> Hatfield Memorial Lecture in Sheffield

On the **2<sup>nd</sup> December 2025**, the Institute of Corrosion (ICorr) was proud to serve as a sponsor of the prestigious **72<sup>nd</sup> Hatfield Memorial Lecture**, (<https://sheffield.ac.uk/cmbe/school/events/72nd-hatfield-memorial-lecture>) hosted at the University of Sheffield. ICorr's President, Dr Yunnan Gao, attended the event on behalf of the Institute, demonstrating ICorr's ongoing commitment to supporting academic excellence and advancing corrosion and materials science across the UK.

### A Distinguished Lecture Delivered by ICorr Fellow Professor Mary Ryan



Photo: Professor Mary Ryan.

This year's lecture was delivered by Professor Mary Ryan, CBE, FEng, FICorr, a Fellow of ICorr and Vice Provost (Research and Enterprise) at Imperial College London, <https://www.imperial.ac.uk/about/leadership-and-strategy/provost/vice-provost-research/> who is renowned globally for her work in corrosion,

surface engineering, and nanomaterials. Professor Ryan offered an insightful and forward-looking presentation entitled "Life and Death at the Nanoscale" that captured the attention of industry experts, academics, and students alike. Her lecture continued the long-standing tradition of the Hatfield Memorial Lecture series, which honours metallurgist Professor William Hatfield and has become a cornerstone event for the UK materials and corrosion community.

### Presentation of the Hatfield Award

During the event, Professor Mary Ryan was formally recognised for her significant academic and professional achievements. She received a commemorative award presented by Professor Joan Cordiner, Head of the Department of Chemical and Biological Engineering (CMBE) at the University of Sheffield, marking a highlight of the evening.

### ICorr's Role and Presence at the Event

As one of the official sponsors, ICorr's support was prominently acknowledged throughout the night, including on the main auditorium screen and event materials. The presence of the ICorr President reinforced the Institute's mission to promote collaboration, scientific excellence, and knowledge exchange across the corrosion and materials community. ICorr's involvement with the Hatfield Memorial Lecture reflects its dedication to fostering innovation and supporting both established and emerging experts in the field.

*continues on page 14*

Event Photos



Photo: Overview of Venue of the 72<sup>nd</sup> Hatfield Memorial Lecture.



Photo: ICorr Highlighted as One of the Event's Sponsors on the Main Screen.



Photo: Professor Mary Ryan (Right) Receiving Her Award from the Head of CMBE of Sheffield University.

Advertisement

Understanding microorganisms can help you manage corrosion.

NCIMB's microbiology experts can provide the data you need to understand microbiologically influenced corrosion threat and investigate failures.



Find out more at [www.ncimb.com/mic/](http://www.ncimb.com/mic/)

[e.enquiries@ncimb.com](mailto:e.enquiries@ncimb.com)

# ICorr Branch Updates



## ICorr Aberdeen Updates

**On Tuesday 25<sup>th</sup> November 2025 the Aberdeen Branch welcomed Ian Crossland and Chris Zealand of Mocean Energy Ltd, with a talk entitled 'Our Approach to Wave Energy.'**

### About the Speakers

**Ian Crossland** has been the Commercial Director at Mocean Energy Ltd for five years. He completed his Institute of Directors (IOD) training in 2015 and is a highly motivated business professional with a proven track record of motivating and empowering individuals and building productive teams to deliver results across multiple continents in operations, management, technical sales, strategic marketing and business development.



Photo: Ian Crossland.

**Chris Zealand** became interested in Marine renewables while completing his BSc in Mechanical Engineering Design at the Robert Gordon University. Since graduating in 2007 he has worked as a design engineer with five companies in the oil & gas and renewables sectors, encompassing diverse products ranging from pipeline isolation tools to full-scale wave energy converters. A career highlight was designing and assembling the hinge systems at Pelamis Wave Power.



Photo: Chris Zealand.

Chris is passionate about pioneering design, detailed engineering and his wider role within the company and beyond and enjoys the occasional opportunity to get hands on with mechanical assemblies.

### About Mocean

Mocean Energy Ltd (MEL) is a pioneering ocean energy company developing advanced systems that convert wave motion into reliable, renewable electricity. Its first product, Blue Star, provides cost-effective power for offshore and off-grid applications where energy supply is typically expensive, complex, or carbon-intensive. The design delivers ocean energy technology to provide clean, carbon-free, renewable power. MEL's successful hybridisation of wave energy with solar power, supplemented by energy storage, has been a key part of its efforts to provide a more capable ocean energy platform for continuous power delivery. MEL is developing scalable core wave energy technology which will feed additional markets, from islands to national energy grids.

At the core of MEL's technology is a proprietary hull-shaped Ocean Energy Converter (OEC), engineered using in-house AI optimisation software. This design enables the device to dynamically adapt to varying wave conditions. MEL has two wave energy technologies:

- The **Blue Star**, a commercially ready device that powers a range of subsea equipment, inspection and maintenance systems.
- The **Blue Horizon**, a larger machine designed to generate grid-scale electricity and is being further developed.

Both technologies are based on the same concept – a hinged raft with a unique geometry that improves performance by up to 300 percent compared to traditional hinged rafts and increases survivability by diving through the largest waves.

The original hinged raft concept has been developed through small

scale testing and software to optimise the product and in turn discovering a new hull geometry which moves more in waves and generates from 2 to 4 times more power than the first-generation model.



The Bluestar ocean energy converter self-rights into the dominant wave direction and acts as an energy source and comms station to remote operations on say the seabed. The wave unit has solar panels which provide sufficient energy to run communications and provide backup power and redundancy to subsea batteries and operations. The unit is tethered through a 3-point mooring system with a swivel point, allowing it to maintain station and optimise its position wrt waves, generating max power by its design. Power generated through the hinge and gear system is transmitted to subsea batteries and units via a 'lazy S' dynamic umbilical. On the seabed the umbilical termination unit, or central manifold of an operation, provides the additional energy storage and management systems for subsea operations. Power is distributed to the various subsea operation equipment, such as sensors and actuators.

The Ocean PULSE project is a multiphase offshore pilot to demonstrate the ocean energy converter (OEC) for powering subsea equipment, specifically equipment used in the electrification of subsea oil & gas infrastructure and future carbon capture and storage (CCS), with the intention to qualify the system for commercial projects.

For the Ocean Pulse the Key Project Outcomes achieved were:

- **Back-up power systems in place to help ensure O&G production** in the event of subsea power failures
- **Lower cost and lower environmental footprint CCS projects** through local offshore renewable power and remote communications
- **Offshore power and comms enable deployment of technologies that improve reliability of offshore operations**, such as higher power sensor arrays (e.g. CCS reservoir monitoring) and residential AUVs

*continues on page 16*

- **Offshore power and comms forms part of the solution for unlocking marginal fields**, alongside other technologies for all-electric subsea development and flow assurance.

### Retrieval and examination

MEL discussed the results of their first major trial, showing details of the retrieval and recovery operation and examination of the components with regard to the gear and hinge mechanicals and superstructure integrity.

Refer corrosion focus illustrations below:

- A high level of cathodic protection anode depletion was noted (the energy converter being located in near surface highly oxygenated waters) this will be reviewed and upgraded for longer term project life.
- Despite picking up over a tonne of marine growth and seaweed the added weight was judged to have little overall effect on converter performance.
- Mechanical components showed high resilience to wear and promise for much longer deployment project life.
- There was some structural coating loss observed.

Interim recovery and in-situ service of offshore units for long-term projects may be considered in future trials



### Future Testing

There are two offshore testing phases planned:

**Phase 1: North Sea** – offshore test in 2026-27 of MEL's Blue Star 10 OEC with a dynamic umbilical and simple subsea system in the North Sea;

**Phase 2: Australia** – offshore test in 2028 of a more complex subsea system in a "Subsea Lab" powered by Blue Star 10 and a subsea battery.

The project is to be run as a JIP including operators, Tier 1's, a university and other stakeholders. This was a fascinating presentation generating many questions from the ICorr/IOM3 audience.

Mocean based in Aberdeen and Edinburgh may be contacted at: <https://www.mocean.energy/contact-mocean-energy/>

### Appreciation – Dr Nigel Owen, External Secretary, Aberdeen Branch

We pay special thanks to **Dr Nigel Owen** who has compiled the Aberdeen Event Reports diligently for more than 10 years on behalf of the Aberdeen Branch.

Nigel will hopefully attend some future events, but has now retired from his full-time Managerial duties at Aberdeen Foundries and can no longer be in Aberdeen on a regular basis, unfortunately.

The committee wishes him good health and happiness in his pending retirement and expresses its gratitude to him for his long service to us. We shall all miss his good humour at Committee.

Our President will present a Certificate of Appreciation for his long service to Nigel in due course.



Photo: Dr Nigel Owen Pictured with Aberdeen Vice Chair Eilidh Macdonald.

### Future Events

Please contact our new chair Stephanie Okoye at [icorrabz@gmail.com](mailto:icorrabz@gmail.com) if you wish to join the Aberdeen branch mailing list and please contact [ABZchair@icorr.org](mailto:ABZchair@icorr.org) if you wish to join its committee or to present.



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



# ICorr India Updates

The ICorr India Branch organised a well-attended and technically engaging webinar **“Impressed Current Cathodic Protection of Steel in Reinforced Concrete”** on **11<sup>th</sup> November 2025**, delivered by **Dr Arpit Goyal**, a specialist in corrosion mitigation and durability of reinforced concrete infrastructure.

## About the Speaker

Dr Goyal holds a PhD and postdoctoral qualification from Coventry University, UK, where he developed a patented Concrete Conductive Anode Paint (CAP) system for Impressed Current Cathodic Protection (ICCP). He is currently General Manager (Cathodic Protection Group) at Structural Specialist Projects (India) Pvt. Ltd. and serves currently as Chair of the Institute of Corrosion – India Branch. His previous work includes over 25 peer-reviewed journal papers, book chapters and international conference publications.

## Details of the Presentation

The presentation began with an overview of corrosion mechanisms in reinforced concrete, highlighting the influence of environmental exposure, chloride ingress and material properties. Conventional repair methods were reviewed and their limitations discussed, particularly in chloride-contaminated environments.

Against this background, ICCP was presented as a proven electrochemical technique capable of continually arresting corrosion rather than providing short-term repair.

Dr Goyal discussed ICCP anode systems and shared laboratory and field performance data for the CAP system, demonstrating compliance with BS EN ISO 12696. The webinar concluded with an interactive Q and A session with the large audience.



Photo: Trial Application of Concrete CAP on Bridge Crosshead at Coventry, UK.

### SACP Vs ICCP

Technique	Advantages	Disadvantages
SACP	<ul style="list-style-type: none"> <li>• Simpler installation, design and low maintenance</li> <li>• No external power source required</li> <li>• Less liable to cause interaction</li> <li>• No control system</li> <li>• Low risk of hydrogen embrittlement</li> <li>• Can be applied to prestressed structures</li> <li>• Cost not necessarily lower than ICCP, depending on geometry more anodes may be required</li> </ul>	<ul style="list-style-type: none"> <li>• Unable to control current</li> <li>• Unknown degree of protection</li> <li>• Additional anode required if current demand changes</li> <li>• Limited services life</li> <li>• Not adequate in high resistance environment, has low driving voltage, thus can be used only in less resistive concrete</li> <li>• Monitoring need to be considered at the design stage</li> <li>• Non-uniform anode consumption</li> <li>• Not recommended if chloride content is above 1.5% because service life will be significantly shortened</li> </ul>
ICCP	<ul style="list-style-type: none"> <li>• Controllable current</li> <li>• Adequate in high resistance environment</li> <li>• Higher life span</li> <li>• Minimal effects on concrete</li> <li>• Monitoring shows it is effective</li> </ul>	<ul style="list-style-type: none"> <li>• Need permanent external power source and continuous monitoring</li> <li>• Specialist expertise required</li> </ul>

Photo: Slide From Presentation by Dr Arpit Goyal.



Photo: Slide Concrete Conductive Anode Paint Trials.

## Upcoming ICorr India Branch Events

17<sup>th</sup> February 2026

**Title: Beyond Monitoring: Leveraging AI and Digital Twins for Predictive Corrosion Resilience**

**Speaker: Dr G H Thanki**

### About the Speaker

**Dr G. H. Thanki** is a globally respected corrosion management expert with over 45 years of experience spanning industry, research and consultancy. A pioneer of real-time corrosion monitoring and life-cycle cost analysis, he has advised organisations such as the World Bank and UNESCO, trained professionals across more than 80 companies, and represented India in international arbitration. His distinguished career has been recognised through the NACE Lifetime Achievement Award and the Indian Achievers Award, presented by the Vice President of India.

continues on page 18

### Details of Future Presentation

The corrosion industry is shifting from reactive monitoring towards predictive, data-driven asset management. This presentation outlines the evolution of smart corrosion management, showing how IoT sensor data can be transformed into actionable insight through advanced machine learning. By moving beyond linear degradation models, AI enables real-time estimation of Probability of Failure and Remaining Useful Life. The role of corrosion digital twins is highlighted as a powerful tool for simulating scenarios, optimising mitigation strategies and supporting risk-free decision-making.

### Stay Connected

To stay informed about ICorr India Branch activities and technical programmes, follow us on LinkedIn:

<https://www.linkedin.com/in/institute-of-corrosion-india-branch-india-branch-ab3003379/>

For branch-related queries, please contact: [INDIAChair@icorr.org](mailto:INDIAChair@icorr.org)



# ICorr London Updates

The branch held a technical evening on **13<sup>th</sup> November 2025**, jointly with LMS, when Dr Adamantini Loukodimou talked on the subject of “*Functional coatings for renewable energy applications.*”

Dr Loukodimou has a degree in chemistry, and an MSc in Synthetic Chemistry and Advanced Polymeric and Nanostructured Materials, both obtained at the University of Patras, Greece. She was sponsored by Lloyd’s Register Foundation (LRF) in 2018 to carry out a PhD with the University of Leicester while being based at the National Structural Research Centre (NSIRC) at TWI Ltd. This programme was in collaboration with the Engineering and Physical Sciences Research Council (EPSRC) Centre for Doctoral Training in Innovative Metal Processing (IMPACT), and in 2023, she successfully defended her PhD viva titled “Development of novel coating systems for mitigating corrosion of offshore wind turbines”. Since then, Adamantini has worked as a Postdoctoral Research Associate at the Materials Innovation Centre (MatIC), a partnership between the University of Leicester and TWI. Her research focuses on corrosion, recycling of multilayer coatings based on ‘green’ solvents, and hydrophobic coatings for PV panels.



Photo: Dr Loukodimou Presenting at the London Branch Technical Evening.

Adamantini’s presentation looked at the corrosion protection of onshore and offshore wind towers. More specifically, the talk focused on the development of anticorrosive systems for the atmospheric zone of offshore wind towers, which are subjected to a harsh and corrosive environment. Additional factors such as sunlight and bird droppings can cause irreversible damage. Whereas cathodic protection is commonly used against corrosion in offshore structures, the lack of continuous electrolyte (seawater) proves this method of protection unsuccessful in the splash and atmospheric zones. To extend the service life, minimise the maintenance cost, and ensure the long-term

protection of the metallic structure, anticorrosive systems were investigated. The first part of this research focused on the formation of microcapsules loaded with corrosion inhibitor (a silane), which can act as a corrosion protection system. After the microcapsules’ formation, these were mixed in a waterborne coating in different amounts and applied on carbon steel substrates. Based on the literature, Zn/Al coatings provide good corrosion protection for metallic substrates, acting as a sacrificial layer; hence, they were used to offer additional protection. A multi-layer system of the Zn/Al coating and microcapsule-enriched paint was tested, in order to estimate the coating system’s efficiency against corrosion, by Electrochemical Impedance Spectroscopy (EIS) tests, exposure to a real marine environment for three months, and a salt spray chamber for 1000 hours. This research demonstrated the efficacy of this system and showed potential for future real-world applications.

Functional coatings could also be implemented in other renewable energy applications, such as photovoltaic (PV) panels, which can experience reduced total energy output because of shading. This could be attributed to various factors, such as soiling that blocks the sunlight. Maintaining the cleanliness of the front glass of the solar unit is crucial to fully benefit from its properties, such as spectrum and light transmittance. However, cleaning techniques can be expensive, time-consuming, impractical or unsafe. To address this challenge, using PDMS, a fluorine-free polymer binder, led to the development of transparent coatings with enriched hydrophobicity. Integrating this technology into sustainable energy communities addresses both short-term energy access and long-term sustainable development challenges in renewable energy solutions.



Photo: Committee Member, Berenika Syrek-Gerstenkorn, Presenting Dr Loukodimou with an ICorr Pen.

Dr Loukodimou’s presentation was well received, and there was a lively discussion. She was then presented with an ICorr pen by committee member, Berenika, in appreciation.

This event was followed by a very successful Christmas luncheon on **4<sup>th</sup> December 2025** at the Royal Overseas League in Piccadilly. After an excellent 4-course Christmas-themed meal, the 160 guests were entertained by Ian Richards, who gave a very entertaining after-dinner speech, which was followed by a raffle and time for networking. The branch would like to thank all the companies who sponsored this and the companies who paid for tables for their staff and guests.



Photo: Christmas Luncheon.

For the first meeting of 2026, the branch hosted the AMPP UK chapter on **8<sup>th</sup> January 2026** when George Winning presented “The Critical Role of Impurity Analysis in Ensuring the Integrity of Carbon Capture Use and Storage (CCUS) Projects.”

George Winning is a highly experienced Corrosion Subject Matter Expert (SME) with a distinguished career spanning over three decades in the oil and gas industry. He currently serves as an Engagement Lead in the ALO team at Wood. His expertise covers a wide range of corrosion-related challenges. In the low-carbon sector, his work has included investigating the effects of acid on the corrosivity of dense-phase carbon dioxide and leading a working group within the Wood Joint Industry Project (JIP) focused on impurities and their reactions in CO<sub>2</sub> transport systems. He has published numerous papers on corrosion, corrosion inhibition and, more recently, on Carbon Capture, Use and Storage (CCUS).

George is actively involved in professional bodies such as the Association for Materials Protection and Performance (AMPP), the Institute of Corrosion, and the European Federation of Corrosion (EFC). The successful execution of CCUS projects hinges on the management of several technical criteria, with the integrity of equipment, materials, and critical components being paramount.



Photo: George Was Introduced by the Branch Chair, Paul Brooks.

Recent data indicates that 33% of all unintentional CO<sub>2</sub> releases in existing assets were attributed to equipment or material/weld issues, primarily stemming from corrosion processes influenced by the poorly understood effect of impurities in the CO<sub>2</sub> streams.

The corrosive properties of CO<sub>2</sub>, in both gaseous and dense phases, are highly sensitive to impurities commonly found in the streams, which can adversely affect integrity and operability. The impurities in the stream, after processing, although at low levels, can react to form new compounds, such as acids and secondary aqueous phases, which can impact the integrity of pipelines. These effects must be considered when setting impurity levels for a project. Even seemingly non-reactive species, like glycols and alcohols, can alter thermodynamics and phase envelopes, affecting the solubility of other impurities during phase changes.

Reaction chemistry in CCUS projects is an evolving field with limited experimental data. Testing the effects of impurities is in its early stages, with new methodologies and approaches being developed, but much more is required to fully understand the effects of the impurities.

The presentation discussed the analysis of impurities and their impact on the selection, qualification, and assurance of materials to ensure the proposed asset life is achieved. Various detrimental mechanisms, including corrosion in relation to the impurity levels, were discussed. Current CO<sub>2</sub> corrosion prediction models in aqueous environments are limited in their ability to predict corrosion in pure CO<sub>2</sub> streams and the effect that impurities have. Recent advances in models consider the effect of the impurities and use thermodynamic models to predict the formation of a secondary water phase; examples of this were discussed in the presentation.



Photo: George Was Presented With An ICorr Pen by Committee Member Jim.

Again, this talk was well received, and as is the custom, George was presented with an ICorr pen by committee member Jim Glynn in appreciation.

## Contact Details

For more information about London branch events, please see the ICorr website.

For London Branch updates and enquiries contact:

[londonchair@icorr.org](mailto:londonchair@icorr.org)



# ICorr Midlands Updates

At the final committee meeting of the year, held in mid-December, the Midlands Branch Committee outlined its plans for 2026. A key focus of the discussion was the preparation for the upcoming in-person joint ICorr/EFC WP15 event, scheduled to take place in Cambridge on **21<sup>st</sup> and 22<sup>nd</sup> April 2026**.

Planning for this two-day meeting is well underway, and the scientific committee will soon begin accepting abstracts for presentations. The Annual General Meeting (AGM) of the branch will also be held during this event.

Following a short break from webinars in January, the branch will resume its online programme with two technical webinars on:

- **Cathodic Protection in February 2026**
- **Asset Integrity Engineering in April 2026**

In addition, the committee has approved the 2026 activity calendar, which promises an engaging and diverse programme. Highlights include workshops on soft skills development, Women in Corrosion, and ICorr services, alongside a series of seminars addressing topical issues such as pipeline integrity and other key subjects throughout the year.

For Midlands Branch updates and enquiries contact:  
[midlandschair@icorr.org](mailto:midlandschair@icorr.org)



## ICorr Wales and South-West Host a Technical Event at Swansea University Focused on Corrosion Science and Emerging Coating Technologies

The Wales and South-West Regional Branch of the Institute of Corrosion continued its commitment to delivering high-quality technical learning and professional engagement with its latest in-person event, held on Thursday 20<sup>th</sup> November 2025 at Swansea University's Bay Campus. The session brought together corrosion professionals, researchers, and students for an afternoon dedicated to advancing understanding of corrosion behaviour, dispelling industry misconceptions, and exploring developments in protective metallic coatings.

The first presentation, "Corrosion Myths and Realities: Separating Misconceptions from Evidence," was delivered by Rachael Piper, Materials Scientist at R-TECH Materials. Rachael addressed some of the most persistent misunderstandings surrounding corrosion across industrial sectors, explaining how these misconceptions often lead to poor maintenance decisions, unexpected asset degradation, and unnecessary expenditure.

Drawing on real case studies, she demonstrated how corrosion is far from a simple, uniform process. Instead, it is influenced by an

interconnected set of electrochemical and environmental factors, which can produce outcomes very different from common assumptions. Her talk underscored the importance of evidence-based assessment and a scientific approach to design, materials selection, and preventive strategies.

The second technical presentation, "Understanding Cut-edge Corrosion of Model Coatings on Different Grades of Galvanised Steel," was delivered by Thomas Michael, a postgraduate researcher at Swansea University working in collaboration with AkzoNobel. His research investigated corrosion mechanisms and the behaviour of organic coating systems used in steel construction products.

Thomas presented detailed findings from his study comparing hot-dipped galvanised steel (HDG) with newer alloy coatings containing aluminium and magnesium. By assessing how these materials performed under controlled environmental cycling—complete with model defects introduced through a polyvinyl butyral (PVB) coating—his research revealed clear differences

in corrosion kinetics, delamination behaviour, and long-term degradation mechanisms.

This successful technical event reflects the branch's ongoing mission to support professional development, strengthen regional engagement, and promote scientific understanding in corrosion and materials performance.



Photo: Rachael Piper's Presentation.



Photo: Delegates at the Event and Thomas Michael's Presentation.

### Contact Details

For more information about the branch and upcoming events, contact [swchair@icorr.org](mailto:swchair@icorr.org)

You can also keep up to date on Wales and South-West events by visiting its LinkedIn page; <https://www.linkedin.com/groups/12992293/>

# ICorr Yorkshire and the Humber Updates



The Yorkshire and Humber branch of ICorr celebrated its relaunch on **20<sup>th</sup> November 2025** with an exciting event hosted by the University of Leeds and the Bragg Centre for Materials Research - <https://www.leeds.ac.uk/bragg-centre-materials-research>

Around 30 members from across the region attended to explore the behaviour of metal alloys produced by additive manufacturing (AM).



Photo: The Attendees and Presenters at the Yorkshire and Humber Branch 'Relaunch' Event.

The event focused on the corrosion of AM alloys, an emerging area of interest for both industry and academia. Branch Chair Dr Joshua Owen, University of Leeds, opened the day by sharing the branch's vision and presenting an overview of corrosion research on AM metals at the University of Leeds. This was followed by Sumia Manzoor, a PhD researcher at Leeds, who discussed her work on AM alloys in carbon capture and storage (CCS) environments as part of the MISSION-CCS Marie Curie Doctoral Network. Her presentation highlighted the significant gaps in understanding corrosion-resistant alloys under CCS conditions. The programme also featured Luke Ansell, a third-year undergraduate at Leeds, who shared insights from his ICorr Summer Internship. His eight-week placement combined research at the university with short stints at Intertek Capcis and LBBC Baskerville, giving him hands-on experience in corrosion experiments, failure investigations, and autoclave design.

The keynote address was delivered by Dr Yogi Pardhi, Global Head of Additive Manufacturing at Sulzer in Leeds.

*continues on page 22*



# CSD - Science Council Celebration of Science 2025

The Science Council hosted its annual Celebration of Science on **2<sup>nd</sup> December 2025**, bringing together professionals from across the sector to recognise individuals and organisations that drive progress, professionalism, and excellence.

This year's event marked the launch of our refreshed Recognition Awards, designed to reflect the diversity of roles and contributions across the UK science workforce. The evening's inspiring keynote presentation was from Professor Liz Bentley, Chief Executive of the Royal Meteorological Society, who highlighted the vital role of effective science communication in building public understanding and trust.

We were proud to celebrate all nominees and extend warm congratulations to our 2025 award winners:

- **Apprentice Ambassador Award:** Amin Mirza – Institute of Cancer Research
- **CSci Award:** Prof. Andy Lane (FCASES) – CASES
- **CSciTech Award:** Helen Harden – ASE
- **Elevating the Science Workforce (Team):** Robert Cast, Gemma Norburn, Christian Burt & Samantha Bell – AAPT
- **Elevating the Science Workforce (Individual):** Niru Dorrian – IMarEST
- **RSci Award:** Jamie Mewburn-Crook – IOP
- **RSciTech Award:** Jane Oldham – ASE
- **Volunteer Award:** Sophie Dunajko – Science Council

The event brought together registrants, professional bodies, industry, academia and government partners, showcasing the collaboration that fuels scientific progress.



Photo: Science Council CEO Della Freeth.



Photo: Brenda Peters Hon Sec ICorr and Professor Catherine Ross Science Council President.



Photo: General View of Audience.

Dr Pardhi has been instrumental in integrating AM into Sulzer's production and repair processes for flow machinery components. His talk explored the practical applications of AM materials and the corrosion challenges encountered in real-world operations.



Photo: Dr Yogi Pardhi, Global Head of Additive Manufacturing at Sulzer, Delivering the Keynote Presentation on The Challenges of Using Additive Manufacturing Techniques in Industry.

The day concluded with a series of flash presentations from industry representatives. Yunnan Gao outlined ICorr's recent activities and plans for international expansion, while Ryan Abou-Shakra introduced Young ICorr and opportunities for early-career professionals. Danny Burkle discussed autoclave development at Cortest and LBBC Baskerville, Nick Jackson from Corrocoat shared expertise in advanced coatings, and Will Vickers showcased Ionix's corrosion detection technologies. Attendees then enjoyed a tour of the Bragg Centre's world-class microscopy facilities, led by Dr Steph Foster, offering a glimpse into the cutting-edge tools driving materials research forward.



Photo: Attendees Were Giving A Tour of Materials Characterisation Facilities in the Bragg Centre for Materials Research at the University of Leeds.

The Yorkshire and Humber branch extends its thanks to all participants and looks forward to hosting more engaging events throughout 2026. If you wish to present, or have any questions about the Yorkshire and Humber branch activities, please contact the Chair. Email: [yorkshirechair@icorr.org](mailto:yorkshirechair@icorr.org)



Photo: Dr Joshua Owen, Yorkshire and Humber Branch Chair, Giving A Tour of the Corrosion Lab Facilities at the University of Leeds.



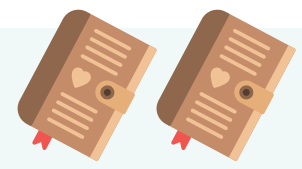
**Please contact Kathy Purnell,  
YICorr Chair for any further information  
at: [YoungICorrChair@icorr.org](mailto:YoungICorrChair@icorr.org)**

**We were very pleased to announce the selected candidates for our 2026 YEP programme, ongoing into 2027 for the winning team members.**

**This year’s programme was 3x oversubscribed and the overall quality of applicants was very high. YICorr offers its many congratulations to all those selected.**

Abish Babu	Lauren Sayer	Reddy Thulasi
Ahmad Usman	Lewis Cation	Sumia Manzoor
Alex Luke	Mai Abdalla	Sydney Coates
Arunima Nair	Mingzhe Zheng	Talia Bayliss
Chijioke Godwins	Miriam Elshiekh	Tasmin Allriott
Daniel Lester	Mohammad Usman Athar	Udit Srivastav
Dylan Clark	Muhammad Haris (Haris)	
Fatima Abdullahi	Muhammad Hashir Zaheer	YEP 2026 officially kicked off on <b>29<sup>th</sup> January at 4:30pm</b> , hosted at the <b>Mott MacDonald</b> offices in Manchester.
Kaivalya Borwankar	Priscilla Ogunlode	

# YEP Journeys – Diary Reflections from AMPP Nashville



**Editor’s Note: We are pleased to have the opportunity to publish the 3<sup>rd</sup> of our series of dairies from the YEP 24 winners.**

**Rochelle-Ann Holness - Materials Engineer  
at Genesis Energies, London**



Photo: Rochelle-Ann Holness with ICorr President Dr Yunnan Gao.

On the **21<sup>st</sup> November 2024** at the ICorr London Branch, I was recognised as being the Winning YEP Individual, for my exceptional case study contributions and presentation skills under Mentor – Chris Googan and I had the incredible opportunity to attend the 2025 Association for Materials Protection and Performance (AMPP) Annual Conference and Expo in Nashville, Tennessee. While I had high expectations, I truly had no idea just how impactful the experience would be. Here’s a look back at one of the most unforgettable weeks of my engineering journey.

## First Impressions and Southern Hospitality

My first taste of Nashville and its legendary Southern hospitality came at the Opening Night Reception. As a first-time attendee, this relaxed and welcoming event offered the perfect way to ease into what was going to be a busy week. The secret challenge for

*continues on page 24*

the night pushed me out of my comfort zone and into conversations with several engineers who worked at Carboline, the night's sponsor (who are also, a generous sponsor of ICorr UK). It was the perfect environment to connect with the YEP team winners and to meet Council members of the Institute of Corrosion (ICorr) who were also conference attendees.

### Diving Into the Technical Sessions

As a materials engineer in the energy industry, I was especially drawn to technical programmes presenting the recent developments in oil and gas, energy transition, and alternative fuels.

One technical programme that stood out to me was *"Chemical Interactions and Corrosion in Impure CO<sub>2</sub> Pipeline Transport"* presented by Johannes Sonke. This session discussed the challenges surrounding the gathering of CO<sub>2</sub> from multiple industrial emitters due to the presence of impurities and their resulting impact on integrity. Sonke delved deeper into the potential chemical interactions of these impurities, which can result in the formation of highly corrosive phases. He approached the topic by first identifying the many potential sources of CO<sub>2</sub>, which included the fermentation of biomass, natural gas treating, direct air capture, the pre-combustion, post-combustion, and oxyfuel combustion of fossil fuels and biomass, as well as other industrial processes (e.g., cement making). From these CO<sub>2</sub> sources, their associated impurities were identified, with a particular highlight on relevant water, oxygen, hydrogen sulphide, sulphur dioxide, and nitrogen dioxide contaminants. These impurities have significant impacts on corrosion due to their ability to react to form sulphur or strong acids (nitric acid and sulphuric acid). Sonke presented chemical equilibrium calculations which provided insight into worst-case compositions with respect to acid formation and drop-out. This chemical equilibration revealed compositions for acid drop-out below previously reported impurity upper limits. I found these results to be extremely useful, especially for the Carbon Capture and Storage (CCS) hub and cluster projects I am involved in. With this new data reported, I am able to provide more suitable guidance on the critical concentration of impurities to avoid acid formation and dropout, as well as quantify the corrosion phenomena in impure CO<sub>2</sub>. Sonke's work, although insightful, is only the beginning of scratching the surface of the corrosion challenges of CCS, and I am keen to learn more about his discoveries in the future.

Another technical highlight was *"Storage Area Assessment for Underground Hydrogen Storage (UHS)- Material Integrity Concerns"* presented by Saba Esmaeely. One of the limiting factors for the large-scale deployment of hydrogen is the development of safe and efficient storage systems. While the underground storage of methane using geological reservoirs such as depleted oil fields, saline aquifers, and salt caverns is well-established, this type of storage is not directly transferable to UHS. The presenter highlighted the need for storage area assessment for UHS that involves hydrogen purity and microbial activity analysis. Although the various types of UHS have large storage capacities, contaminants such as water, CO<sub>2</sub>, organic acids, and other sulphur-containing compounds have the potential to cause accelerated corrosion, as well as result in the escape of hydrogen due to unwanted reactions. Saba discussed these contaminants in detail, outlining their likely sources, impacts, and potential solutions. A subsurface microbial biosphere review of native bacteria and bacteria introduced during drilling, pumping, and mining was noted to be key in understanding the storage impact due to microorganisms. Methanogenesis, acetogenesis, sulphur reduction, and aerobic hydrogen oxidation are examples of processes by microorganisms that can take place in UHS, resulting in the loss of hydrogen. With a global shift towards energy transition and alternative fuels, this presentation provided great context into the world of hydrogen and its current challenges.

### Inspiration Beyond the Technical

With a week designed to promote the new technical efforts within the industry, one of my most memorable moments came from a

different type of session: the keynote speech by NASA astronaut Dr Mike Massimino. Drawing from his experiences in space and his time at NASA, he reminded us that success, whether it's in high-profile space exploration or in equally impactful industries like materials and corrosion, relies on resilience, teamwork, and innovation. Teamwork was the speech's noteworthy theme, with "the team's success is your success" being one of the many one-liners stressing the value of collaboration. This message resonated powerfully with many attendees, as it is not industry-specific but valuable to those who want to overcome challenges with safety, innovation, and efficiency at the forefront. Dr Massimino's address was a powerful reminder that even the most technical work is deeply human at its core.

### A Night to Remember

The EMERGING Leaders Bash was, without question, a highlight of the week, as young engineers were recognised for their excellence across the industry. I had the honour of receiving an award for my success in the YEP alongside the members of the 2024 winning team, as well as national and international scholarship recipients. The night was filled with celebrations, as we shared our achievements and experiences with peers, mentors, and industry professionals. The EMERGING Leaders Bash served as a poignant reminder of the community I'm part of, and the dedication to supporting the next generation of engineers.



Photo: YEP Participants and ICorr Leaders at the EMERGING Leaders Bash.

### Soaking Up the Nashville Vibes

While the conference kept me busy, I made sure to carve out some time to explore Nashville. The city's vibrant culture provided many opportunities to experience food, history, and entertainment in an unforgettable way. I visited Broadway Street every day, each time discovering something new. My standout spots were the National Museum of African American Music, for an immersive and enlightening experience into the history of American music, and Hattie B's Hot Chicken for some of the world's best fried chicken. Regrettably, I left Nashville without a pair of cowboy boots from one of the many "boot barns." However, the memories I brought home are more than enough.

### Full Circle

Attending the AMPP Annual Conference and Expo felt like the perfect capstone to what was already an incredible year with ICorr and YEP. This experience not only allowed me to grow technically but also helped me connect with others across the industry, from fellow young engineers to seasoned experts. I've walked away feeling more inspired, better equipped, and even more excited about the road ahead. Thank you ICorr for creating such valuable opportunities for young engineers to grow, connect, and be recognised. Your continued support of emerging talent in materials and corrosion is appreciated. A special shoutout to Danny Burkle and Izabela Gajewska for their dedication in organising such a valuable experience.

As Dr Massimino said, to be truly "mission-ready", you need to trust your equipment, your training, and your team. I'm taking that mindset with me as I continue my engineering journey. An experience of this magnitude is only the beginning!

# ICorr Training: CPGB – A Year of Achievement New CPGB Chair



We have recently welcomed **Ben Magee** CEng MIEI MICE MICorr | Director at McFarland Consulting Ltd and ICorr Level 4 Cathodic Protection Specialist as our new Chair and offer our full support to him.



## Ben Magee – McFarland Consulting

Ben is no stranger to ICorr and has followed many of its Training courses and participated in several of its events.

## Retiring Chair

The President has awarded a Certificate of Appreciation to Raju Narayan Cathodic Protection Specialist at Cathodic Corrosion Control Ltd, following 3 successful years, as Chair of CPGB and the committee greatly acknowledge his contributions during this time.



Photo: Raju Narayan.

Raju remains with us as a CPGB committee member and ICorr CP Tutor.

## CPSM Report

Our joint CP scheme managers Eva and Bill Whittaker continue to deliver excellent performance for ICorr.

In a grand nutshell, this was our best year ever based on capacity maximisation (typically around 95%), total income and overall profit achieved of ICorr courses.

## 2025 Highlights

- Cadent is currently the biggest investor in ICorr CP training followed by Concrete Repairs Ltd and then Pragmatic (which is the new agent for National Gas).
- There were many bookings made in 2025 for 2026 CP courses, so the year ahead looks very promising for us.
- The CP Buried sector remains the main pulling force for the ICorr scheme but it's great to see finally Concrete courses now taking more prominence and we expect the Marine sector to expand when the planned facility at Blyth opens.
- A total of 233x CP exams were taken last year including resits and we had a 91.4% passing rate across the entire season.

We thank everyone who has supported us during the past year.

## ETGB – Connecting the Corrosion Community Through Training Excellence



### ETGB Chair Introduction

Welcome to the dedicated Engineering Training Governing Board (ETGB) page in each issue of *Corrosion Management Journal*. This space highlights our ongoing work across ICorr training and our commitment to delivering best-in-class corrosion education worldwide.

Our mission is to strengthen meaningful, lasting connections across the global corrosion community—those currently enrolled in our programmes, professionals considering certification and advanced skills, and individuals or organisations interested in developing new training opportunities. Your expectations, experience, and feedback continually shape our direction, ensuring our courses remain relevant, rigorous, and aligned with industry needs.

We warmly encourage subject matter experts - whether retired or active - to contribute to the development of new courses. Your expertise and passion are invaluable.

All proposals undergo peer review by ICorr SMEs to ensure they reflect our standards and support our shared goal of preserving and advancing vital corrosion knowledge for future generations.

*continues on page 26*

We also invite the wider community to join us in expanding our outreach. By helping us raise awareness of corrosion protection practices, you support professionals worldwide as they engage with the latest technologies, methods, and insights.

We look forward to collaborating with you, growing our community, and ensuring that ICorr training continues to lead global professional development in corrosion management.

Get in touch, contact Dr Tony Rizk on: [ETGBchair@icorr.org](mailto:ETGBchair@icorr.org)

Today, we are pleased to highlight two key courses from the ICorr training portfolio:

**Microbiologically Influenced Corrosion (MIC) and Fundamentals of Corrosion Engineering (FOCE).**

**Microbiologically Influenced Corrosion (MIC)**



**Photo: Pipeline MIC Corrosion.**

This intensive programme provides a structured route into Microbiologically-Influenced Corrosion (MIC), offered at three levels: a one-day Awareness course, a four-day MIC Technologist course, and the full ICorr Certified MIC Technologist programme with examination. Across seven focused modules, participants develop a strong understanding of MIC—from corrosion fundamentals and microbial mechanisms to monitoring, inspection, control methods, and material susceptibility. Training includes practical techniques such as field assessment, lab methods, and hands-on MIC identification, supported by real case studies and integration into Corrosion Management Systems. Designed for those working in corrosion, microbiology, asset integrity, or reliability, it is suitable for engineers, scientists, senior technicians, consultants, R&D specialists, and managers responsible for system performance and risk mitigation.



**Photo: Training in MIC Detection.**

**Fundamentals of Corrosion Engineering (FOCE)**

The FOCE course gives engineers essential knowledge of why corrosion occurs, how failures develop, and the practical steps needed to manage, remediate, and prevent damage. The course covers corrosion processes in common engineering metals—stainless steels, aluminium, copper alloys, and galvanizing—and the influence of environments such as immersion, atmospheric exposure, concrete, high temperatures, and buried conditions. Participants gain an understanding of the corrosion engineer’s role through real case studies involving failure investigation, inspection, and testing. The four-day, classroom-based course is delivered in English by an experienced corrosion consultant. All attendees receive a Certificate of Attendance, and those who pass the exam earn a Certificate of Achievement—meeting the corrosion training requirements for direct application to ICorr membership grades including TICorr and MICorr. Delegates have ranged from complete beginners to practicing corrosion consultants.



**Photo: Cathodic Protection in Concrete Monitoring.**

# ETGB Updates



In 2025, we laid the foundations for a stronger corrosion community through the establishment of the ICorr Engineering Training Governing Board (ETGB)—a structure designed to meet industry demands and raise professional standards. It was a year marked by productive collaboration with our membership, committee expansion and meaningful strategic progress.

In 2026, we are committed to building on this momentum by delivering a comprehensive certified training portfolio that meets the expectations of our wider corrosion network and supports the continued growth of competent, confident professionals.

The current Engineering Training Governing Board (ETGB) course portfolio includes:

- ✓ **Boiler Materials Failure, Mechanisms, Inspection and Prevention**
- ✓ **Corrosion Mechanisms in Stainless Steels**
- ✓ **Fundamentals of Corrosion Engineering (FOCE), suitable for TICorr and MICorr membership**
- ✓ **Microbiologically Influenced Corrosion (MIC)**

Further **awareness and more advanced** courses expected to launch in **2026** are:

- ❖ **An Introduction to Failure Analysis**
- ❖ **Corrosion at Home and Its Prevention**
- ❖ **Galvanic Corrosion**
- ❖ **Production Chemistry Fundamentals**

These courses are designed to help professionals advance their careers, enhance their contributions, and protect critical assets across sectors.

We encourage engagement from both seasoned corrosion experts willing to tutor and share their insights, and aspiring professionals looking to grow through our training programmes. Let's continue building a corrosion-resilient future - together.

We have recently welcomed Steve Paterson to our ETGB committee who we know will make a valuable contribution. Steve received the 2019 Paul McIntyre Award in recognition of his outstanding contributions to corrosion science. He holds a BSc and PhD in Metallurgy from Imperial College London and spent 34 years with Shell International in a wide range of materials, corrosion, welding and integrity management roles. His work spanned the research, refining, chemical, and oil & gas production sectors, with assignments in the UK, the Netherlands, Norway and Malaysia. Since retiring from Shell in 2017, he has worked as an independent corrosion and materials consultant and as a part-time lecturer at Robert Gordon University (RGU), teaching materials and corrosion science and management.



Photo: Steve Paterson, New ETGB Committee Member.

For further information, please contact **Dr. Tony Rizk, Chair of the ICorr Engineering Training Governing Board**, at [ETGBchair@icorr.org](mailto:ETGBchair@icorr.org)

For registration enquiries in respect of any of the above 2026 training courses, please email [admin@icorr.org](mailto:admin@icorr.org)

## STGB - TÜV China Training, a Continuing Success Story

TÜV Rheinland, (Technischer Überwachungsverein) are a very well-established ICorr/ARL (Argyll Ruane Ltd) training partner. They are important operating arm of ARL, delivering ICorr courses in many subject areas. They have issued 133x ICorr Training Certifications and 68x ICorr Training Re-Certifications in 2025 alone from their Shanghai Training Centre. Jing Anita Fang is the Key Account Manager for TÜV Rheinland in China.



Photo: TÜV HQ, Shanghai.

### About TÜV Rheinland

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.

### 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 is conducted in coastal cities such as Shanghai, Tianjin, Qingdao, Zhuhai, Qidong, and Zhoushan, where numerous international offshore FSPO and LNG

projects are active. During 2024, ICorr, TÜV Rheinland (China) Ltd., and Argyll Ruane (Sheffield, UK) celebrated 7 years' collaboration and achieved the 1000th ICorr Certificate issue 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 now.



Photo: Recent TÜV ICorr Level 2 Inspector Candidates.

TÜV have some excellent teaching facilities located in Shanghai, very near to the beautiful Daning Lingshi Park <https://hillsshanghai.com/blogs/explore-shanghai/daning-lingshi-park-shanghais-urban-oasis-of-blooms-waterways>.



Photo: All Set For The 2025 Festive Season Ahead, Successful TÜV ICorr Level 2 Protective Coating Inspector Candidates.

TÜV China corrosion prevention courses are offered through ICorr Training Partner Argyll Ruane Ltd **Global Leaders in NDT, Corrosion and Coatings Training.**

Sheffield, England  
4 Europa View  
Sheffield Business Park  
Sheffield S9 1XH

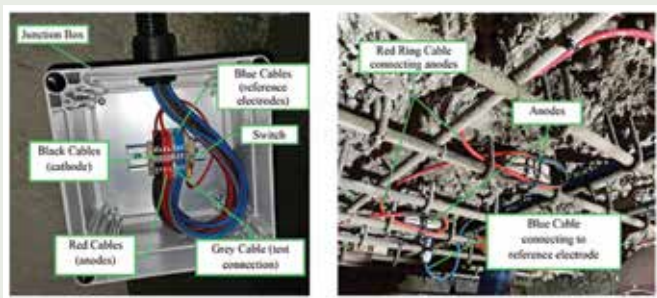


+44 114 399 5720



[enquiries@argyllruane.com](mailto:enquiries@argyllruane.com)





Figures 3 and 4 – Monitored Repair, Edinburgh North Bridge.

Similarly, there is one test connection that is embedded in epoxy resin. This is a grey cable that allows testing against the reference electrodes without current interference. There are 2 reference electrodes, one in the parent concrete (R1) and one tied to the reinforcement to be embedded in the repair spray concrete (R2). These are connected to the junction box by a blue cable.

Before the repair is sprayed with concrete, the area is tested for continuity and the reference electrodes are tested. After spraying, the concrete is left to set so that the junction box can be drilled into the soffit. An initial reading is taken from the box to ensure that everything is working, in which case the switch is left on for 3 months prior to the first data collection.

The data is collected as follows

1. The system is switched on and energised for 3 months.
2. On the date of inspection, the air temperature is recorded, and the as-found current is measured in mA using a multimeter.
3. A potential reading (reference electrode against test connection) is taken for both reference electrodes (R1 and R2).
4. The junction box is switched off, and an instant off potential reading is taken for R1 and R2.
5. The potential is measured for R1 and R2 after 30 minutes, 1 hour, 4 hours and 24 hours to monitor the potential decay as the system depolarises.
6. The data is downloaded using a laptop or other portable device.
7. The junction box is switched on for 3 months. and this process is repeated.

Taking this data, the anode corrosion rate can be calculated using the Butler-Volmer equation (Glass et al., 2008).

$$i_{appt} = i_{corr} \left( \exp\left(\frac{2.3\Delta E}{\beta_c}\right) - \exp\left(\frac{2.3\Delta E}{\beta_a}\right) \right)$$

Where:

$i_{appt}$  = applied current density (mA/m<sup>2</sup>)

$i_{corr}$  = corrosion current density (mA/m<sup>2</sup>)

$\Delta E$  = electrode potential shift (mV)

$\beta_c, \beta_a$  = Tafel constants of the cathodic and anodic reactions, respectively

The current output can be used to estimate an anode lifespan with Faradays Law of electrolysis (Technologies, 2016).

$$m = \left(\frac{Q}{F}\right) \times \left(\frac{M}{z}\right)$$

Where

$m$  = the mass of the substance liberated at an electrode (g)

$Q$  = the total electric charge passed through the substance (C)

$F$  = Faraday constant = 96485 (C/mol)

$M$  = molar mass of the substance (g/mol)

$z$  = valency number of ions of the substance

## Results and Discussion

### Data Analysis

The data has been assessed against criteria as per British Standard 12696, Section 8.6:

*“For any structure, any representative steel in concrete location shall meet any one of the criteria given in 8.6, a) to c):*

- a) An “Instantaneous OFF” potential more negative than -720 mV with respect to Ag/AgCl/0.5 mol/l KCl;
- b) A potential decay over a maximum of 24 h of at least 100 mV from “Instantaneous OFF”;
- c) A potential decay over an extended period (typically 24 h or longer) of at least 150 mV from the instant off subject to continuing decay and the use of reference electrodes (not potential decay probes) for the measurement extended beyond 24 h.

*These criteria apply to all types of cathodic protection system applied to steel in concrete.”*

As well as this, performance verification in the Designer Specification states that “passive steel is indicated by a corrosion rate of less than 2mA/m<sup>2</sup>. A falling trend in corrosion rates is also a sign that protection is being achieved.” 2mA/m<sup>2</sup> = 2µm/year (Stewart, 2022).

The 24-hour decay is the difference between the 24-hour and the instant-off potential. On achievement of one of the criteria or confirmation of passive steel, no further measures are necessary.

MN1 is a repair in the North Span. Figure 5 shows the 24-hour decay for both R1 and R2 within the repair; these are 17 and 24 mV, respectively. As they are both less than 100 mV, the protection in this area does not meet the criteria set out by BS12696. For all 7 repairs, the results were similar. Of the 32 readings collected over all 3 spans of the bridge, only 4 were greater than 100 mV. Observing temperature and current readings with decay did not return any trends.

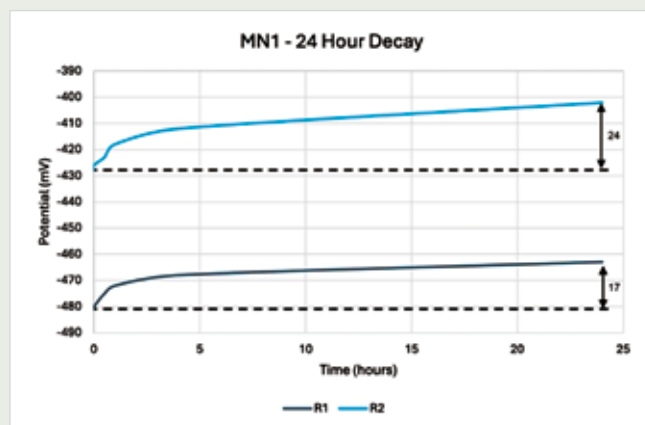


Figure 5 – 24 Hour Decay, MN1.

continues on page 30

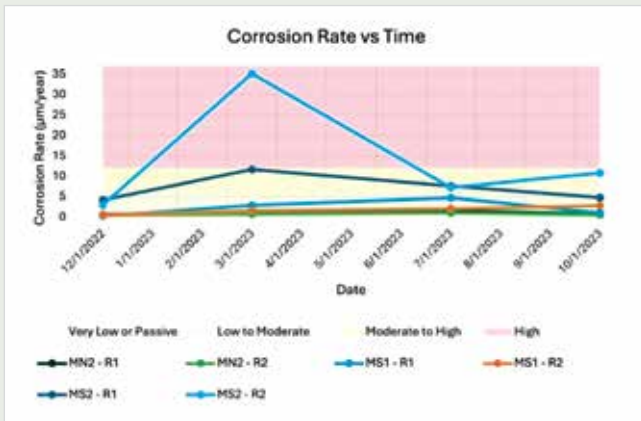


Figure 6 – Corrosion Rate vs Time.

Figure 6 shows the corrosion rates from all the locations with a year of data for ease of comparison. This makes clear an increase in corrosion rate through spring and into the summer and a drop with the most recent reading in mid-October. This highlights the effects of temperature on the anodes. An increase in temperature results in a higher current output and therefore corrosion rate. This is because in a chemical reaction temperature is a control variable, and corrosion is an electrochemical reaction; therefore, a higher temperature speeds up the steel corrosion rate, forcing the anodes to produce more current and undergo consumption faster. The current output also reflects this trend. These results mean that the anodes are adjusting themselves according to demand, making them effectively self-regulating.

Comparing figure 6 with the Designer Specification, a huge number of readings are within the ‘passive’ classification of less than 2 mA/m<sup>2</sup>. Where this is not the case, the corrosion rates are falling, which also indicates the steel is passive and that protection is being achieved.

An estimation of anode lifespan (for locations with a year of data) can be made using an average of the 4 current readings and dividing this by the number of anodes in the repair locations (12). The results give a 19 and 22.5-year anode lifespan in some locations, it is sensible to assume a 20-year replacement time for the systems. It is unlikely that the anodes will perform at this level for their entire lives, as they tend to drop off after around 10 years of service due to an anode aging factor. For this reason, it must be made clear that this estimation of anode lifespan is not the limiting factor for the repair strategies reliability, making the use of a 20-year lifespan for the whole life cycle analysis suitable regardless of these calculations.

Looking at the data analysis, it is evident that the GACP systems are working effectively to provide cathodic protection. In most cases the analysis meets at least 1 of the requirements of standard protection, and the systems show signs of lasting their full employment period with possibilities of exceeding this. Though it is a positive result, the question of whether GACP is the best fit for the project can only be answered on investigation of the whole life impacts; this is explored, allowing for a just review of the repair strategy.

**Life Cycle Analysis**

To adequately quantify the costs and environmental impacts of each strategy, the expected lifespan of the GACP was taken as 20 years, which was confirmed by calculations using the data collected on site.

**Cost Analysis**

Figure 7 shows the costs of both strategies over a whole life period

of 120 years, as this is the design life Atkins quoted for a full deck replacement. From this, we can see that the initial cost of a full deck replacement is 3 times that of the GACP systems. The gradient of the lines is similar, meaning the running costs are very close; the only difference is a slight discrepancy between the costs of a principal inspection and that GACP requires annual maintenance that is not necessary for a full deck replacement. Due to the lifespan of the anodes being roughly 20 years, after 60 years, which is half of the deck design life, the cost of GACP exceeds that of a full deck replacement. Although initially the establishment cost is lower for GACP, in the long term it is a more expensive strategy.

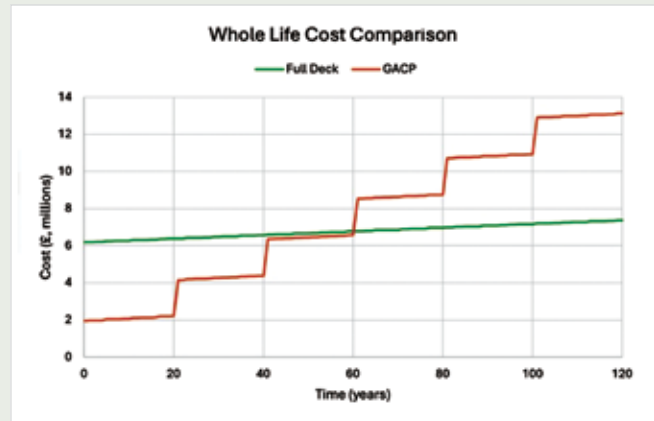


Figure 7 – Whole Life Cost Comparison, GACP vs Full Deck Replacement.

This is showing a case when GACP is continually renewed, and there is no guarantee that GACP would be chosen every 20 years; however, figure 7 highlights that it is in fact a short-term fix rather than a long-term solution. When considering only the costs, the more expensive initial cost of a full deck replacement will be beneficial over its whole life.

**Environmental Analysis**

Materials considered for the environmental analysis of GACP included spray concrete, steel rebar, zinc anodes and embedding mortar. Table 1 shows the embodied carbon results per stage of product life cycle. The most intensive stage was B, use. This can be attributed to the lifespan of the components. This analysis was over a whole life of 120 years, however the components employed for GACP are often replaced after 20 or 30 years which drives up the embodied carbon associated with stage B. Materials considered for the environmental analysis of a full deck replacement included concrete, steel rebar, steel angles and Formwork Panels. Table 2 contains the results of the embodied carbon calculations sorted into stages. The ‘product and construction’ stage is the most carbon intense for this strategy. It is likely that this is because of the volume of concrete required for a deck replacement. The old concrete deck sections that were removed were taken off site by Hamilton Waste and ground down to aggregate for use as recycled material, thus promoting a circular economy and contributing towards the negative value of stage D.

Table 1 – GACP Embodied Carbon Results.

GACP	A – Product and Construction	B - Use	C – End of Life	D – Beyond the Life Cycle
Total (tCO <sub>2</sub> e)	61	197	17	0

Table 2 – Full Deck Replacement Embodied Carbon Results.

Full Deck Replacement	A – Product and Construction	B - Use	C – End of Life	D – Beyond the Life Cycle
Total (tCO <sub>2</sub> e)	1272	337	96	-33

To calculate the Structural Carbon Rating Scheme (SCORS) grade from A++ to G, stage A must be converted into kgCO<sub>2</sub>e and divided by the bridge's gross internal area.

The SCORS value for GACP is 16 kgCO<sub>2</sub>e/m<sup>2</sup>, which is a rating of A++. This is a very positive result. The SCORS value for a full deck replacement is 333 kgCO<sub>2</sub>e/m<sup>2</sup>, which is an E rating. This is a low rating; however, this is expected with a scheme of this nature where copious amounts of concrete are required.



Figures 8 & 9 – SCORS Rating for GACP and Full Deck Replacement, Respectively.

Figure 10 shows the cumulative embodied carbon of each strategy over a whole life period of 120 years. This can be compared with figure 7, as this is the same concept; however, in this case, embodied carbon is the unit of cost. In figure 7, the cost of GACP overtakes that of a full deck replacement; however, in this case, the embodied carbon of GACP does not come close even after 120 years.

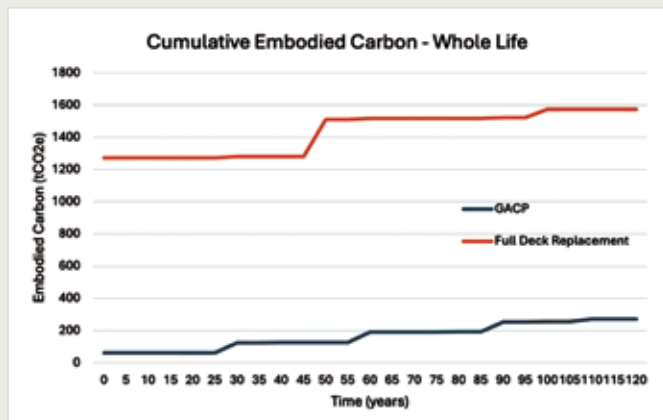


Figure 10 – Comparison Of Cumulative Embodied Carbon Over Whole Life.

Figure 10 clearly shows the increase in emissions due to component replacements. These increments of roughly 50 tCO<sub>2</sub>e per replacement result in much higher embodied carbon values than initially intended and highlight the importance of using long-lasting materials. This is something that can be overlooked in the design stage, but substitution during construction or the replacement of specific components can be beneficial to the project over time. This figure once again confirms that repairs are always less carbon intensive than replacement.

How the industry values its expenses is critical in an evaluation of whole life; it should be made clear that money is not the only unit of cost!

## Conclusion

A quantitative analysis of live site data and consideration of the whole life cost and environmental implications of the repair strategy when compared with a full deck replacement allowed for a critical analysis of cathodic protection for the Edinburgh North Bridge refurbishment.

The live data from the monitored repairs provided confirmation that the GACP was working effectively with the aim of repair life extension and prevention of the incipient anode effect. Analysis also returned estimations of anode lifespans of 20 years, meaning that with residual effects, the bridge deck repairs could last up to 30 years before the initiation of concrete deterioration. Nevertheless, as a repair strategy, it is considered a short-term solution rather than a permanent fix. The GACP is essentially buying time and providing an extended maintenance cycle from 2-5 years to 15-30 years.

The whole life cost analysis demonstrated that a full deck replacement would have been a less expensive strategy in the long term. With the bridge being a main artery of the city and the consequent impact on stakeholders, it is understandable that these constraints pushed for a quicker and less disruptive fix to ensure the bridge is repaired to the best possible standard.

Additionally, possibilities of future deck alterations, for example, the installation of proposed new tramlines, would make a full deck replacement needless. Without a guarantee of GACP being re-employed after its use, this analysis is limited; however, it has proved beneficial in showing how quickly the 'repair and prevent further deterioration' strategy exceeds initial cost expectations.

Embodied carbon calculations constituted proof that repair is environmentally less harmful than replacement, both initially and over a whole life. Attention was drawn to the materials and replacement stages of the whole life cycle as they returned the highest values for embodied carbon across both strategies.

GACP is preferable, as it is closer to the UK's net-zero emission targets, and sustainability should be at the forefront of industrial decisions.

Although working effectively, the GACP repair strategy is considered not suited to the project service life in the long term and results in unnecessary expenditure as time passes. On the contrary, the use of a repair rather than a replacement is preferable environmentally, suggesting that an alternative, longer-lasting, ICCP-based repair strategy would be better suited to the project.

## References

1. Atkins 2020. Concrete deck defects additional patch repair deck slab typical details sheet 5 of 6. *NBR-ATK-SBR-HY622\_101\_9-\_BN-DR-CB-002024*.
2. Glass, G. K., Roberts, A. C. & Davison, N. 2008. Hybrid corrosion protection of chloride-contaminated concrete. *Construction Materials*, 161, 163-172.
3. Stewart, B. 2022. Edinburgh north bridge refurbishment phase. *Series 1700 Structural Concrete Specification Appendices*. Atkins.
4. Technologies, V. C. 2016. Validation specification version. Vector Corrosion Technologies.

### Editor's Note:

This article should be read in conjunction with our Edinburgh's £86M North Bridge Refurbishment feature published in the July/August 2025 issue.

# Industry News

News from ICorr Corporate Members and Other Industry News

## bp Announces Leadership Transition as Meg O'Neill Appointed Chief Executive Officer



bp p.l.c. has announced a major leadership transition with the appointment of **Meg O'Neill** as its next Chief Executive Officer, effective **1st April 2026**.

Meg O'Neill will succeed **Murray Auchincloss**, who has stepped down from his role as CEO and Board director.

Meg O'Neill joins bp from **Woodside Energy**, where she has served as CEO since 2021. Prior to Woodside, O'Neill spent 23 years at ExxonMobil, holding senior technical, operational and leadership roles across multiple global regions, including North America, Southeast Asia, Canada and Norway.

From a technical and asset integrity perspective, leadership changes at this level are closely watched across the energy sector. bp operates a complex global portfolio of upstream, midstream and downstream assets, many of which involve ageing infrastructure and demanding operating environments. Strategic decisions taken at executive level directly influence investment in corrosion management, materials selection, inspection technologies and life extension programmes.

In her statement, Meg O'Neill highlighted bp's critical role in delivering energy globally and expressed her commitment to

advancing safety, innovation and sustainability. Her background in large-scale asset integration and operational transformation is expected to be particularly relevant as bp continues to balance conventional energy production with its evolving low-carbon strategy.

The leadership transition underscores bp's intent to sharpen execution and strengthen its competitive position in a rapidly changing energy landscape, where technical integrity, reliability and cost-effective asset management remain central to long-term success.



Source: <https://www.bp.com/>

## Carboline Launches Traceable Intumescent Coating for Structural Steel Fire Protection

Carboline has announced the launch of Thermo-Sorb HB, a high-build, elastomeric intumescent coating designed for both shop and field application on structural steel. Rated for up to 3.5 hours of fire resistance, the new product represents a notable advancement in passive fire protection technology, particularly for demanding construction and industrial environments.

Based on Carboline's patented elastomeric intumescent technology, Thermo-Sorb HB has been developed to withstand mechanical damage during application, transport and construction phases. The solvent-based coating cures rapidly, achieving weather resistance within one hour, making it well suited to accelerated and open-frame construction schedules where early exposure to environmental conditions is unavoidable.

A key innovation associated with Thermo-Sorb HB is the incorporation of **Optifire® taggant technology**, which enables real-time traceability of the coating throughout its service life. Unlike conventional construction materials, which typically lose traceability once installed on site, Optifire technology allows detection of the coating in its wet and dry film states, as well as in the resultant char following a fire event.

From an asset protection and compliance perspective, this capability offers significant advantages. Traceability supports quality assurance during application, facilitates inspection and verification during service, and enhances warranty protection. For owners,

inspectors and insurers, the ability to confirm product identity years after installation addresses a longstanding challenge in fire protection systems.

Michael Hollman, Global Intumescent Product Manager at Carboline, described the product as a major enhancement to the company's Thermo-Sorb portfolio, enabling designers and contractors to optimise fire protection solutions across a wider range of fire durations and exposure conditions.

Although Thermo-Sorb HB is currently available across North America, its technical features are highly relevant to global markets, including the UK and Europe, where regulatory scrutiny of passive fire protection systems continues to increase. For corrosion and materials professionals, intumescent coatings must often perform dual roles, providing both fire resistance and long-term durability in corrosive or mechanically challenging environments. By combining high fire resistance, rapid curing and traceable performance assurance, Thermo-Sorb HB reflects a broader industry trend towards smarter, more verifiable protective coating systems that support lifecycle asset management and regulatory compliance.



Source: <https://www.carboline.com/>

# Hempel Introduces Hempaline Defend 430 to Improve Tank Lining Efficiency in the Energy Sector

Hempel has expanded its high-performance lining portfolio with the launch of **Hempaline Defend 430**, a solvent-free epoxy phenolic tank lining designed to improve efficiency, safety and durability in energy storage applications. The new product is aimed at operators seeking to reduce downtime, extend inspection intervals and lower total lifecycle costs.

Hempaline Defend 430 is engineered for **single-coat application at 400 µm**, significantly simplifying installation compared with traditional multi-coat systems. Its rapid curing properties enable a return to service in as little as **three days at 20°C**, reducing outage durations and associated energy use during maintenance campaigns. The solvent-free formulation delivers additional benefits in terms of health, safety and environmental performance. By minimising volatile organic compound (VOC) emissions, the lining reduces occupational exposure risks for applicators and supports compliance with increasingly stringent environmental regulations.

According to Hempel, trial applications conducted with a major tank builder demonstrated measurable productivity gains, particularly due to reduced inspection time compared with conventional linings. This is a critical consideration for fabrication workshops and tank owners operating under tight delivery schedules. From a technical standpoint, Hempaline Defend 430 offers strong resistance to hydrocarbons and elevated temperatures, withstanding crude oil service up to **93°C**.

The lining is approved for sensitive cargos, including **potable water (WRAS)** and **jet fuel (EI 1541)**, making it a versatile solution for a wide range of storage applications.



Inspection intervals can be extended up to **five years** when applied in accordance with API 652 and API 653 guidelines, with optional glass fibre mat reinforcement. Compatibility with Hempaline Prepare 130 primer further enhances its suitability for immersion service at elevated temperatures.

For corrosion engineers and asset integrity managers, tank linings play a critical role in preventing internal corrosion, contamination and unplanned failures. The introduction of solvent-free, high-build linings such as Hempaline Defend 430 reflects a growing emphasis on efficiency-driven maintenance strategies that align technical performance with sustainability goals.

As energy infrastructure continues to age and operational demands increase, innovations in lining technology that reduce maintenance frequency while maintaining robust corrosion protection will remain central to safe and reliable storage operations.

Source: <https://www.hempel.com/>

## Corrosion Communications Awarded its First Impact Factor: 9.5

Corrosion Communications, a diamond open access journal published by Elsevier, publishes the latest advances and significant achievements in corrosion and protection research worldwide, covering the full scope of the field. Its content spans corrosion mechanisms and protection technologies; advanced corrosion-resistant materials design; corrosion inhibitors and functional protective coatings; corrosion and mitigation strategies in extreme environments; multiscale modeling of corrosion processes and service life prediction; and advanced corrosion monitoring and intelligent detection techniques. This journal is currently indexed in major databases, including **ESCI, Ei Compendex, Scopus, and DOAJ**.

On June 18<sup>th</sup>, 2025, Clarivate Analytics released the **2024 edition of the Journal Citation Reports (JCR)**. We are proud to announce that Corrosion Communications has received its first Impact Factor (IF) of 9.5, following its launch in 2021. In the category of **METALLURGY & METALLURGICAL ENGINEERING**, *Corrosion Communications* ranked **4th out of 96 journals (4/96, Q1)**.



**To understand Corrosion, we need Communications !**

As we celebrate this important milestone, we sincerely invite you to join us in building an outstanding platform for the dissemination of scientific achievements, and in exploring the unsolved mysteries in the field of corrosion and protection.

Website: <https://www.sciencedirect.com/journal/corrosion-communications> | E-mail address: [cc@imr.ac.cn](mailto:cc@imr.ac.cn)

icats

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

# Fellow's Corner

.....  
 This series of articles is intended to highlight industry-wide engineering experience, guidance and focussed advice to practising technologists. It is written by ICorr Fellows who have made significant contributions to the field of Corrosion Management.  
 .....

## A Comparative Study of Indirect Inspection of Cross-Country Gas Pipeline for Internal Corrosion Through ILI and ICDA

J N Agrawal, FICorr



### Meet the Author



J N Agrawal

**J N Agrawal** holds a B Tech in Electrical Engineering and an MBA in Marketing Management. He has a long and varied experience of 40 years in oil and gas industry in Pipeline Integrity and Cathodic Protection. He is a consultant and CEO of Corrsol Tech, providing services in the field of Asset Integrity, Corrosion Management and Cathodic Protection. He has presented several papers on different topics of Corrosion Control and Cathodic Protection in AMPP and ASME conferences. He is the recipient of Corrosion Awareness Award by AMPP India Chapter in 2023 for his contribution to the field of corrosion science and technology in industrial organisations, certified as a CP Level 4 ICorr CP specialist and Fellow of ICorr UK. He is author of several books on Cathodic Protection and Pipeline Integrity Management.

### Introduction

Internal corrosion is a serious hazard in a pipeline transporting natural gas with a mixture of water and corrosive constituents that may accumulate in low spots and cause internal corrosion. The content of water and other corrosion impurities in natural gas has been listed in Appendix A (Non-mandatory) in the AMPP standard SP 0106: Internal corrosion of pipelines. The main impurities in gas are water, bacteria, carbon dioxide, chloride, hydrogen sulfide, oxygen, etc.

The systematic steps in controlling internal corrosion in gas pipeline start from analysing the specifications of these corrosion constituents in the gas to be transported and then controlling their content by extraction of these impurities (or chemical inhibition) and further monitoring online these constituents.

Second step is to carry out inspection, monitoring and testing of internal corrosion through several methods such as visual inspection, corrosion coupons and probes, Inline inspection, pressure testing, NDT inspection and following Internal Corrosion Direct Assessment.

The statutory requirements of inspection and monitoring for internal corrosion have been given in the Petroleum and Natural Gas Regulatory Board (PNGRB) T4S and IMS standards for natural gas 'piggable' pipelines (ICDA). These refer to In-line inspection (ILI) and ICDA at an interval of 10 years for sweet gas and 5 years for sour gas. For non-piggable pipelines, ICDA can be carried out for the same frequency.

This paper presents a comparative study of results obtained from two inspection and assessment methodologies, In-line inspection and ICDA. about metal loss due to internal corrosion. The results indicate the limitations and degree of inaccuracies in the inspection and assessment of following only ILI and not supplementing with ICDA. While in a 'piggable' pipeline, ILI is possible, but ICDA is

the recommended method for detection of internal corrosion. Other monitoring methods such as online monitoring of product specifications, corrosion coupons and probes, and NDT should be continued along with ICDA.

### Research Significance

The significance of research lies in the fact that the accuracy of the metal loss due to application of only one method, such as ILI cannot be relied on because it may not be perfect despite of all precautions. It has been shown by actual case studies that the recorded metal loss from ILI was not accurate and caused gas leakage in due course of time and metal loss was found considerable, possibly due to poor pipe cleanliness at the time of inspection.

Further, in another pipeline, the dig verification indicated a mismatch in the result of ILI and ICDA. This established the fact that it will be wise to carry out both ILI and ICDA and carry out dig verification based on these findings.

### Materials and Methods

The pipeline was API 5L X60 grade, 18" diameter, 90 Km, a wet and sour gas pipeline with wall thickness of 9.52 mm, commissioned in 2000. Both ILI and ICDA were conducted in the year 2010. The two methods of detection and quantification of internal corrosion in carbon steel pipeline due to the presence of water and other constituents in a natural gas were adopted. Both ILI and ICDA were conducted in the year 2010. Magnetic Flux Leakage (MFL) detected metal loss, while ICDA projected low elevation areas susceptible to metal loss. The metal loss features detected and projected by two methods were verified by dig verification and carrying out NDT at the projected location of metal loss.

- MFL-A detects corrosion in the circumferential direction but not in the axial direction. Hence, metal loss in the axial direction will not be detected by MFL-A. Both MFL-A and MFL-C tools are required to detect corrosion in both circumferential and axial directions. In addition, MFL tool may fail to detect and size some corrosion features due to limitations like variation in wall thicknesses particularly, in seamless pipe, flow of the product, residual magnetism, stresses in the pipe, lack of magnetic strength in thick-walled and less diameter pipe, lack of detecting smaller and near surface defects, and stuck in the pipeline due to accumulated debris and dust.
- ICDA or Internal Corrosion Direct Assessment is a four-step process that helps assess and manage internal corrosion in pipelines, forecasting accumulation of water and other corrosive elements by a multiphase modelling system. However, ICDA also has limitations, such as errors in computing elevation profiles or the location of water hold-up, susceptibility to corrosion, lack of prediction of sizing or features of internal corrosion, etc.

The dig verification and direct measurement of corrosion features, including sizing, indicated vital information regarding the prediction of internal corrosion by MFL and ICDA. The variations in location and sizes of internal corrosion as predicted by two methods were apparent, while it was also surprising that some of the defects were not predicted by one method or another, clearly each having their limitations.

### Results and Discussion

The results of the two detection methods, MFL and ICDA, are represented with different tables and graphs as shown below. The wall loss based on ILI at low elevation is shown in Figure 1. The graph shows orientation and sizing of defects, chainages, and elevation. The interpretation can be drawn based on the graph about relationships among elevation, sizing of the defect and its orientation.

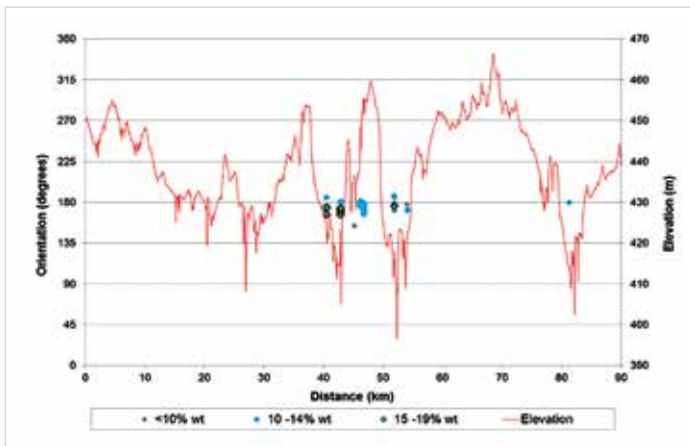


Figure 1. Graph Showing Wall Loss Based on ILI at Low Elevation.

Figure 2 shows an elevation vs inclination graph based on the Dry Gas (DG) ICDA approach. Elevation profiles can be drawn based on pipeline alignment drawings. Inclination angle is the angle formed by the pipeline segment relative to a horizontal plane.

It is essentially the slope of the pipeline, which is based on the elevation profile. A sudden change in the elevation will cause variation in the inclination angle.

A drop in elevation increases the inclination angle and may result in the accumulation of water at the bottom and cause internal corrosion as per DG-ICDA. Critical angle is the angle where the possibility of corrosion increases if the inclination angle is more than the critical angle. Critical angle can be computed by a formula which has different gas parameters such as pressure, temperature, and flow.

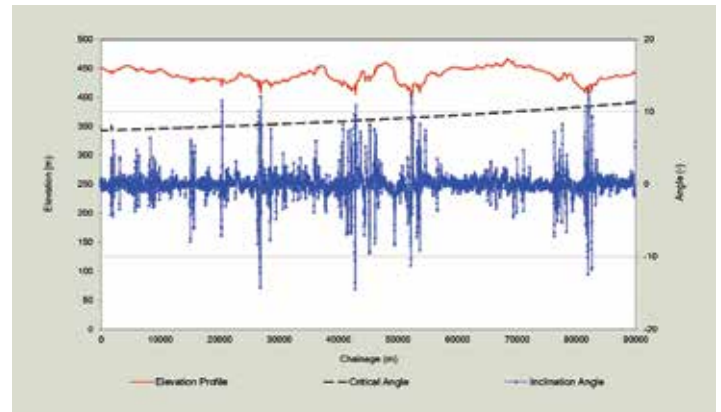


Figure 2. Elevation vs Inclination Based Graph on ICDA.

Table 1 shows comparison of defects detected by ILI and ICDA. The defects are based on the graph 1 and 2.

Table 1: Comparison of Defects Detected by ILI and ICDA.

Chainage m	Inclination angle	Critical angle	Corrosion reported by ILI	Corrosion detected by ICDA	Remark
20420	11.5	8	No	No	1. The locations of higher inclination angle than critical angle may not be subjected to internal corrosion.
26920	12.0	8.2	No	No	
42916	10.8	8.8	18%	18%	2. ILI may also pin point wrong locations or indicate lesser or more defect sizes.
42660	9.6	8.8	18%	18%	
52265	12.2	9.2	19%	No	
52489	8.6	8.2	10-14%	19%	
82076	12.7	10.7	10%	No	

**Note:** Corrosion reported by ILI is based on detection by tool, not by dig verification but corrosion detected by ICDA was based on its prediction on accumulation of water and subsequent dig verification. The anomaly is indicated in the remark.

### Conclusions

The following conclusions are drawn in this case study from the above two graphs and Table 1.

1. There is a mismatch of detection of corrosion loss and its sizing at some of the locations as indicated by ILI and ICDA.
2. The prediction that metal loss may be more at lower elevation and where inclination angle is more than critical angle is not always true as shown in the table.
3. ILI indicates metal loss at some locations where metal loss is not observed or there is inaccuracy in the sizing of metal loss. The limits of the ILI tool to be deployed are best verified before the ILI run takes place.
4. The corrosion loss is indicated mostly at the 6 o'clock position and at a lower elevation.
5. The key factors of internal corrosion are the presence of water and corrosive constituents at the 6 o'clock position.
6. The recommended remedial measures include frequent cleaning, corrosion monitoring and identification of critical areas for water hold up by ICDA for probable internal corrosion and verification by ILI.
7. The dig verification and NDT are done based on detection of metal loss by ILI and identification of water accumulation areas by ICDA.
8. The purpose of carrying out both ILI and ICDA is to locate probable water hold up areas and verification of metal loss and its sizing by dig verification.

### References

1. ASME B31.8: 2010 Gas transmission and distribution piping systems.
2. ASME B31.8S-2010 Managing system integrity of gas pipelines.
3. SP 0106-2006 Control of internal corrosion in steel pipelines.
4. SP 0110-2010 Wet gas internal corrosion direct assessment methodology.
5. SP 0206-2006 Internal corrosion direct assessment methodology for pipelines carrying dry natural gas.

# Establishing Atmospheric Corrosion Test Sites in Alaska for Monitoring and Assessing Cold-Climate Infrastructure Degradation



Dr Raghu Srinivasan, PhD



## Meet the Author



Dr Raghu Srinivasan

**Dr Raghu Srinivasan** is an Associate Professor and Chair of the Mechanical Engineering Department and Director of the Environmental Degradation Laboratory (EDL) at the University of Alaska Anchorage (UAA). He received his MS and PhD degrees in mechanical engineering at the University of Hawaii at Manoa in 2005 and 2010, respectively. Dr Srinivasan’s research focuses on atmospheric and marine corrosion, materials compatibility, and corrosion in oil and gas infrastructure, with a strong emphasis on Arctic and sub-Arctic environments. He currently serves as the Chair of the Research Society Leadership Council (RSLC, 2025–2027) and served as Vice-Chair of the Research Programme Committee (RPC, 2023–2025) for the Association for Materials Protection and Performance (AMPP). He has been recognised with multiple awards: UAA’s Chancellor Award for Research, the NACE Foundation Book Scholarship Award, the Harvey Herro Best Poster Award, the Materials Performance Corrosion Innovation of the Year Awards (2019 and 2023), and the NACE International Research Seed Grant (2019).

## Introduction

Atmospheric corrosion is a complex process, which involves chemical, electrochemical, and physical changes to the metal exposed. Atmospheric corrosion occurs when a metal surface is under a thin layer of moisture, but not completely immersed, and the metal surface corrodes while exposed to environmental factors. The atmospheric corrosion damage in cold environments is close to the main human activity, which is concentrated near the coastal areas. The substantial human growth and climate change in the Arctic and sub-Arctic region push for a renewed, better understanding of the atmospheric corrosion mechanisms that can lead to a good choice of materials selection and better design practices for infrastructure and other applications. This article describes the development of multi-angle corrosion test racks that were deployed at four test sites across Alaska, each distinct in their environment and equipped with weather sensors and chloride candles.

## Atmospheric Corrosion in Cold Climates

The Arctic and sub-Arctic region identified by the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) [1] has an average temperature of  $-18^{\circ}\text{C}$  or less during winter. The most common assumption is that there is very little to no corrosion in cold environments [2]. However, previous studies in the Antarctic and Arctic regions have disproved that notion, finding that corrosion rates are substantial [3-5]. The atmospheric corrosion damage in cold environments is close to the main human activity, which is concentrated near the coastal areas. Previous studies in the sub-arctic region of Canada, Norway, and Russia show extensive atmospheric corrosion rates (when compared to Antarctica) due to human developments and the resulting increase in mining and metallurgical industries [2]. Experimental and theoretical work has shown that the electrochemical process proceeds at temperatures as low as  $-25^{\circ}\text{C}$  to  $-20^{\circ}\text{C}$  [6-7].

Sereda measured the potential between platinum and zinc electrodes at  $-20^{\circ}\text{C}$ , concluding that when an electrolyte is present, corrosion will proceed [6]. Moreover, very little corrosion data is available for metal alloys exposed to cold conditions. Studies by Divine and Perrigo [5] in Anchorage, Alaska; Biefer [8] in the

Canadian Arctic and sub-Arctic sites; Kucera et al. [9] in Scandinavia; and Mikhailov et al. [10] in eastern Siberia have shown corrosion rates of carbon steel close to the C1 category of the ISO 9223 classification (Table 1).

**Table 1: One-Year Corrosion Rates and Corrosion Categories.**

Categories	Classification	Steel (g/m <sup>2</sup> )	Copper (g/m <sup>2</sup> )	Aluminum (g/m <sup>2</sup> )	Zinc (g/m <sup>2</sup> )
C1 (Very Low)	Rural	<10	=0.9	Negligible	=0.7
C2 (Low)	Urban	11-200	0.9-5	0.6	0.7-5
C3 (Medium)	Temperate Marine	201-400	5-12	0.6-2	5-15
C4 (High)	Tropical Marine	401-650	12-25	2-5	15-30
C5 (VeryHigh)	Industrial	651-1500	25-20	5-10	30-60

Even though the corrosion rates are lower than the C1 category, the substantial human growth and climate change in the Arctic and sub-Arctic region push that envelope. Because of this, there is a case to add a cold climate category to the classification. Factors that drive the atmospheric corrosion in cold climates are winds that can bring in salt-laden snow from the marine environment, and the use of de-icing salts can also contribute to high levels of chlorides [2]. The eutectic point, or the freezing point, of de-icing salts can be lowered to  $-50^{\circ}\text{C}$ , melting the ice/snow layer on top of metal samples [7]. This phenomenon keeps metal samples moist for much longer periods, thus increasing the time of wetting (TOW).

In the presence of chlorides and moisture, extensive atmospheric corrosion damage can be observed on metal samples. Another contributing factor to high corrosion rates is low rainfall, which in turn cannot periodically wash off the deposited chlorides and  $\text{SO}_2$  on top of the samples [2]. In addition, ever-increasing ambient temperatures due to climate change in recent years affect the snow presence on top of the metal samples [11]. The temperature of the samples is not too high to evaporate the deposited snow/ice but high enough to cause melting and sustain moisture for longer periods of time. This leads to the formation of varying thicknesses of wet ice/snow layers on the metal surface. Long hours of sunlight in the summer also increase the surface temperature of metal samples beyond the ambient temperatures, causing dew formation and condensation, which in turn results in higher TOW.

## Multi-Angle Test Rack Design

The design and methodology of atmospheric corrosion test racks have been guided by several pivotal standards over the years. Prominently, the ASTM standard G50: "Standard Practice for Conducting Atmospheric Corrosion Tests on Metals," and more particularly subsection five concerning exposure racks and frames, has served as an instrumental reference point for this research herein [12]. Similarly, ISO 8565, "Metals and alloys—Atmospheric corrosion testing—General requirements for field tests," was another crucial standard consulted during the design process [13]. Over time, atmospheric corrosion test racks have seen iterative developments to address specific research requirements. Notable research endeavors that have trod a similar path include studies conducted in diverse geographies. These studies offer a comparative perspective and serve as benchmarks for the current investigation. A seminal study from 1995 introduced an atmospheric test rack design that facilitated specimen exposure across various orientations and angles [14]. Subsequently, a research team from the University of Hawaii devised the "Compact Octagonal-Prism Portable Exposure Rack" (COP-PER) to specifically assess the impact of wind direction and specimen orientation on corrosion rates [15]. Additionally, collaborative efforts from Spain and Portugal resulted in the development of a tree-shaped rack, designed to concurrently evaluate specimen orientation and exposure angle in atmospheric corrosion studies [16].

Traditional test racks used for atmospheric corrosion monitoring are often inadequate for Arctic deployment. They cannot withstand snow loads, high winds, or severe temperature swings. To address this, a modular and adjustable atmospheric corrosion test rack was designed, later patented in the United States as US 11,499,909 B2. The rack design includes adjustable exposure angles (0°, 30°, 45°), a modular aluminum frame, integrated sensors, and corrosion-resistant construction (Figure 1).

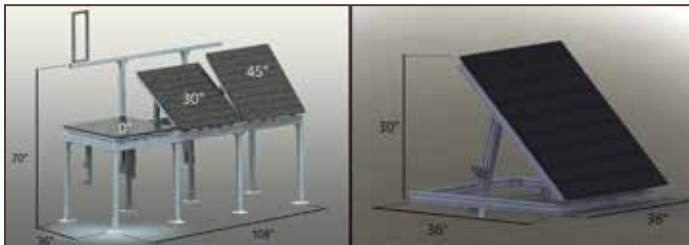


Figure 1: Adjustable Multi-Angle Corrosion Test Rack.

Atmospheric corrosion standards recommend an exposure angle of 30 degrees from the horizontal, facing south, and the lowest specimens be at least 30 inches above the ground. Time of wetness is one of the main parameters for atmospheric corrosion testing and can vary drastically depending on the angle of the exposed surface. This modular and adjustable corrosion test rack allows us to change the direction of exposure (north, south, east, or west) and the angle of exposure (0, 30, or 45 degrees to horizontal). These changes can be made easily and will save time when future adjustments are required for different exposure angles and directions. Lastly, this design can support a full weather monitoring system (Figure 2). These parameters include, but are not limited to, relative humidity (RH), ambient air temperature, TOW, rainfall, wind velocity, UV radiation, barometric pressure, and aerosol chloride and sulfate deposition.

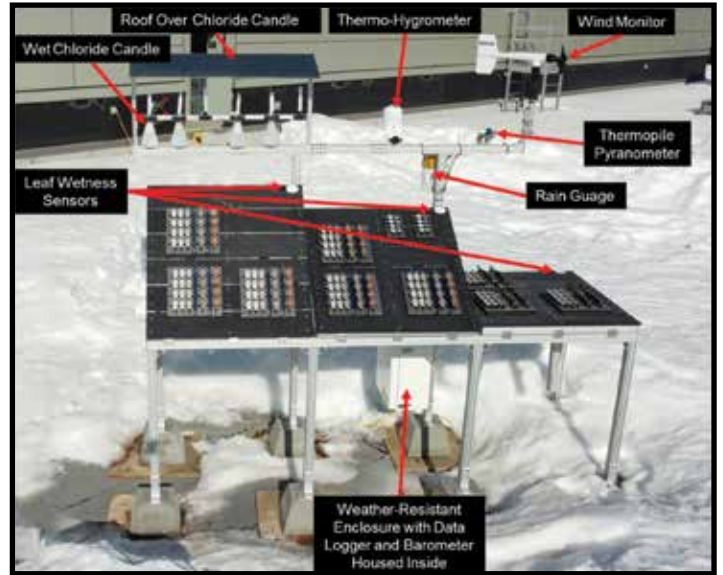


Figure 2: Multi-Angle Corrosion Rack with Auxiliary Weather Station.

## Establishing Test Sites

Four strategic locations were selected as preliminary testing sites, with site selection and characterization heavily influenced by ASTM G92 "Standard Practice for Characterization of Atmospheric Test Sites" [17]. Their positions can be referenced in Figure 3, which provides a map of Alaska.

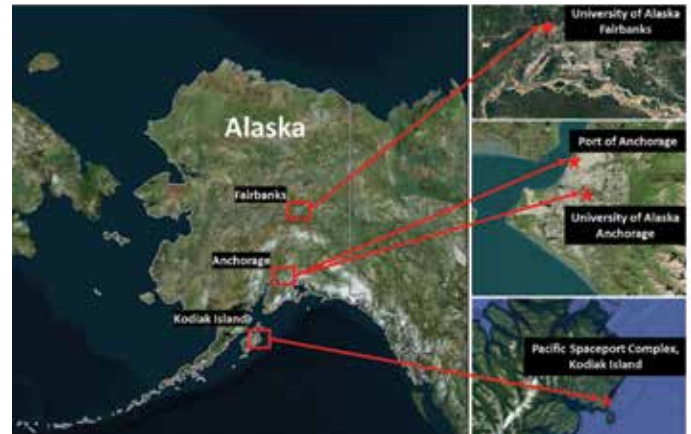


Figure 3: Map of Alaska Showing Four Corrosion Monitoring Sites.

## Kodiak, AK – Pacific Spaceport Complex (PSCA) – Aggressive Marine Environment

Kodiak, AK, represents the aggressive marine environments commonly found along the southern and southeastern coastlines of Alaska. Coastal cities, such as Kodiak, receive on average a steady coastal breeze averaging 9 knots (4.6 m/s), average yearly precipitation of 65 inches (1651 mm), and average ambient temperatures of 41°F (5°C). This creates an aggressively corrosive environment with relatively steady electrolyte exposure from rainfall and high relative humidity levels, as well as steady prevailing winds that provide high deposition rates of aerosol-borne Cl-

*continues on page 38*

During the summer months, Kodiak experiences a maximum daily sunlight period of approximately 16 hours at the summer solstice and a minimum of 6.5 hours at the winter solstice. Both the summer and winter solstice are indicative of the maximum and minimum number of sunlight hours, respectively. This provides for periods of consistent solar irradiance exposure, which are maximized during the summers in Alaska. The exact exposure site is located in close proximity to the Pacific Spaceport Complex on Kodiak Island. Using pre-existing structures places the exposure rack ~5-6 feet elevated from the ground level and ~600 feet from the open ocean water.

### Anchorage, AK – University of Alaska Anchorage (UAA) – Mild Marine Environment

Of the two exposure sites operated in Anchorage, AK, one resides at the University of Alaska Anchorage (UAA) and represents a very mild marine environment. Positioned 25 miles farther north than Kodiak, this site presents colder average temperatures and lower average precipitation rates comparatively. The average ambient temperature in Anchorage is 39°F (3.9°C) with an average precipitation of 16.9 in (430 mm). Both Anchorage sites typically exhibit lower average levels of relative humidity and receive lower Cl<sup>-</sup> deposition rates than those of Kodiak, but still experience these coastal effects, being only slightly offset from the shoreline. Anchorage sites receive longer periods of daily sunlight exposure, reaching upwards of 18.5 hours at the summer solstice and lowering to 5.5 hours at the winter solstice. This again provides generous solar irradiance exposure that is maximized during the summer months. At UAA, the particular exposure site is positioned on a building roof and is therefore elevated above the ground floor by ~30-45 feet. The site is also positioned much farther from the shoreline of the neighboring head of both the Knik and Turnagain Arm by ~4 miles. Where Kodiak is positioned far from any industrial or urban environment, UAA is positioned only a couple of miles from the downtown center. UAA is therefore more apt to be influenced by associated factors with urban areas, such as vehicle emissions and combustion byproducts, among others.

### Anchorage, AK – Port of Alaska (POA) – Moderate Marine Environment/Mild Industrial Environment

The second of the two exposure sites, which operates in Anchorage, AK, resides at the Port of Alaska (POA, or “The Port”) and represents two environmental types with varying positions. Being situated similarly to the UAA site, all of the previous meteorological averages and data also apply to this site. The Port of Alaska handles the majority of fuel and freight cargo in Alaska, and it is an understatement that it is the lifeline of the Alaskan people. Its proximity to the ocean and constant truck movements make the Port of Alaska a strategic location to collect atmospheric corrosion data. In summary, upon inspection, the site presents a less corrosive environment than Kodiak does, with ample summer time solar irradiance exposure.

### Fairbanks, AK – University of Alaska Fairbanks (UAF) – Inland Urban Environment

The last site is operated in Fairbanks, AK, at the University of Alaska Fairbanks (UAF), which best represents an inland urban environment. The summers are warmer than both Anchorage and Kodiak, with an average temperature of 60°F (15.6°C). However, the winters are much colder, with average winter temperatures of -4.3°F (-20°C). Average annual precipitation levels are the lowest of the four sites at 12.4 in (~315 mm). Fairbanks, being situated in a more northern location than Anchorage, receives exceptionally long periods of sunlight during the summer months, exceeding 21 hours at the summer solstice. During winters, the inverse occurs with a mere 4 hours of sunlight at the winter solstice. This provides an incredibly large amount of solar

irradiance exposure during the summer months relative to the other sites. Due to Alaska’s sheer size, Fairbanks lies approximately three hundred miles (~500 km) away from the nearest coastal area, which provides quite radical and unique weather challenges during the winter months. The particular site lies atop the Usibelli Engineering Building at approximately four stories, thus elevating the exposure rack ~60–72 feet above the ground floor.

While the exposure to airborne Cl<sup>-</sup> and SO<sub>4</sub><sup>2-</sup> is expected to be considerably lower than at 28 Kodiak due to the relative positioning from open bodies of salt water, respectively, the UAF exposure site does typically experience an elevated exposure to airborne SO<sub>4</sub><sup>2-</sup>. Interior Alaska is abundant in individual residential heating solutions for the winter months. The most common combustion sources include heating oil and wood. Both produce either primary or secondary SO<sub>4</sub><sup>2-</sup> within the atmosphere, with primary SO<sub>4</sub><sup>2-</sup> generally making up the most significant percentages. Fairbanks’ geographical characteristics are also highly conducive to frequent temperature inversions during winter. Temperature inversions most often cause cold air masses to settle beneath larger warm air masses. In effect, this traps any and all airborne contaminants within the lower-lying cold air masses. Trapped contaminants then have a longer period and a chance to deposit on the sample surfaces. Additionally, UAF also sits across the street from the University Power Plant. Table 2 gives a detailed layout of each test location and geographical coordinates.

Table 2: Test Sites’ Coordinates, Distance From Sea, and Elevation.

Test Site	Coordinates	Distance to nearest body of salt water	Height (above ground level)
PSCA	57.435°N, 152.346°W	~600 feet (183 m) from Gulf of Alaska (Pacific Ocean)	0 feet (0 meters)
UAF	64.855°N 147.817°W	~250 miles (400 km) from Pacific Ocean ~350 miles (560 km) from Arctic Ocean	60 - 72 feet (18 - 22 meters)
PAA	61.239°N, 149.888°W	~30 feet (9 m) from Kinik Arm (Pacific Ocean)	30 - 36 feet (9 - 11 meters)
UAA	61.192°N 149.822°W	~4 miles (6.4 km) from Gulf of Alaska (Pacific Ocean)	30 - 45 feet (9 - 13 meters)

### Some Notable Results and Trends

Figure 4 delineates the ambient air temperature at the PSCA site, which, during the winter months, dips below the freezing mark on several instances and occasionally falls beneath -5°C. Despite these sporadic plunges, the overall trend captured by the solid red line indicates that the ambient air temperature stays above 0°C throughout the entire year-long exposure period, with the mean average, illustrated by the dotted red line, stabilizing around 6°C. The PSCA’s proximity to the Pacific Ocean, a mere 600 feet away, confers a stabilizing effect on its air temperature, moderating the extremes that might otherwise be observed. The climatic profile of Fairbanks, Alaska, is characterised by its starkly contrasting temperatures, with intense cold in the winter and, unexpectedly, notable warmth in the summer. As depicted in Figure 5, the ambient air temperature at the UAF site plummets to a frigid -35°C in December 2022 and soars to 28°C by late June 2022.

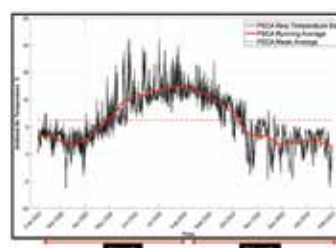


Figure 4: Ambient Air Temperature at PSCA – Raw vs Averaged Data.

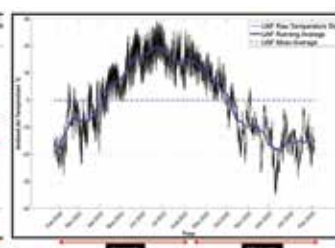


Figure 5: Ambient Air Temperature at Fairbanks – Raw vs Averaged Data.

Table 3 shows the calculated chloride and sulfate deposition rates for each test site over each exposure. The PSCA site has four to seven times the amount of chlorides when compared to UAF and UAA, the PAA test sites. Figure 6 depicts the corrosion rates for 1008 carbon steel (UNS G10080) for a 12-month exposure period. The carbon steel samples at the PSCA site exhibited corrosion rates at least four times greater than the carbon steel samples exposed at UAF, PAA, and UAA.

This can be attributed to the weather data, where PSCA recorded at least four times the amount of chloride deposition, and the samples spent at least 18% more time wet through all sites and exposures. At the PSCA site, a distinct correlation was observed between the exposure angle and corrosion rate. Samples exposed at 0° showed the highest corrosion rates, followed by those at 30°, with the lowest rates seen at 45°. The TOW data indicates that the 0° angle samples remained wet for longer periods compared to 30° and 45°. Although the other sites - UAF, PAA, and UAA - exhibited less pronounced trends and experienced four times less corrosion than PSCA, the samples at 0° consistently showed higher corrosion rates than those at 30° and 45°.

Table 3: Chloride and Sulfate Deposition Rates.

Test Site	Chloride Deposition [ $\frac{mg}{m^2 \cdot day}$ ]			Sulfate Deposition [ $\frac{mg}{m^2 \cdot day}$ ]		
	1 <sup>st</sup> 6 mo.	2 <sup>nd</sup> 6 mo.	Full 12 mo.	1 <sup>st</sup> 6 mo.	2 <sup>nd</sup> 6 mo.	Full 12 mo.
PSCA (~600 feet from ocean)	119.1	71.6	95.4	22.5	18.0	20.3
UAF (~250 feet from ocean)	25.0	12.0	18.5	3.3	8.7	6.0
PAA (~30 feet from ocean)	30.4	15.4	22.7	2.8	7.1	5.0
UAA (~4 feet from ocean)	26.5	9.0	17.6	2.3	5.2	3.8

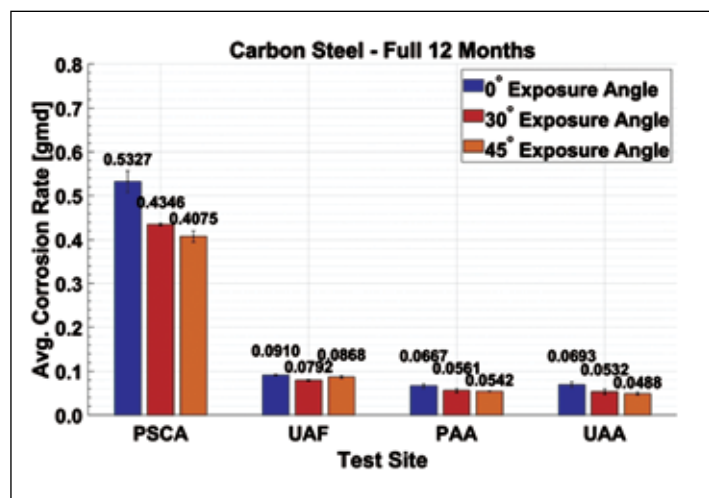


Figure 6: Average Corrosion Rates of 1008 Carbon Steel Over Full 12-Month Exposure Period.

### Corrosion Rate Conversion

The following table is useful to put the above corrosion rates into context for the four test regions above.

Table 4: Corrosion Rate Conversion.

Unit	mA cm <sup>-2</sup>	mm year <sup>-1</sup>	mpy	gm <sup>-2</sup> day <sup>-1</sup>
mA cm <sup>-2</sup>	1	3.28 M/nd	129 M/nd	8.95 M/n
mm year <sup>-1</sup>	0.306 nd/M	1	39.4	2.74 d
mpy	0.00777 nd/M	0.0254	1	0.0694 d
g m <sup>-2</sup> day <sup>-1</sup>	0.112 n/M	0.365 /d	14.4 /d	1

### Conclusion

New and innovative multi-angle corrosion test racks, each with auxiliary weather stations, were established at four test sites spanning across Alaska, USA. Each of Alaska's four test sites presents a distinct

corrosion profile: Kodiak (PSCA) exhibits high chloride-driven corrosion, Anchorage (PAA/UAA) faces freeze-thaw cycles with de-icing salts, and Fairbanks (UAF) experiences frost-dew cycling. Initial field campaigns revealed a clear correlation between exposure angle and corrosion rate. The combination of urbanization and proximity to marine environments makes Arctic and sub-Arctic regions in North America, particularly Alaska, an important natural laboratory to study atmospheric corrosion in cold regions and the development of predictive models and corrosivity maps tailored for Arctic conditions. The fundamental knowledge of studying the basic atmospheric corrosion mechanisms in extreme cold conditions will result in better design practices for the built environment in the changing Arctic.

### Acknowledgements

The author acknowledges the UAA's College of Engineering and ConocoPhillips Arctic Science and Engineering Endowment, NASA EPSCoR CAN grant, and the many undergraduate students and collaborators who contributed to the design, installation, and operation of the corrosion monitoring sites across Alaska. Special thanks to graduate students Mr Tyler Cushman, Mr Jozef Huner, Mr Lawrence Giron Jr., Mr. Jacob Bodolosky, and machinist Mr Corbin Rowe. The author also gratefully acknowledges the organizations that provided access and site space for test rack installation, including the Pacific Spaceport Complex-Alaska (Kodiak), the Port of Alaska, the University of Alaska Anchorage, and the University of Alaska Fairbanks.

### References

1. E A Wright, CRREL's First 25 Years: 1961-1986, US Army Cold Regions Research and Engineering Laboratory, Hanover, NH, 1986.
2. Revie R. Winston (2000) Uhlig Corrosion Handbook, 2<sup>nd</sup> Edition. New York: John Wiley & Sons, Inc
3. ASTM Committee G1 "Corrosiveness of Various Atmospheric Test Sites as Measured by Specimens of Steel and Zinc," in Metal Corrosion in the Atmosphere, ASTM STP 435, American Society for Testing and Materials, Philadelphia, PA, 1968, pp. 360-391.
4. E. A Pearce and C G Smith, The Hutchinson World Weather Guide, Hutchinson, London, 1984.
5. J R Divine and L D Perrigo, "Atmospheric corrosion testing in the arctic and subarctic—a review," Paper No. 389, in Proceedings of the Corrosion 86 Conference, NACE, Houston, TX, 1986.
6. P Sereda, "Weather Factors Affecting Corrosion of Metals," in Corrosion in Natural Environments. ASTMSTP 558, American Society for Testing and Materials, Philadelphia, PA, 1974, pp. 7-22.
7. G W Brass, "Freezing depression by common salts: implications for corrosion in cold climates," in Proceedings of the National Association of Corrosion Engineers, Canadian Region Western Conference, Anchorage, Alaska, 1996, pp. 447-453.
8. G A Bieffer, Mater. Perform., 20(1), 16 (Jan. 1981).
9. V Kucera et al., "Corrosion of Steel and Zinc in Scandinavia with Respect to the Classification of the Corrosivity of Atmospheres," in S.W. Dean and T. S. Lee (Eds.), Degradation of Metals in the Atmosphere, ASTM STP 965, American Society for Testing and Materials, Philadelphia, PA, 1988, pp. 264-281.
10. A Mikhailov, M Syloeva, and E Vasilieva, Data Base on Atmospheric Corrosivity in Towns and Industrial Centres in the Territory of the Former USSR, Institute of Physics and Chemistry, Russian Academy of Science, Moscow, 1992.
11. A A Mikhailov, P V Strekalov, and Yu M Panchenko, "Atmospheric corrosion of metals in regions of cold and extremely cold climate (a review)", Protection of Metals, 2008.
12. ASTM G50, "Standard Practice for Conducting Atmospheric Corrosion Tests on Metals," ASTM International, 2020. doi: 10.1520/G0050-20.
13. ISO 8565, "Metals and Alloys. Atmospheric Corrosion Testing. General Requirements," BSI Standards Limited, 2011.
14. S. Coburn, M Komp, and S. Lore, "Atmospheric Corrosion Rates of Weathering Steels at Test Sites in the Eastern United States — Effect of Environment and Test-Panel Orientation," in Atmospheric Corrosion, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959: ASTM International, 1995, pp. 101-101-13.
15. L H Hihara, J Kealoha, and N Das, "Studying the effect of wind direction and specimen orientation on the corrosion of 1018 steel using a compact octagonal prism portable exposure rack," NACE, 2019.
16. J J Santana, et al., "The influence of test-panel orientation and exposure angle on the corrosion rate of carbon steel. mathematical modelling," Metals (Basel), vol. 10, no. 2, p. 196, Jan. 2020.
17. ASTM G92, "Standard Practice for Characterization of Atmospheric Test Sites," ASTM International, 2020.

# Case Study - Investigating the Dynamics of Atmospheric Corrosion and the Impact of Climate Change in Mauritius



Yashwantraj Seechurn, PhD



## Meet the Author



Dr Yashwantraj Seechurn

**Dr Yashwantraj Seechurn** is a senior lecturer in the Department of Mechanical and Production Engineering at the University of Mauritius. He teaches asset management at postgraduate level, and his main research interests include atmospheric corrosion, marine corrosion, materials chemistry, coatings, and surface engineering. He has presented at various international conferences and has many publications in international peer-reviewed journals. In 2019, he received a Commonwealth split-site PhD award for research in corrosion engineering at the University of Southampton. Yashwantraj is now actively involved in corrosion research as a principal investigator, striving towards achieving better corrosion prediction techniques and prevention strategies. He employs both field and accelerated lab-based corrosion testing, followed by advanced characterisation and modelling in his working approach. One of his most notable achievements is the development of the first corrosion map for Mauritius. He is also the chairperson of the Mechanical Engineering Standards Committee of the Mauritius Standards Bureau.

## Introduction

Mauritius has a tropical climate with only two seasons: summer, which is hot and humid, and winter, which is colder and drier. In the absence of spring and autumn seasons, transition months indicate when the seasons shift. January and February are usually the most humid and the warmest, with the average daily high temperature reaching 29.2°C (Mauritius Meteorological Services, 2026). Furthermore, the later summer months (February and March) are the wettest. However, rainfall varies significantly across the island; the central plateau receives the majority of the island's rainfall, while the sheltered west coast receives far less.

Within Mauritius, climate change adds a layer of urgency to managing atmospheric corrosion. Changes in pluvial precipitation patterns and wind regimes are expected to affect pollutant deposition and thus influence corrosion in coastal and industrial areas (Valdez *et al.*, 2016). For instance, stronger winds can increase the inland reach of marine aerosols and industrial plumes, exposing new regions to higher chloride (Cl<sup>-</sup>) and sulphur dioxide (SO<sub>2</sub>) deposition (Alcantara *et al.*, 2017; Tasic *et al.*, 2013). Similarly, shifts in rainfall intensity and frequency could lead to changes in atmospheric corrosion rate (Alcántara *et al.*, 2017). Wind is the primary driver for the transport of atmospheric pollutants, including Cl<sup>-</sup> and SO<sub>2</sub>. Wind speed and direction dictate the distance pollutants travel and their concentration at a given location. The effect is highly dependent on the direction of the wind relative to the pollutant source and the exposure site location (Santucci, Davis and Sanders, 2022; Daneshian *et al.*, 2023). Also, increased wind speeds (> 3 - 5 m s<sup>-1</sup>) enhance wave breaking and turbulence, accelerating marine aerosol production (Alcantara *et al.*, 2017; Madawala *et al.*, 2024). However, higher wind speeds can also dilute SO<sub>2</sub> concentrations depending on the wind direction. Several studies have noted that higher wind speeds are generally correlated with lower SO<sub>2</sub> concentrations due to atmospheric dilution and mixing (Tasic *et al.*, 2013). This effect was seen in urban-industrial environments. However, pollutant deposition may still increase if the monitoring site is located directly downwind of emission plumes (Tasic *et al.*, 2013).

Rainfall also plays an important role in the atmospheric deposition of both SO<sub>2</sub> and Cl<sup>-</sup>. In general, low to moderate rainfall increases the surface moisture, which acts as an electrolyte, facilitating the dissolution of pollutants on exposed metal surfaces (Alcántara *et al.*, 2017). For instance, rain promotes the formation of sulfurous and sulfuric acids by absorbing SO<sub>2</sub> from the atmosphere, thus accelerating corrosion. Similarly, Cl<sup>-</sup> in marine aerosols is more readily deposited during precipitation, leading to sustained surface conductivity (Alcántara *et al.*, 2017). However, heavy rain (more than 600 mm) efficiently removes deposited pollutants from exposed surfaces, exerting a cleansing effect (Vera *et al.*, 2018). The overall influence of rain on pollutant deposition rate also depends on its frequency. Intense and frequent rainfall can reduce surface corrosion by continuously washing off deposits (Gobinddass *et al.*, 2020; Zhao & Li, 2013).

Relative humidity (RH) and temperature (T) are two of the most influential climatic parameters affecting pollutant deposition rate, and consequently corrosion rate (Michel, Nygaard and Geiker, 2013; Cai *et al.*, 2020). An electrolyte film is formed on a metal surface when RH reaches the critical relative humidity (CRH) threshold, which subsequently triggers corrosion. High RH facilitates the dissolution of SO<sub>2</sub> into atmospheric moisture and on surfaces (Cai *et al.*, 2018, 2020). Similarly, Cl<sup>-</sup> deliquesces and adheres more readily to surfaces at RH > 75%, leading to a higher deposition rate. RH is dependent on T, which influences the evaporation and condensation of water vapor (Michel, Nygaard and Geiker, 2013). The period during which the water film is present on a metal surface is indicated by the Time-of-Wetness (TOW) (Hoseinpoor, Prošek, and Mallégo, 2025). Rainfall, dew and melting snow are some factors contributing to the formation of water films on metal surfaces (ISO 9223, 2012). TOW integrates the effect of RH and T. It is measured as the number of hours RH > 80% and T > 0°C in a year (ISO 9223, 2012). Higher TOW values indicate longer periods of water film presence, increasing the rate and severity of the corrosion process (Cai *et al.*, 2020; Hoseinpoor, Prošek, and Mallégo, 2025). Temperature fluctuations affect RH, thus increasing the frequency of wet/dry cycles. High temperatures also accelerate the chemical reactions. A temperature increase of two units is likely to increase the corrosion rate by approximately 15% (Cai *et al.*, 2018).

This study, specific to Mauritius, provides an insight into the time effects of changes in climatic factors on atmospheric corrosion by performing field exposure of metal samples and comparing the corrosion kinetics with those obtained about a decade ago.

### Materials and Methods

Carbon steel plates of size 150 mm × 100 mm × 3 mm were exposed in two different service environments in Mauritius (Figure 1): Port-Louis - PL (marine-industrial) and Medine Camp de Masque - MC (rural). All samples were mounted at 45° to the horizontal as per ISO 8565 (2011) (Figure 2). Figure 1 also shows sites SJ and PL (previous), where field exposures of carbon steel specimens were performed over a decade ago (Surnam & Oleti, 2012). MC lies 2.4 km from SJ (also rural), while the site in PL is just 1.1 km away from the previous one. Given the proximity, MC and PL (current) have the same environmental characteristics as SJ and PL (previous), respectively. To determine the effect of the environment on corrosion kinetics, the deposition rates of SO<sub>2</sub> and Cl<sup>-</sup> were measured using the Huey lead dioxide plate and wet candle methods, respectively, according to ISO 9225 (2012). Furthermore, the TOW was estimated from daily RH variations obtained from the Mauritius Meteorological Services.

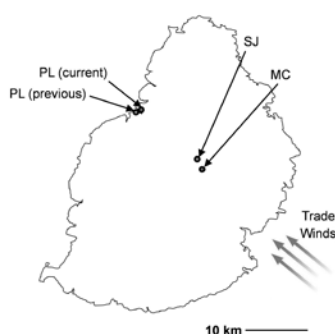


Figure 1: Map of Mauritius Showing Test Sites (Previous and Current).



Figure 2: Exposure Racks at Medine Camp de Masque – MC (Left) and Port-Louis – PL (Right).

Following exposure, triplicate samples were retrieved at two-, five-, eight-, 11-, 14- and 24-month time points. The corrosion products were removed with the samples immersed in a solution of 50% wt./vol. HCl and 3.5 g/L hexamethylenetetramine according to ISO 8407 (2014). The mass loss was measured using a Kern PNS 600-3 precision balance, with an accuracy of ± 0.001 g. Corrosion rate was then calculated over the first year of exposure using:

$$r_{corr} = \frac{\Delta m}{A \cdot t}$$

where  $r_{corr}$  is the corrosion rate in g m<sup>-2</sup> y<sup>-1</sup>,  $\Delta m$  is the mass loss in g, A is the surface area in m<sup>2</sup>, t is the exposure time in years (y).

A Zeiss Merlin scanning electron microscope (SEM) was used to

determine the morphology of corrosion products on the surface of a 1 cm x 1 cm internal portion cut from the sample.

### Results and Discussion

Table 1 lists the Cl<sup>-</sup>/SO<sub>2</sub> deposition, the estimated TOW, and the corrosion rate at each site. The ISO 9223 (2012) classifications, including those of the previous sites, are given in Table 2. The corrosion rate for MC and PL (current) was found to be in the C3 (medium) and C2 (low) categories, respectively, while both SJ and PL (previous) were assigned corrosivity category C4 (Surnam & Oleti, 2012). Over more than a decade, there has been a significant decrease in corrosivity from C4 to C2 in PL and from C4 to C3 in the rural environment. This can be associated with a reduction of SO<sub>2</sub> deposition (P1 to P0) in PL and a decrease in TOW (T5 to T4) for SJ/MC.

Table 1. Pollution, Climatic and Corrosion Data Measured at MC and PL (Current).

MC				PL (current)			
Cl <sup>-</sup> / mg m <sup>-2</sup> d <sup>-1</sup>	SO <sub>2</sub> / mg m <sup>-2</sup> d <sup>-1</sup>	TOW / hour	CR / g m <sup>-2</sup> y <sup>-1</sup>	Cl <sup>-</sup> / mg m <sup>-2</sup> d <sup>-1</sup>	SO <sub>2</sub> / mg m <sup>-2</sup> d <sup>-1</sup>	TOW / hour	CR / g m <sup>-2</sup> y <sup>-1</sup>
71.5	1.17	3300	207.7	11.4	1.16	1800	109.1

Table 2. Comparison of Environmental and Corrosivity Classification.

SJ				MC				PL (previous)				PL (current)			
Cl <sup>-</sup>	SO <sub>2</sub>	TOW	CR	Cl <sup>-</sup>	SO <sub>2</sub>	TOW	CR	Cl <sup>-</sup>	SO <sub>2</sub>	TOW	CR	Cl <sup>-</sup>	SO <sub>2</sub>	TOW	CR
S0	P0	T5	C4	S1	P0	T4	C3	S1	P1	T3	C4	S1	P0	T3	C2

Emissions of SO<sub>2</sub> have continued to rise over the years, driven by current growing energy demand on the island, mainly met by the combustion of heavy fuel oil. Furthermore, the presence of oil-fired power stations in PL implies significant SO<sub>2</sub> concentration in the atmosphere. Wind in PL generally blows towards the west/northwest (Figure 3), i.e., from land to sea. The exposed specimens face the sea but on the downwind side, which explains the low deposition of SO<sub>2</sub> and Cl<sup>-</sup>. However, climate change manifests as changes in the frequency and intensity of cyclones (World Bank Group, 2025), which disrupt normal wind patterns. Changes in wind directions are known to induce seasonal variations in chloride concentrations, which are more consequent during periods of strong winds (Gobinddass *et al.*, 2020). High wind speeds also tend to coincide with rainfall, adding to the washing effect (Daneshian *et al.*, 2023). Thus, the Cl<sup>-</sup>/SO<sub>2</sub> environmental classification may vary periodically. Nevertheless, the gradual shift to renewable energy sources will eventually lead to SO<sub>2</sub> being less of a concern to atmospheric corrosion.

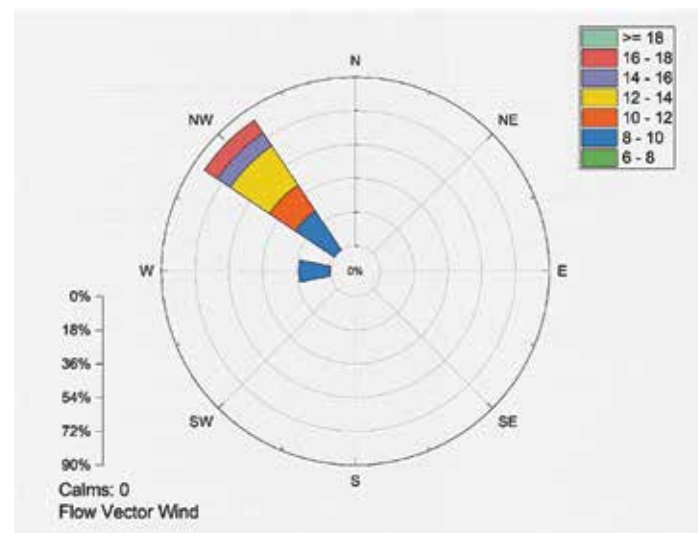
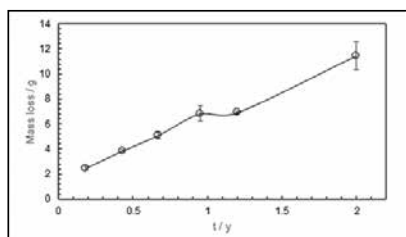


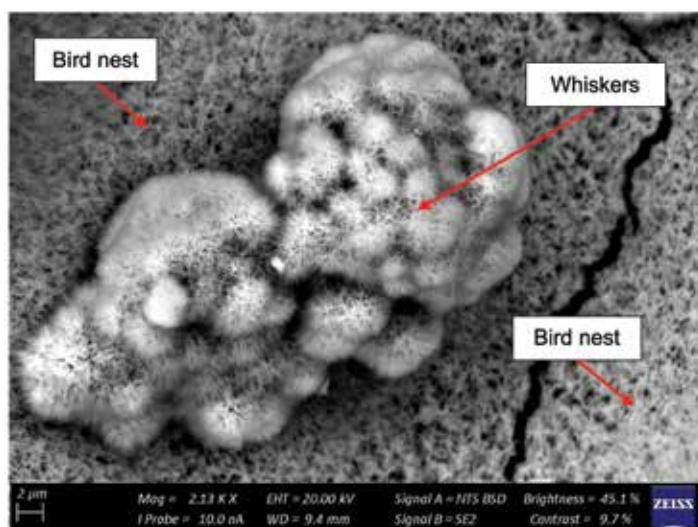
Figure 3: Wind Rose Showing the Orientation (Blowing to) and the Speed (in km h<sup>-1</sup>) for Port Louis (PL).

continues on page 42

The plot of mass loss vs time for MC (Figure 4) shows a rise in corrosion rate following stabilisation around the first year of exposure. Corrosion kinetics at SJ show a similar trend during this time period (Surnam, 2015), except that the mass loss is lower for MC. SEM imaging of the 11-month exposed surface at MC shows a mixture of lepidocrocite ( $\gamma$ -FeOOH) and goethite ( $\alpha$ -FeOOH) rust phases (Figure 5), a characteristic of regions with longer TOW (Thandar *et al.*, 2022). MC/SJ is an inland rural area, and TOW is the most likely factor influencing the corrosion rate, as observed with a shift in TOW from category T5 to T4 over the years. In general, Mauritius experienced a higher precipitation from 1990 to 2020, with an average annual increase of 8.6% (World Bank Group, 2025). This could have been effective in washing off deposited pollutants and thus contributed to the decrease in corrosion rate.



**Figure 4. Mass Loss vs. Time for Carbon Steel Exposed at Medine Camp de Masque (MC).**



**Figure 5. SEM Image of the 11-Month Exposed Surface at Medine Camp de Masque (MC) Showing Bird Nest ( $\gamma$ -FeOOH) and Whiskers ( $\alpha$ -FeOOH) Formations.**

## Conclusions

Construction in high-corrosivity areas, such as marine or industrial zones, requires careful consideration with regard to materials selection and applied preventative measures, due to the increased corrosion risks to structural integrity and public safety. A range of international standards and regulatory policies exist to ensure the durability, safety, and longevity of infrastructures and these should be utilised. However, future climate variability will influence the dynamics of atmospheric corrosion, thus the need for renewed corrosion management strategies. This study has shown that it is essential to consider climatic parameters in atmospheric corrosivity classification, which not only account for present environmental aggressiveness but also for likely climate-driven variations in  $\text{SO}_2/\text{Cl}^-$  deposition. Together with rainfall and wind patterns, time of wetness is likely to change, thus altering the corrosivity classifications.

## References

1. J Alcántara *et al.*, (2017) "Marine atmospheric corrosion of carbon steel: A Review," *Materials*, 10(4), p. 406. <https://doi.org/10.3390/ma10040406>.
2. Y Cai *et al.*, (2018) "Influence of environmental factors on atmospheric corrosion in dynamic environment," *Corrosion Science*, 137, pp. 163–175. <https://doi.org/10.1016/j.corsci.2018.03.042>.

3. Y Cai *et al.* (2020) "Atmospheric corrosion prediction: A review," *Corrosion Reviews*, 38(4), pp. 299–321. <https://doi.org/10.1515/corrrev-2019-0100>.
4. B Daneshian. *et al.* (2023) "Effect of climatic parameters on marine atmospheric corrosion: correlation analysis of on-site sensors data," *npj Materials Degradation*, 7(1), p. 10. <https://doi.org/10.1038/s41529-023-00329-6>.
5. M L Gobinddass *et al.*, (2020) "Coastal sea salt chlorine deposition linked to intertropical convergence zone (ITCZ) oscillation in french guiana" *Journal of the Atmospheric Sciences*, 77(5), pp. 1723–1731. <https://doi.org/10.1175/JAS-D-19-0032.1>.
6. M Hoseinpoor *et al.*, (2025) "Comprehensive assessment of time of wetness on coil-coated steel sheets," *Corrosion Science*, 244, p. 112641. <https://doi.org/10.1016/j.corsci.2024.112641>.
7. ISO 8565 (2011) *Metals and alloys — Atmospheric corrosion testing — General requirements*.
8. ISO 8407 (2014) *Standards Publication Corrosion of metals and alloys- Corrosivity of atmospheres - Removal of corrosion products from corrosion test specimens*.
9. ISO 9223 (2012) *Standards Publication Corrosion of metals and alloys- Corrosivity of atmospheres - Classification, determination and estimation*.
10. ISO 9225 (2012) *Corrosion of metals and alloys — Corrosivity of atmospheres — Measurement of environmental parameters*, BSI Standards Publication. BSI Standards Limited.
11. A Michel, *et al.*, (2013) "Experimental investigation on the short-term impact of temperature and moisture on reinforcement corrosion," *Corrosion Science*, 72, pp. 26–34. <https://doi.org/10.1016/j.corsci.2013.02.006>.
12. R J Santucci *et al.*, (2022) "Atmospheric corrosion severity and the precision of salt deposition measurements made by the wet candle method," *Corrosion Engineering, Science and Technology*, 57(2), pp. 147–158. <https://doi.org/10.1080/1478422X.2021.2005227>.
13. B Y R Surnam, and C V Oleti (2012) 'Atmospheric corrosion in Mauritius', *Corrosion Engineering Science and Technology*, 47(6), pp. 446–455. <https://doi.org/10.1179/1743278212Y.0000000026>.
14. B Y R Surnam (2015) 'Three years outdoor exposure of low carbon steel in Mauritius', *Anti-Corrosion Methods and Materials*, 62(4), pp. 246–252. <https://doi.org/10.1108/ACMM-12-2013-1328>.
15. V Tasić, *et al.*, Kovačević, R. and Milošević, N. (2013) "Investigating the Impacts of Winds on  $\text{SO}_2$  Concentrations in Bor, Serbia," *Journal of Sustainable Development of Energy, Water and Environment Systems*, 1(2), pp. 141–151. <https://doi.org/10.13044/j.sdwes.2013.01.0010.shie>
16. W Thandar *et al.* (2022) "Investigation of Initial Atmospheric Corrosion of Carbon and Weathering Steels Exposed to Urban Atmospheres in Myanmar," *International Journal of Corrosion*, 2022. <https://doi.org/10.1155/2022/4301767>.
17. B Valdez *et al.*, (2016). "Corrosion assessment of infrastructure assets in coastal seas". *Journal of Marine Engineering & Technology*, 15(3), 124–134. <https://doi.org/10.1080/20464177.2016.1247635>
18. R Vera *et al.* (2018) "Tropical/non-tropical marine environments impact on the behaviour of carbon steel and galvanised steel," *Materials and Corrosion*, 69(5), pp. 614–625. <https://doi.org/10.1002/maco.201709873>.
19. World Bank Group (2025). *Climate risk country profile: Mauritius*. pp.1–21.
20. H Zhao and X Li, (2013) "Understanding the relationship between heavy metals in road- deposited sediments and washoff particles in urban stormwater using simulated rainfall," *Journal of Hazardous Materials*, 246–247, pp. 267–276. <https://doi.org/10.1016/j.jhazmat.2012.12.035>.
21. Mauritius Meteorological Services (2026) *Meteorological Observations and Climatological Summaries*. <http://metservice.intnet.mu/publication.php>.



# Atmospheric Corrosion Control for Exposed Bridge Structures – A Case Study of Tamar Bridge, UK

Kevin Harold, Director, Paintel Ltd. and Thomas Harold, Director, Paintel Ltd.



## Meet the Authors



Kevin Harold



Thomas Harold

**Kevin Harold** is a Director at Paintel Ltd. He is a Level 3 ICorr Painting Inspector and Technical Director of Paintel Ltd. and has been involved with painting and coatings for nearly 50 years. Kevin is the retiring Correx Managing Director and also a Correx (Institute of Corrosion) ICATS trainer. During 2025, Paintel was awarded a new Painting / Inspection / Maintenance contract to refurbish and maintain the important Tamar Bridge crossing, running for the next 10 years. The company has maintained the structure since 1999.

**Thomas Harold** is employed as the Paintel Contracts Manager and is also a Director of Paintel Ltd. He is IPAF & IRATA qualified and an ICorr Level 2 Painting Inspector and ICATS approved Industrial Painting Supervisor with more than 15 years' experience of applying protective coatings.

## Introduction

This article is about the environmental effects and maintenance painting required for 'Atmospheric Corrosion Control' on exposed bridge structures and, in particular, the Tamar Bridge linking Devon and Cornwall on the A38 trunk road.

Spanning the River Tamar by the side of Brunel's famous Saltash railway bridge, the new Tamar Road bridge provided an important new link by road between the City of Plymouth and the county of Cornwall. It was opened in October 1961; it has a total suspended length of around 335 meters plus two side spans and a water-level clearance of between 32 and 35 meters. All in all, a weighty corrosion problem.



Photo: Overview of the Tamar Bridge With Cheery Picker Painting Maintenance Ongoing.

The structure carries around 50,000 vehicles per day in each direction. and is located in a fairly aggressive marine environment, towering over the river Tamar as it flows further into Cornwall in one direction and towards Devonport Dockyard in the other. The bridge has been in continual service since opening, even when it had two cantilevers added and coated during 1999-2000, under the supervision of Paintel.

## Corrosivity of Bridge Environment

Its corrosivity classification in accordance with ISO 12944 (the accepted standard that sets out rules for the protection of assets from corrosion by use of coating systems and paint, originally released in 1998) probably ranges between a C4 and C5 (high to very high), plus the effects of the driving Southwest rain and winds, keeping it wet/damp for long periods, and also depending on the geography of the structure, causing corrosion deposits to build up.

The Tamar Bridge's unique location over the tidal River Tamar and exposure to marine elements means site-specific monitoring and protection are critical for its structural integrity. Engineers conduct routine inspections normally every four months and use advanced techniques including test gauges to measure the depth of corrosion on main cable ropes, to monitor the progression of corrosion.

## Challenges and Costs

The bridge's **annual maintenance cost is approximately £2 million**, with significant, multi-million-pound projects funded by tolls to specifically address issues like corrosion and deck resurfacing.

As with many similar suspension type bridges, preparation and re-painting of the Tamar Bridge is not without its challenges. When you drive over any bridge you tend to only notice everything at ground/

*continues on page 44*

deck level, occasionally you might glance up to the towers and think my goodness that's high or how on earth do you access that? Working on tower tops or beams roadside of course involves significant challenges, as does painting beneath the deck level, and that is the case for all types of bridge structures really.



Photo: Distance Harness Assisted Solvent Wash Under Deck.

The steel arrangement beneath deck levels can appear to be very complex and once again your thoughts turn to how would you go about accessing what you might think is particularly inaccessible. Each area not only comes with access challenges but also must address the **type and classification of corrosion** at any location and how fast it may be progressing, particularly with structurally important fixings and smaller detail areas where corrosion is simply not acceptable.

### Maintenance Painting Process and Access

Of course, it would very helpful if you could scaffold a bridge or structure every time maintenance was required or there was a permanent one in place (designed-in), but this can be expensive and time consuming and a quicker fix is often what's required, providing of course, the quicker fix is acceptable and safe to all.

Access options at the Tamar Bridge do include scaffolds, but only when other methods are considered too dangerous or the works required will be of long duration. The Tamar Bridge has 4 gantries, two main deck and two cantilever gantries; these give access to many locations, but not directly underneath the deck and some other important areas.

Paintel has a MEWP (Mobile Elevating Working Platform)-trained team as well as a RAT (rope access trained) team using rope access methods for preparing, painting, repairing or cleaning surfaces. All these techniques allow us to paint areas that might appear at first to be inaccessible.



Photo: MEWP (Mobile Elevating Working Platform).

### Selective Corrosion Repair Sites

You would have heard people say, "It's like painting the Forth Bridge; I suppose you start at one end and work towards the other and then start again," but this couldn't be further from the truth. Corrosion is very selective, and the geography and geometry of a

structure play a huge part in corrosion risk and corrosion rates, as well as the conditions each part is exposed to. Then add in some contamination, and different types appear: general, pitting, crevice and galvanic, to mention a few.

Corrosion first needs a base metal, steel most commonly, an electrolyte, water, or other, and of course oxygen to corrode/oxidise any steel. Corrosion areas and rates vary considerably across the structure according to geometry and degree of exposure.



Photo: Bridge Hangar Painting.

### Geography and Geometry

High sections (pier/tower tops) are prone to additional exposure, high and low temperatures, intense UV light, continuous wetting and drying, and North, South, East or West perspectives. Of which South dries the most, North dries the least, West is wetter, and East will be cooler; all of these conditions affect corrosion rates.

Many of these areas are accessed by 'rope access' methods, as many of the team are IRATA (Industrial Rope Access Trade Association) trained, with a level 3 RAT Team Lead.



Photo: Metal Coating Using A Trug.

RAT work necessitates:

- A Head for Heights
- Exposure to extremes of Climate
- High levels of Fitness

The compensation for operatives is some of the best views a person can have.

### Deck/Road Level – Traffic Issues

Exposed, but not the same exposure as the tops of the towers. Higher and lower temperatures. Temperatures can be higher at this level due to radiated heat from the road surface, lower windage and other protection from parapets/tower bottoms and cabins/storage areas. UV intensity remains high, and many surfaces remain wet

for long periods due to drainage design with water weepage long after rain has stopped. Contaminated surfaces from traffic activity and the effects of north, south, east or west winds, perspectives all contributing additional corrosion effects.

Temperatures can be lower due to more standing water and ice during the winter and additional shading from piers and storage containers. Surfaces are also wetted and dried continuously with the additional consideration of contaminants.

Pollution from passing vehicles, salt from salt spreaders during winter months, and sludges created by dirt and wet from vehicles that do not dry all add to ongoing corrosion rates and challenges.

### Below Deck

These areas are often the most prolific in terms of workload. Much more structural steel is being affected by microclimates. Other factors that influence corrosion rates include being closer to the water/river, rain run-off (from the deck), salt contamination from road salting and bird contamination. Little or no direct sunlight and non-drying of surfaces, sludges and slurry build-up accelerate corrosion rates enormously.



Photo: RAT Based Pressure Cleaning Activities.

### Preparation and Painting Specifications

Because of the environmental difficulties associated with blasting, set-up, noise, encapsulation, danger, dust, time factor, clean-up, and spillage, all the preparation prior to painting is done by mechanical preparation standards. This is therefore normally done using small tools like needle guns, grinders, sanders, scrapers, etc., but not before precleaning with degreaser to remove most of the dirt and grease. All surfaces are then prepared to an ISO 8501-1 'very thorough' surface preparation. Once an area of preparation is complete and re-cleaned, it is then inspected for quality control for acceptance. After acceptance, all areas receive a multi-coat paint system of:

**Stage 1 - Spot prime as required, surface tolerant Aluminium epoxy**

**Stage 2 - Full coat of surface tolerant Aluminium epoxy coating (DFT 120 microns).**

**Stage 3 - Full coat of High-Build epoxy coating (DFT 120 microns).**

**Stage 4 - Full coat of two pack Polyurethane finish (DFT 75 microns).**

The final dry film thickness (DFT) is in excess of 300 microns throughout (higher at spot primed locations).

The paint system being utilised can change depending on prevailing corrosion classification to include additional build with MIO, micaceous iron oxide. The bridge is subjected to a maximum of 6 monthly inspections, sometimes more frequent depending on the site zone, and these inspections flag up the more corroded affected areas, and they become priority work packages. Paint is most usually applied by brush and roller. This avoids problems associated with potential overspray and sheeting issues.



Photo: Incline Cable Painting.

### Paint Lifetime Expectancy

In the coating business we often discuss and compare lifetime expectations of different types of preparation and painting techniques. Although many would argue that there is nothing better than blasting prior to painting with all the rules in place, as experienced coating applicators, we have proven 'year on year' that if you do thoroughly clean surfaces, prepare to the correct standard and paint to the specification, then this work will also last a very long time, often 10 years plus. Our extensive work on the Tamar Bridge has proved this conclusively.

### References

1. BS EN ISO 12944 (2019) - Multi-part Document - Corrosion protection of steel structures by protective paint systems.
2. Bridging The Tamar Visitor Centre | Tamar Crossings. <https://www.tamarcrossings.org.uk>
3. 'Daredevil decorators' protecting Tamar Bridge from corrosion - BBC News. <https://www.bbc.co.uk>
4. Structural health monitoring of the Tamar suspension bridge | Request PDF. <https://www.researchgate.net>
5. Tamar Bridge | VolkerLaser. <https://www.volkerlaser.co.uk>

The Institute values the support of all the companies and organisations who are Branch sponsors, Corporate or Sustaining Members. A detailed listing of these members is published annually as a stand-alone supplement to the January/February issue of Corrosion Management, and a regularly updated searchable listing is published on the Institute's website.

## CORPORATE MEMBER COMPANIES

### ARGYLL RUANE LTD

4 Europa View, Sheffield Business Park, Sheffield, S9 1XH  
Tel: +44 114 399 5720  
Email: enquiries@argyllruane.com  
Web: www.argyllruane.com



### BILFINGER (CORPORATE MEMBER)

4 Greenhole Place, Aberdeen AB23 8EU  
Email: johnny.morton@bilfinger.com  
Web: www.uk.bilfinger.com



### BP

Chertsey Road, Sunbury on Thames, Middlesex TW16 7LN Tel: 0203 401 9908  
Email: chris.williams3@uk.bp.  
Web: www.bp.com



### CARBOLINE

Unit 2, Dorsey Way, Leicester LE19 4DB  
Email: Rob.Allan.rallan@carboline.com  
Web: www.carboline.co.uk



### CORRODERE

(NEW CORPORATE MEMBER)  
T: +44 (0) 1252 732 236  
Email: Lucy.Pavia.lucy@corrodere.com  
Web: www.corrodere.com



### HEMPEL UK LTD

(NEW CORPORATE MEMBER)  
Berwyn House, The Pavilions, Cwmbran, Torfaen, South Wales, NP44 3FD, United Kingdom  
Tel: 01633 874024 Fax: 01633 489012  
Email: Sales.uk@hempel.com Web: www.hempel.com



### INTERNATIONAL PAINT LTD

International Paint Ltd, Stoneygate Lane, Gateshead, Tyne and Wear England, NE10 0JY  
Email: suman.bhat1@akzonobel.com  
Web: www.akzonobel.com



### JOTUN PAINTS (EUROPE) LTD (NEW CORPORATE MEMBER)

Stather Road, Flixborough, Scunthorpe, North Lincolnshire DN15 8RR  
Tel: 01724 400 125 Fax: 01724 400 100  
Email: enquiries@jotun.co.uk  
Web: www.jotun.co.uk



### OCEANEERING INTERNATIONAL (CORPORATE MEMBER)

Building 3, Levels 2&3, Aberdeen International Business Park, Dyce Drive, Aberdeen, UK, AB21 0BR  
Tel: 01224 758500  
Email: adodds@oceanengineering.com  
Web: www.oceanengineering.com



## GOLD SUSTAINING MEMBER COMPANIES CATHODIC PROTECTION CONSULTANCY SERVICES

### SGK

Technoparkstr 1, Zurich 8005, Switzerland  
Tel: +41 44 2131590 Email: sgk@sgk.ch

## CATHODIC PROTECTION AND MONITORING

### BAC

Stafford Park 11, Telford TF3 3AY, UK  
Tel: +44 (0) 1952 290321 Email: sales@bacgroup.com  
www.bacgroup.com

### 3C CORROSION CONTROL COMPANY AB

Box 324, 23 Landskrona, Sweden  
Tel: +46 418 411 900 Fax: +46 418 411 935  
Email: info@3ccc.se Website: www.3ccc.se

### AUTOMA (NEW SUSTAINING MEMBER)

Ancona (An) - Italy  
Tel.: +39.071.8028042  
Email: sales@byautoma.com  
www.byautoma.com



### CATHODIC PROTECTION CO LIMITED

Venture Way, Grantham, Lincolnshire, NG31 7XS, United Kingdom  
Tel: +44 (0) 1476590666  
Email: sales@cathodic.co.uk

### CORROSION CONTROL INCORPORATED

494 Fairplay Street, Rutledge, Georgia 30663, USA  
Tel: +706 557 9624  
Email: brianwyatt@controlcorrosion.co.uk

### CORROSION TECHNOLOGY SERVICES EUROPE LTD

11 & 12 Merlin Park, Mildenhall, Suffolk IP28 7RD  
Tel: 01638 711955 Fax: 01638 711953  
Email: enquiries@ctsonline.com www.ctsonline.com

### CORRPRO COMPANIES EUROPE LTD

Adam Street, Bowesfield Lane, Stockton On Tees, Cleveland  
Tel: 44(0) 1642 614 106 Fax: +44(0) 1642 614 100  
Email: ccel@corrproeurope.com www.corrproeurope.com

### DUVINE

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

### INTERPROVINCIAL CORROSION CONTROL CO. LTD

930 Sheldon Court, Burlington, Ontario L7L 5K6, Canada  
Tel: 905-634-7751 Email: contact@rustrol.com  
www.rustrol.com

### MGDUFF INTERNATIONAL LIMITED

1 Timberline Estate, Gravel Lane, Quarry Lane, Chichester, West Sussex, PO19 2FJ  
Tel: +44 (0) 1243 533336 Fax: +44 (0) 1234 533422  
Email: sales@mgduff.co.uk www.mgduff.co.uk

### OES GROUP LTD

Coupe House, Station Lane, Birtley DH2 1AJ  
Tel: 0191 815 5035 Email: sales@oesgrouppltd.com  
www.oesgrouppltd.com

### OMNIFLEX UK LTD

Tel: 0161 491 4144 www.omniflex.com

### COATING APPLICATORS

### CORROSERVE

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

### OWENS CORNING FOAMGLAS® INDUSTRY

31-35 Kirby Street, Hatton Garden, London, EC1N 8TE  
Tel: 07789 507094 Email: kevin.bauld@owenscorning.com

### R&R CORROSION LTD

Tel: 01358 729644 www.rrcorrosion.com

## CONSULTING TESTING AND INSPECTION

### SGK

Technoparkstr 1, Zurich 8005, Switzerland  
Tel: +41 44 2131590 Email: sgk@sgk.ch

### CHEMCO INTERNATIONAL LTD

East Shawhead Ind. Est, Coatbridge, Scotland ML5 4XD  
Tel: 01236 606060 www.chemcoint.com

## SUPPLIERS COATINGS

### CORROCOAT

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

### DENSO (WINN & COALES DENSO LTD)

Denso House, Chapel Road, London SE27 0TR  
Tel: 0208 670 7511 Fax: 0208 761 2456  
Email: mail@denso.net www.denso.net

### JOTUN PAINTS (EUROPE) LTD

Stather Road, Flixborough, Scunthorpe, North Lincolnshire DN15 8RR  
Tel: 01724 400 125 Fax: 01724 400 100  
Email: enquiries@jotun.co.uk Web: www.jotun.co.uk

### PPG PROTECTIVE & MARINE COATINGS

Huddersfield Road, Birstall, Batley, West Yorkshire, WF17 9XA Tel: 01924 354700  
Email: PMCcustomerservice@ppg.com www.ppgpmc.com

### SHERWIN-WILLIAMS PROTECTIVE & MARINE COATINGS

Tower Works, Kestor Street, Bolton, BL2 2AL, UK  
Tel: +44 (0)1204 521771 Email: enquiries.pm.emea@sherwin.com  
sherwin-williams.com/protectiveEMEA

## SUPPLIERS SPECIALIST

### ARMACELL (NEW SUSTAINING MEMBER)

Mars Street, Oldham, Manchester, OL9 6LY  
Email: mark.swift@armacell.com

### RYSCO INTERNATIONAL INC

101 - 8024 Edgar Industrial Cr Red Deer, Alberta, Canada, T4P 3R3 Tel: +1 877 899 5988  
Email: tommy.mccann@ryscointernational.com  
www.ryscocorrosion.com

## SUSTAINING MEMBER COMPANIES

### INDUCTOSENSE

Bath Road, Bristol, BS4 3AP  
Email: info@inductosense.com  
Web: www.inductosense.com

### SPECIALIST COATINGS & INSPECTION LTD

114 Eastlake, Swindon, SN25 2RZ  
Tel: 01793 380 389 / 0747 654 3218  
Email: info@specialistcoatings.net; www.specialistcoatings.net

### TPS360

Cardiff, Wales https://www.tps360.co.uk/

## CATHODIC PROTECTION CONSULTANCY SERVICES

### BEASY

Tel: 02380 293223 www.beasy.com

### CORROSION ENGINEERING SOLUTIONS LTD

Tel: 01442 767 899 www.corrosionengineering.co.uk

### SEGCORR LTD

Tel: 07484838232 Email: paul.segers@segcorr.com

## CATHODIC PROTECTION AND MONITORING

### AQUATEC GROUP LIMITED

Tel: 01256 416010 Email: inquiry@aquatecgroup.com

### CORRINTEC CATHELCO

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

### CORROCONSULT UK LIMITED

Tel: 01952 740234 www.corroconsult.com

### DEEPWATER EU LTD

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

**DUVINE**

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

**ICR INTEGRITY LTD**

Tel: 01224822822 www.icr.world.com

**IMPALLOY LTD**

Tel: 01922 714400 www.impalloy.com

**METEC CATHODIC PROTECTION LIMITED**

Tel: 0191 7316010 714411 Email: sales@metecgroup.com

**MILLER FABRICATIONS LTD**

Overtown Road, Waterloo, Wishaw, Scotland, ML2 8EW  
Tel: 01698 373 770 www.millerfabrications.com

**OMNIFLEX UK LTD**

Tel: 0161 491 4144 www.omniflex.com

**PHOENIX CPC LTD**

Tel: 07486076800 www.phoenixcpc.com

**PMAC Inspection Ltd**

Tel: 01224 703032

**R&R CORROSION LTD**

Tel: 01358 729644 www.rrcorrosion.com

**SAITH LTD**

Tel: 01425 207555 www.saithlimited.com

**SILVION LIMITED**

Tel: 01476 590932 www.silvion.co.uk

**SPECIALIST CASTING LTD**

Tel: 0191 5108843 www.specialistcastings.com

**VECTOR CORROSION TECHNOLOGIES**

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

**COATING APPLICATORS**

**ALFRED BAGNALL & SONS LTD**

Tel: 01274 714800  
Email: info@bagnalls.co.uk www.bagnalls.co.uk

**APB GROUP LIMITED**

Tel: 01538 755377 www.apbgroup.co.uk

**AW RAIL SERVICES LTD**

Tel: 01303 257462

**BRIDGECOAT LTD**

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

**CC INFRASTRUCTURE SERVICES**

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

**CORROSERVE**

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

**D&P COATINGS LIMITED**

Tel: 0151 356 7061 Email: jond@dandpcoatings.co.uk

**D.F. COATINGS LTD**

Tel: 02380 445634 Email: info@dfcoatings.co.uk

**DYER & BUTLER LTD**

Tel: 02380 742222  
www.dyerandbutler.co.uk

**FOUNTAINS (PART OF THE OCS GROUP)**

Tel: 07593 611577 Barry Crewick  
Email: barry.creswick@fountainsgroup.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

**SAFINAH LTD**

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

**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.surfacechnik.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**

**CAN**

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

**EQUILIBRANT LTD**

Tel: 02890 767227 www.equibrant.co.uk

**ERIMUS INSULATION**

Tel: 07968828825 www.erimusi.com

**HYDROCOMM LTD**

Tel: 07779333781 Email: hydrocomm@btinternet.com

**HYDROSAVE UK LTD**

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

**LBBC BASKERVILLE**

Tel: 0113 2057423 www.bbcbaskerville.com

**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

**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

**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

**INDESTRUCTIBLE PAINT LTD**

Tel: 0121 7022485 www.indestructible.co.uk

**SUPPLIERS GENERAL**

**CORRODERE ACADEMY**

Tel: 01252 732236 www.corrodere.com

**FUTURE PIPE LIMITED**

Tel: 0207 8388660 www.futurepipe.com

**GMA GARNET (EUROPE) GMBH**

Tel: 01606 836223

**LAKE CHEMICALS & MATERIALS LTD**

Tel: 01527 594630 Email: dean.kenny@lakecm.co.uk

**LBBC BASKERVILLE**

Tel: 0113 2057423 www.bbcbaskerville.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

**GALVANISERS ASSOCIATION**

Tel 0121 355 8838 Email: Ga@hdg.org.uk

**INSTITUTE OF MATERIALS FINISHING (IMF)**

Unit 2 The Coutyard, Roman Way, Coleshill Birmingham B46 1HQ  
Contact Helen Wood Email: helen@materialsfinishing.org  
Tel: 0121 622 7387 www.materials-finishing.org

**OIL & COLOUR CHEMISTS' ASSOCIATION (OCCA)**

4th Floor Clayton House, 59 Picadilly, Manchester M1 2AQ  
Contact Ann-Marie Etherington Email: admin@occa.org.uk  
Tel 0161 257 6488 www.occa.org.uk

**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**

Email: kristian.hampson@argyllruane.com Web: www.argyllruane.com

**CORRODERE ACADEMY**

Tel: 01252 732236 Web: www.corrodere.com

**ICATS / CORREX**

(Kevin Harold -ICATS courses) Email: kevin@paintel.com (Admin) Email: correx@icorr.org

# DIARY DATES 2026

Latest event details are posted at:  
<https://www.icorr.org/events/>  
General enquiries to:  
[Institute of Corrosion admin@icorr.org](mailto:Institute of Corrosion admin@icorr.org)

## BRANCH EVENTS

### 12<sup>th</sup> February 2026, Wales and South-West Branch

In-person Inaugural CorMat Dinner.  
Contact: [swchair@icorr.org](mailto:swchair@icorr.org)

### 17<sup>th</sup> February 2026, India Branch

Online Technical Talk - Beyond Monitoring: Leveraging AI and Digital Twins for Predictive Corrosion Resilience.  
Contact: [INDIAchair@icorr.org](mailto:INDIAchair@icorr.org)

### 19<sup>th</sup> February 2026, Midlands Branch

Online Technical Talk - Cathodic Protection.  
Contact: [midlandschair@icorr.org](mailto:midlandschair@icorr.org)

### 25<sup>th</sup> February 2026, Central Scotland

Hybrid Technical Talk - Enhancing Integrity Management with Predictive Analytics: Case studies on Corrosion under Insulation.  
Contact: [cschair@icorr.org](mailto:cschair@icorr.org)

### 5<sup>th</sup> March 2026, Aberdeen Branch

In Person Technical Talk - Joint Event with BINDT.  
Contact: [ABZchair@icorr.org](mailto:ABZchair@icorr.org)

### 12<sup>th</sup> March 2026, London Branch

In Person AGM + Presidents Talk - Institute of Corrosion 'Highlights from 2025/2026'  
Contact: [londonchair@icorr.org](mailto:londonchair@icorr.org)

### 12<sup>th</sup> March 2026, Yorkshire and Humber Branch

In Person - IONIX company visit.  
Contact: [yorkshirechair@icorr.org](mailto:yorkshirechair@icorr.org)

### 19<sup>th</sup> March 2026, Midlands Branch

Online Technical Talk - Application of Reliability Engineering Models in AIM and Corrosion Studies.  
Contact: [midlandschair@icorr.org](mailto:midlandschair@icorr.org)

### 26<sup>th</sup> March 2026, North-East Branch

In Person Technical Talk  
Contact: [nechair@icorr.org](mailto:nechair@icorr.org)

### 21<sup>st</sup>-22<sup>nd</sup> April, 2026, Midlands Branch

Hybrid - AGM + ICorr/EFC- WP15 Joint Symposium.  
Email: [midlandschair@icorr.org](mailto:midlandschair@icorr.org)

### 24<sup>th</sup> April 2026, Yorkshire and Humber Branch

In Person Technical Talks (CED Day).  
Contact: [yorkshirechair@icorr.org](mailto:yorkshirechair@icorr.org)

## CED

### 24<sup>th</sup> April 2026, CED, Yorkshire and Humber Branch

CED Conference 2026 - Global Corrosion Awareness Day.  
Contact: [yorkshirechair@icorr.org](mailto:yorkshirechair@icorr.org)

## YICORR

### 26<sup>th</sup> February 2026, YEP

In Person Event - YEP Session 1.  
Contact: [youngicorrchair@icorr.org](mailto:youngicorrchair@icorr.org)

### 26<sup>th</sup> March 2026, YEP

In Person Event - YEP Session 2.  
Contact: [youngicorrchair@icorr.org](mailto:youngicorrchair@icorr.org)

### 30<sup>th</sup> April 2026, YEP

In Person Event - YEP Session 3.  
Contact: [youngicorrchair@icorr.org](mailto:youngicorrchair@icorr.org)

## COURSES AND EXAMS

### Cathodic Protection (CP) Training Scheme

An International Certification Scheme that evaluates the competence levels of CP personnel in accordance with BS EN ISO 15257:2017. The scheme is designed for the competence assessment and certification of CP technicians, engineers and specialists performing inspection, testing, performance assessment, investigation, and design in various cathodic protection fields and is entirely operated and administered by the Institute of Corrosion.

### Cathodic Protection buried ISO courses

All based at Argyll Ruane Ltd, Sheffield  
2<sup>nd</sup> - 4<sup>th</sup> February 2026, 9<sup>th</sup> - 11<sup>th</sup> February 2026,  
30<sup>th</sup> March - 1<sup>st</sup> April 2026, 27<sup>th</sup> - 29<sup>th</sup> April 2026

### CP Level 4 Exams

All based at Northampton HQ  
26<sup>th</sup> February 2026, 4<sup>th</sup> June 2026,  
10<sup>th</sup> September 2026, 26<sup>th</sup> November 2026

### ETGB - Engineering Training Scheme

Corrosion Mechanisms in Stainless Steels  
22<sup>nd</sup> April 2026, Birmingham  
8<sup>th</sup> October 2026, Birmingham

### Fundamentals of Corrosion for Engineers (FOCE)

2<sup>nd</sup> - 6<sup>th</sup> March 2026, Northampton HQ

### Microbiological Induced Corrosion (MIC)

26<sup>th</sup> - 30<sup>th</sup> April 2026, Le Meridian Hotel, Al Khobar, Saudi Arabia (via MEA).  
11<sup>th</sup> - 15<sup>th</sup> May 2026, Northampton HQ  
16<sup>th</sup> - 20<sup>th</sup> October 2026, Northampton HQ

## STGB

# ARGYLL RUANE

### Hot Dip Galvanising Inspector Level 2

Online. Sign up anytime.

### Protective Coatings Inspector Level 1

16<sup>th</sup> - 23<sup>rd</sup> March (Dunfermline)  
13<sup>th</sup> - 20<sup>th</sup> April (ARL Sheffield)

### Protective Coatings Inspector Level 2

02<sup>nd</sup> - 09<sup>th</sup> March (ARL Sheffield)  
08<sup>th</sup> - 15<sup>th</sup> June (ARL Sheffield)

### Protective Coatings Inspector Level 3

06<sup>th</sup> - 10<sup>th</sup> July 2026 (ARL Sheffield)

### ICorr Recertification Programme

Available for all core methods - Online.  
Sign up anytime.

### Insulation Inspector Level 2

Online. Sign up anytime.

### Passive Fire Protection (PFP) Coating Inspector (Cementitious) Level 2

Online. Sign up anytime.

### Passive Fire Protection (PFP) Coating Inspector (Epoxy) Level 2

Online. Sign up anytime.

### Transition to ICorr Programme

Online. Sign up anytime.

## Corrodere Academy



### ICorr Training Partner

#### Coating Inspection Level 1

Online - enrol anytime. Practical workshop and assessment dates available at [corrodere.com/events](http://corrodere.com/events)

#### Coating Inspection Level 2

Online - enrol anytime. Theoretical workshop and assessment dates available at [corrodere.com/events](http://corrodere.com/events)

#### Coating Inspection Level 3

Online - enrol anytime. Advanced workshop

and assessment dates available at [corrodere.com/events](http://corrodere.com/events)

#### Insulation Inspection Level 2

Online - enrol anytime

#### Pipeline Coating Inspection Level 2

Online - enrol anytime

#### Hot Dip Galvanising Inspection Level 2

Online - enrol anytime

#### Thermal Metal Spraying Inspection Level 2

Online - enrol anytime

#### Transition to ICorr Level 1

Online - enrol anytime

#### Transition to ICorr Level 2

Online - enrol anytime

## BRANCH CONTACT DIRECTORY

### ABERDEEN:

ABERDEEN: Stephanie Okoye (Chair)  
Email: [ABZchair@icorr.org](mailto:ABZchair@icorr.org)

### CENTRAL SCOTLAND:

Philip Enegele (Chair)  
Email: [cschair@icorr.org](mailto:cschair@icorr.org)

### LONDON:

Paul Brooks (Chair)  
Email: [londonchair@icorr.org](mailto:londonchair@icorr.org)

### MIDLANDS BRANCH:

Prafull Sharma (Chair)  
Email: [midlandschair@icorr.org](mailto:midlandschair@icorr.org)

### NORTH EAST:

Matt Fletcher (Chair)  
Email: [nechair@icorr.org](mailto:nechair@icorr.org)

### NORTH WEST:

Greg Brown (Chair)  
Email: [nwchair@icorr.org](mailto:nwchair@icorr.org)

### WALES and SOUTH WEST:

Sarah Bagnall (Chair)  
Email: [swchair@icorr.org](mailto:swchair@icorr.org)

### YORKSHIRE and HUMBER:

Joshua Owen (Chair)  
Email: [yorkshirechair@icorr.org](mailto:yorkshirechair@icorr.org)

## OVERSEAS CONTACTS:

### INDIA

Arpit Goyal (Chair)  
Email: [INDIAchair@icorr.org](mailto:INDIAchair@icorr.org)

### UAE

Dr Muhammad Ejaz (Chair)  
Email: [UAEchair@icorr.org](mailto:UAEchair@icorr.org)

## DIVISIONAL CONTACTS:

### CSD DIVISION:

Julian Wharton (Chair)  
Email: [csdchair@icorr.org](mailto:csdchair@icorr.org)

### CED DIVISION:

Danny Burkle (Chair)  
Email: [cedchair@icorr.org](mailto:cedchair@icorr.org)

### YICORR:

Kathy Purnell (Chair)  
Email: [youngicorrchair@icorr.org](mailto:youngicorrchair@icorr.org)

### ENGC REGISTRATION:

Anthony Setiadi (Chair)  
Email: [ECReg@icorr.org](mailto:ECReg@icorr.org)

### SCI.C REGISTRATION:

Brenda Peters (Chair)  
Email: [Hon.Sec@icorr.org](mailto:Hon.Sec@icorr.org)

### PAC REGISTRATION:

Paul Lambert (Chair)  
Email: [pac.chair@icorr.org](mailto:pac.chair@icorr.org)