

A journal of the Institute of Corrosion

Corrosion Management

Issue 148 March/April 2019

Testing and Inspection



**Our look inside ICorr
with Institute News**
Page 4



**Find out all the latest
in Industry News**
Page 12

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Contents

Issue 148 March/April 2019

- 4**
The President Writes
- 4**
Institute News
- 12**
Industry News
- 16**
Technical Article
Digital/Paperless Quality Reporting
- 18**
Technical Article
Non Destructive Testing Methods to Assess
Corrosion under Insulation
- 20**
Technical Article
ISO 12944 - THE standard for coatings for
corrosion protection
- 22**
Sustaining Members
- 28**
Diary Dates

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The President Writes



ICorr President,
Gareth Hinds.

As usual the year is flying by at an incredible rate while I have been gradually settling into the role of President, with the valuable support of Sarah Vasey and other Past Presidents. There are so many different aspects to consider and I have been learning more than I ever thought possible about training course provision, financial reporting, membership development, quality management, conference organisation, award nomination, local branch activities, property management and relationships with other organisations, to name just a few!

On 7th March, Past President Trevor Osborne received the keys to our new Head Office at 5 St Peters Gardens in Northampton. Over the past two years, Trevor has devoted an admirable amount of his valuable time to looking for and then purchasing a new home for the Institute, dealing with estate agents, failed bids, complex negotiations, surveys, refurbishment work and not least all of that annoying red tape. I would like to thank him warmly on behalf of the Institute for his patience and perseverance in getting this over the line. I'm sure that like me you're all looking forward to seeing the fruits of his labour – a sneak preview is available in this issue.

Within Council, and on various Institute committees, we've been giving a lot of thought to strategy development over the past few months. The world is changing at a faster rate than at any time in human history, as witnessed by the evolving transition to low carbon energy, the digital revolution and increasing generational and political polarisation. In order for the Institute to survive, we must adapt to these external influences and we've been discussing a number of ideas that will help us build towards a sustainable future. Thankfully, from the perspective of our members at least, one thing that will never change is the thermodynamic tendency of metals to revert to their oxides!

Another important initiative that we have launched recently is to refresh the Institute brand, which has served its purpose but is now looking a little bit dated. The overall vision is to develop a fresher and more clean-cut look, while maintaining the gravitas of a professional body. A change in focus will be the use of photos showing pristine infrastructure, rather than rust and corroded components, to emphasise that our members do things right! We have commissioned the development of a new logo, branding and brand guidelines, and will be implementing these on our website, stationery and marketing material over the summer. This is never easy and it is difficult to please everyone but I hope that most of you will like the end result. The new brand will play a key role in our marketing and membership development activities.

One of the more enjoyable aspects of being President is getting to meet our members up and down the country. I'm very much looking forward to attending local branch events and already have confirmed dates in the diary to speak at Aberdeen, Midlands and London branch meetings. I'm not sure whether I will get away with giving the same talk each time but I can always try!

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www.icats-training.org



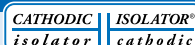
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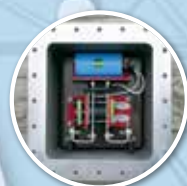
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From the Editor



It's almost Spring and our industry is gearing up for the busy maintenance period. This involves a lot of inspection work and testing against standards, which are the themes of this issue. Firstly there is an up-date of the important protective coatings standard, ISO 12944 from Trevor Fielding of the British Coatings Federation, and Malcolm Morris of Sherwin Williams. Several of the parts were revised and these are highlighted in the article. There is also an article on the non-destructive test methods available to assess corrosion under insulation, by Kristian Hampson

of IMechE Argyll Ruane, to complement the article in the previous issue on the testing of coatings for use under insulation. Finally, Ian Patterson of Paint Technology Solutions discusses the development of digital/paperless reporting of site data from painting contractors and inspectors.

The issue also has, as usual, reports from the various sections of the Institute, and what's been happening within our industry.

Remember to send me information about your new products or any other news you have about your company or what's happening within your part of our industry. I also welcome submissions of technical articles and the editorial themes can be found at <https://www.icorr.org/publications>.

I can be contacted at, brianpce@aol.com

Brian Goldie, Consulting Editor

ICATS News

The new ICATS course material launched in November is proving to be a great success, with positive feedback received from all the Trainers that have started to present the new course modules.

We are pleased to announce the appointment of two new Approved Training Centres, K M Decorating Ltd in London and Survivex in Aberdeen. These ATCs are in areas where previously we were not able to offer Training to ICATS Registered Companies that don't have in-house Trainers.

ICATS is also introducing the new ICATS Managers/Engineers Industrial Coating Awareness course. This is a structured training module for managers, engineers, specifiers and anyone that would benefit from an understanding of coating application.

The module covers the following subjects:

- Health and Safety in Industrial Painting
- Preparation Standards
- Blasting and Abrasives
- Mechanical and manual preparation
- Other surface preparation methods

- Painting Specification
- Toolbox talks
- Paint technology
- Scale of Nobility
- Convertible and Non-Convertible Coatings
- Over-painting existing paint systems
- Paint Manufacturers
- Paint Faults
- QC and QA

The Industrial Coating Applicator (ICA) faces many issues within Industrial Coatings. It is recognised that the ICA role can be misunderstood, leading to a potentially dangerous situation or misinterpretation and expectation of what can or can't be achieved. This is a one-day classroom based presentation. Courses will take place at our Northampton training facility and other locations.

Please contact the office correx@icorr.org, phone 01604 438222, or check the ICATS website <http://www.icats-training.org/> for details of all courses.

Industrial Coating Applicator apprenticeship Scheme - update

David Horrocks, a member of the NHSS19a Sector Scheme Advisory committee for Highways England, and the Sector Scheme Chairman of the Training Committee, recently visited North Lindsey College in Scunthorpe, to see the start of Industrial Coating Applicator (ICA) apprenticeship course, to meet the first cohort of candidates who have already started their training, and to personally offer support to them throughout their apprenticeship training. A more detailed report on this scheme will feature in a future issue of *Corrosion Management*.



New Head Office Building

As noted in the President's column, the official handover of Corrosion House in Northampton from the architect, was performed at the beginning of March.

Apart from the outer shell and the roof, the building has been gutted and rebuilt, with unbelievably fantastic results. It's a 3-story building, the ground floor being dedicated for the Admin team, the middle floor for training, and the top floor as a conference room. Each floor has its own kitchen, and the training centre has a breakout facility for delegates.

Trevor Osborne commented that this is a world class facility fitting for the Institute of Corrosion and based in a location in easy reach for both national and global customers, and that we look forward to welcoming our customers and members to our new facility.

It's state of the art, extremely well converted, and a credit to all those involved.



From L to R, David Robinson, architect, Lee Gardner, contractor, Tony Collins, Honorary Treasurer and Trevor Osborne.

Review of the Institute Development Plans

The Institute started to implement its bold new development plans in January 2018.

The aims were in essence simple, and based on the growth of two of its three revenue streams, Membership and Training.

Over the past 12 month period we have made great progress with a renewed relationship with IMechE ARL leading to the ability to market ICorr training programmes globally through the IMechE network.

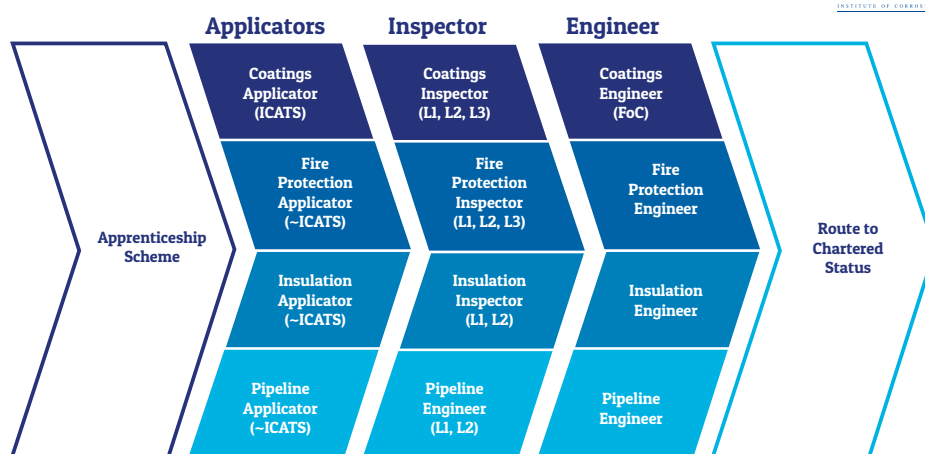
Chris Kirby the General Manager of IMechE ARL said "we are delighted with the new arrangement and the ability to link our Corrosion and NDT training through approved training centres in key locations to meet our global customer's needs. Our current focus is North Asia, SE Asia, Middle East and CIS countries with other options being considered".

The Institute has people in place to review and rewrite all of the training programmes, and IMechE have employed a new team to market and deliver the courses.

The potential is huge with expected growth in the UK through Highways, Rail and Nuclear sectors, and overseas with developments on the NW Shelf of Australia, China, SEA, ME, CIS and Russia.

In terms of membership development, the main drive has been to recruit and retain younger members. The Young ICorr initiative has been invigorated initially by the work done by Chris Bridge and more recently by Simon Bowcock , who

ICorr Training Concept – Surface Treatments



is in the process of enlisting more help as the workload to reach out to Young ICorr members at all levels is time consuming and demanding.

Simon and his team are also driving the Route to Chartered Status, and supporting the Young Engineer programme which has just finished its second round.

We also have a policy to support members though all states of their professional development from apprenticeship to chartered status. The addition of the Industrial Coating Applicator Apprenticeship scheme completes this strategy to deliver training and mentoring programmes (see left).

New Sustaining Member Client Inspection Services Ltd



C.I.S. Ltd. Wallsend, offer third-party inspections, technical advice, and surveying in the oil and gas industry, as well as in other sectors, throughout the UK. Using the latest technology and their own unique reporting system, they are dedicated to

meeting customers' needs and requirements, and are driven by quality. A newly formed company based in the heart of the North East within the Swan Hunters regeneration zone on the banks of the Tyne, their in-depth technical approach to work is based on over 20 years of experience in the oil, gas and petrochemical sectors throughout the UK, but are always pleased to form new working relationships and can work in many different sectors. The inspectors are certified to a minimum of NACE / ICORR level 2 and have a minimum of 5 years' experience in their respective fields, and offer a comprehensive third-party inspection of all aspects of fabric maintenance, from surface preparation to completion, ensuring that work is up to specifications and any required standards are met.

C.I.S. has the expertise and the technology to carry out a comprehensive assessment of coatings, insulation and PFP conditions and deliver an in-depth analysis, with all the answers a client needs.

The technical survey reporting system is unique to C.I.S Ltd, and coupled with a registered database of quality control and quality assessment templates, they gather information that forms the analysis and advice to their clients.

They can offer destructive and non-destructive tests to determine the condition of coatings, measuring adhesion strength and overall thickness, holiday testing, salt tests and surface profile readings amongst others, and they can also provide in-depth corrosion surveys, each component, whether structural or pipework, is measured and then its condition determined using the RI scale. Passive Fire Prevention (PFP) is a vital part of keeping any working environment safe, and detailed PFP surveys to either verify existing surveys, or establish that an area meets the required standard, can be provided.

Without knowing why something works, it can be hard to determine why it might fail. Their experienced investigators can provide a comprehensive failure analysis service, considering conditions, application and other factors to deliver an unbiased diagnostic report that can also help prevent future failures.

C.I.S Ltd is driven by quality, their experienced investigators and qualified inspectors can provide a comprehensive failure analysis service, and are dedicated to delivering their customers 'desired outcome, from third party inspection of coating conditions to assessing PFP standards and personal safety. As the industry is ever changing and evolving, they only use the latest technology and equipment to ensure their commitment to quality.

WEBSITE

Imma Mobbs

Imma has been working for the Institute for just over a year, maintaining and updating the website. Her background is in sales and marketing in the Protective Coating Industry and she has worked for over 10 years for International Paint in the Far East, and gained an excellent understanding of detailed specification work.



In her work for ICorr she initially carried out a benchmark study of all the other UK Professional Institutes' websites to establish how ours performs in comparison, and what needed to be done to increase traffic. She has implemented a new look, and has reviewed every page and document on the website. This is a continuous process with news and updates from all sectors of the Institute being posted on a weekly basis.

The first phase of the revamp has increased traffic through the site and the plan through 2019 is to continue to review it and update its content to attract even more traffic.

We look forward to your continued support in sending news and other reports so that the website is a more valuable tool, and a showcase for the Institute. These should be sent to Imma (imma.mobbs@c-i-m.co.uk).



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ICorr steps up Cathodic Protection Training - Examination, Assessment and Certification

For over 20 years ICorr has been providing training courses and competence assessment for Cathodic Protection Technicians. The early course, only for Buried applications, (buried onshore pipelines and tanks), was written for ICorr by John Thirkettle, and for many years presented by him and Chris Lynch through ICorr's training partner, Argyll Ruane. During this time British Gas, later National Grid, offered parallel training in courses developed by John O'Shea (Past ICorr President) and John Dyson.

In 2006, BS EN 15257, in which ICorr participated in the preparation, provided a standardised framework and levels of competence for CP personnel throughout Europe, bringing together the strengths of disparate national schemes in UK, France and Italy. This Standard defined the competence requirements for CP Technician, Senior Technician and Design Engineer levels in the Buried, Marine, Steel in Concrete and Internal application sectors. At the time of its implementation ICorr significantly improved the "Buried sector" courses and, in conjunction with the Corrosion Prevention Association (CPA), developed the Steel in Concrete courses. In 2015 ICorr also introduced courses in Marine CP.

In 2017, the International Standard, BS EN ISO 15257 'Cathodic protection - Competence levels of cathodic protection persons - Basis for certification scheme' was published. This Standard established equivalence between CP Competence Certification worldwide, including the transitional equivalence between the many European schemes complying with EN 15257, the Australian scheme and the NACE scheme from the USA.

activity. ICorr are about to start ISO 15257 Level 1 Buried CP courses closely tailored to the needs of National Grid and the various gas distribution companies, leading to Certification of Competence to ISO 15257, viz.

- New ISO Level 2 CP Technician courses; these are to the equivalent level as the old EN Level 1 courses, but with improved courses, training and assessment, leading to Certification.
- New ISO Level 3 Senior CP Technician courses; these are to the equivalent level as the old EN Level 2 courses, but with improved courses, training and assessment, leading to Certification.
- New ISO Level 4 CP Specialist; this is to the equivalent level as the old EN Level 3 Certification for Specialists and Engineers, with demonstrated Certificated Competence to undertake CP designs and complex data interpretation, with a more rigorous assessment process.
- An entirely new ISO Level 5 Expert Certification for those meeting all of the requirements of Levels 1-4 but who also have advanced the state of the art of CP by scientific work and peer-reviewed publications and have made a marked and original contribution to the science or practice of corrosion control by CP.

Courses will be run at Level 1 in the Buried Sector and at Level 2, Technician and 3, Senior Technician Level in Buried, Marine and Steel in Concrete Sectors. As is established practice, the Steel in Concrete Sector courses will be run in conjunction with the CPA.

Application sector	Level 1 of this document	Level 2 of this document	Level 3 of this document	Level 4 of this document
Buried on-land structures	NACE Level 1 (CP Tester)	NACE Level 2 (CP Technician) EN 15257 Level 1	NACE Level 3 (CP Technologist) EN 15257 Level 2 AS 2832.1 (Corrosion Technician)	NACE Level 4 (CP Specialist) EN 15257 Level 3 AS 2832.1 (Corrosion Technologist)
Marine and immersed structures	Level 1S CEFRA COR Certification/Protection cathodique (France)	NACE Level 2 (CP Technician: maritime ships only) EN 15257 Level 1	EN 15257 Level 2	EN 15257 Level 2
Steel-reinforced concrete structures	No present equivalent	EN 15257 Level 1	EN 15257 Level 2	EN 15257 Level 2
Inner surfaces	No present equivalent	EN 15257 Level 1	EN 15257 Level 2	EN 15257 Level 2

Extract from BS EN ISO 15257:2017 showing equivalence with existing certification schemes during the transition period.

This new ISO Standard established international requirements for Training, Examination, Experience Assessment and Competence Certification for FIVE levels of competence in the same four Sectors as the EN 15257.

Since the publication of the new Standard, ICorr has been working to both restructure its procedures and courses to meet these new internationally recognised requirements, and also to further improve the quality and professionalism of the ICorr CP courses and their delivery. These improvements are now being rolled out initially in the UK, but then, through the international partnership with IMechE, overseas. The major changes to the ICorr CP Training and Certification Scheme are summarised below:

- New Level 1 CP Data Collector (or Tester) Level (equivalent to the NACE CP 1, a level not previously within the EN 15257), typically intended for asset owner company staff who need to collect accurate CP data as only part of their weekly

Over the period of the next few months all ICorr Certificated CP Personnel with valid Certificates for EN Levels 1-3 will be issued with new Certification for ISO Levels 2-4 respectively, and the certificates will terminate (for re-Certification) at the same dates as the old EN certification.

Over the same period all the new courses will begin to be delivered and ICorr have now approved 12 tutors to deliver them, all are highly experienced specialists in the Sector being taught, and have been selected for their ability to teach effectively at the particular Level in their Sectors.

We are pleased to announce that National Grid and some of the gas distribution companies have committed to all of their CP staff and those of their contractors being trained and Certificated by ICorr.

In order to further improve the quality of the courses, ICorr have:



ICorr Buried Training and Testing Facility at IMechE Argyll Ruane, Sheffield.

■ In conjunction with IMechE Argyll Ruane, our training partner, established a Buried pipeline training and testing facility at the IMechE Training and Examination Centre at Sheffield. This includes galvanic and impressed CP systems, a range of coupon and reference electrode options, coating defects and an interference source.

■ Determined that all Marine CP courses will be undertaken with practical training on real CP systems, and real corroding assets in real marine environments. This has already started with two courses having been held on the River Clyde in Glasgow. The courses were held at the Riverside Museum and site work included the “Tall Ship” Glenlee moored alongside (which is also shown on the cover of this issue). Seaforce Glasgow provided logistic support, and Swain Meter Co, Cygnus Instruments Ltd and Buckleys (URVAL) Ltd supplied the instruments. Other locations have also been used and more are planned.

■ In conjunction with the CPA and IMechE, will soon have an equivalent Steel in Concrete training and testing facility to the Buried facility, at Sheffield.

The 2019 new ISO 15257 course programme has been agreed,

- Buried Data Collector, Level 1: IMechE AR, Sheffield, monthly starting July, to be confirmed.
- Buried Technician, Level 2: IMechE AR, Sheffield, weeks starting, 20 May, 29 July, 9 September, and 11 November.
- Buried Senior Technician, Level 3: IMechE AR, Sheffield, weeks starting, 24 June, 26 August, and 28 October.
- Steel in Concrete Technician, Level 2: IMechE AR, Sheffield, week starting 2 October.
- Marine Technician Level 2: Port of Dover, week starting 17 June.
- Marine Technician Level 3: venues to be arranged, expected start July onwards.

The planned venues for the Marine Technician courses, in addition to the Port of Dover, are East Coast and South Coast of England and Scotland.

Remember TO BOOK EARLY, to avoid missing these courses. Contact IMechE AR, <https://argyllruane.imeche.org>



Riverside Museum and Tall Ship, Glenlee. Courtesy of Glasgowlife.org.uk

Respected and Fond Memories of Gordon W. Curren

CEng MIEE MICorrST, Cathodic Protection Engineer, June 1927 – November 2018



So many times we have heard the expression, ‘He was a Gentleman and a Scholar’, and that was exactly what Gordon Curren was.

A kindly man, very mild mannered, and thorough to the extreme, in his duties as a dedicated technologist, and always keen to pass on knowledge and learning (with patience) to those students that had an aptitude to learn the mysterious art of Cathodic Protection.

Gordon was a Chartered Engineer and held membership in the Institute of Electrical Engineers; the Institute of Corrosion Science and Technology, the forerunner of ICorr, as well as the National Association of Corrosion Engineers.

He published many papers and gave countless lectures and presentations; both throughout the UK and the rest of the world. With a career spanning over fifty years he once listed all the countries he had visited purely for business purposes - the tally was an impressive thirty seven.

Like many in the enigmatic world of Cathodic Protection he entered it by accident, joining MAPEL. During his pioneering days lot of the CP testing techniques (that are practised today) were trialled and refined by him and his colleagues of that time. It was refreshing to hear some of his humorous memories, which revealed that he too, in all his reverence, went through quite difficult practical learning curves as they built up procedures and routines that now form part of the CP standards of today.

After having worked for many years with MAPEL and as a senior team member, he played a great part in building the Company up to become one of the most respected in the NDT/CP industry. An extremely loyal team of stalwarts was the result of his leadership. There were no bosses unless the chips were down and a serious problem needed attendance and then Gordon would deal with the issue with clarity and a quiet firmness respected and appreciated by all.

With the close co-operation MAPEL had built up with British Gas, Gordon moved across, with some selected engineers,

to the Gas Council offices in Hinckley. They helped form the corrosion division responsible for the production and implementation of Cathodic Protection systems for all the major high pressure gas feeder mains throughout the UK. Gordon stayed with British Gas for over 13 years before returning to MAPEL as their Chief Engineering Manager. Even now, crews working in the East Midlands have reported back that they are referring to drawings, drawn from the archives signed by GWC.

His true values and courage came to the fore at MAPEL when let down by two senior engineers he took on recovering a very serious project on the Kori Nuclear Power station in South Korea. He worked in the most arduous conditions without complaint; completing the venture for GEC spanning 1978/79. In 1987/88 his time was focussed on a feasibility study for Mobil Oil based around the Yanbu Oil Refinery on the Red Sea coast of Saudi Arabia, and in 1990 he developed a design for the Adnoc Oil Refinery in Abu Dhabi, then in 1993 as a retained consultant for MAPEL, he travelled a circuitous route into Libya to work on the Great Man Made River project for Brown and Root and the Turkish company STFA.

These are just snippets of the countless large projects he was involved with over the years, and on retirement he still maintained the interest and took on some private consultancy work representing the writer on a project in Trinidad and Barbados.

The memories of his work and travels remain on the sideboard at his home in Frisby-on-the-Wreake, enjoyed by his devoted wife Sheila, two daughters Jill and Deborah and their son Tim.

Rest in Peace Gordon... an Icon of your era.

Robin E, Bailey FICorr

Editor’s note: A more detailed description of Gordon’s life and career can be found on the Institute website at, www.icorr.org/respected-and-fond-memories-of-gordon-w-curren-c-eng-miee-micorrst-cathodic-protection-engineer-june-1927-november-2018/ g/

Local Branch News

Aberdeen Branch

The branch was very fortunate to have some excellent speakers for its winter meetings at Robert Gordon University (RGU) which attracted good audiences.

Dr Ed Whyte, principal corrosion engineer, and Paul McCarthy, of Plant Integrity Management (PIM) commenced the Q1 2019 programme with some great insights into the concepts of Maximising Economic Recovery (MER). Ed's role has encompassed the provision of corrosion and integrity engineering services to PIM's clients, while Paul is currently involved in various maintenance and inspection optimisation projects for a range of North Sea Operators.

They discussed the historic barriers to MER and how a step change from 60-74% production efficiency has recently been achieved, highlighting that only a 1% increase in efficiency, can dramatically produce an extra 12 million barrels per year in the North Sea, as 2016 figures have demonstrated.



The initial UKCS Review (2013), the final Wood Report (2014) and new OGA (2015) UK MER Legislation (2018), have all recognised the importance of reducing UK plant downtime / lost production. The most high profile MER document being the Wood Review (<https://www.ogauthority.co.uk/about-us/what-we-do/the-wood-review/>)

Although there has been a continuing downward trend in the number of plant losses, there remains an ever growing demand to limit UK Oil / Gas production outages, so as to maximise what income is available.

Most importantly, the presenters explained how gains to production efficiency can be achieved by approaching integrity management in a very different manner than has been the case before, through taking a long-term (but modular) view, with improved collaboration and engagement, assisted in all this by modern IT tools and devices that control data and costs more effectively.

The McKinsey Global Institute (2017) has studied in detail the longer term economic impact of "short termism", and industry's reluctance to invest in larger / longer maintenance projects. McKinsey claim that this figure is as high as 87% of executives and directors that feel pressured to demonstrate strong financial performance within 2 years or less, thus limiting available anti-corrosion / preventative maintenance expenditure.

In line with the McKinsey findings, PIM proposed that large maintenance projects be broken into more manageable / more achievable smaller repair / intervention scopes that target just one specific area or system, under a single project manager. This approach was then explained in greater detail by looking at the specific needs of upcoming CUI / PFP / FM preventative maintenance programmes and how they could be accommodated within this new modular approach to minimise external corrosion risks.

The full text of this most interesting and informative presentation can be seen at: <https://www.youtube.com/watch?v=6Y36lf6ApIE>

The February meeting was billed as a special Coating / Linings event, with two very knowledgeable presenters, Ajith A Varghese from International Paint Ltd and Gary Carswell of AEGION Group of Companies, who gave most interesting talks on Corrosion under Insulation (CUI) preventative coatings and Anti-Microbial Pipeline Linings, respectively.



Firstly CUI, which is a major issue that causes great cost to industry, and is currently the subject of a major project by the Oil & Gas Technology Centre, Aberdeen (OGTC). CUI poses a significant operational, safety and economic challenge. This is magnified in the North Sea, where many of the assets and infrastructure are operating well beyond their expected design life, and the OGTC vision is to eliminate all corrosion failures due to CUI by 2026.



Ajith explained in great detail, the mechanisms of CUI, the integrity risks created, and the extensive research and development programmes undertaken in their Newcastle Laboratories. All prevailing ISO and NACE Standards, and their recent amendments, were discussed in the context of developing a new preventative product, and the lengthy but very necessary processes by which

this is then taken to market, incorporating lessons learnt from field trials and customer feedback. In particular alkylated amine epoxies were discussed, which have been proven to have superior DFT cracking tolerance to over-application and increased productivity even at low temperatures, compared to standard epoxy phenolic systems.

Gary Carswell then explained in the context of internal corrosion prevention, how the use of protective pipeline liners has been very widely adopted by both the Energy and Non-Energy Sectors.

MIC related pipeline leaks typically account for 40% of all corrosion related failures, thus these compressive and rotational liner insertion processes can bring great advantages and enormous savings by extending the lives of water injection lines offshore and in many water distribution systems onshore. The 47km long Tweedsmuir offshore water injection lining was a prime example of this technology being put into practice for North Sea operations with sections pre-lined before laying.

This technology incorporates anti-microbial mitigation chemicals into the lining system that can then successfully prevent the growth and spread of MIC organisms. Typically a design life of 25yrs is specified for such lining systems but further R&D programmes are working towards a 50 year design life. In service failure of linings is extremely rare, provided adequate care is taken in respect of preparation and across pipeline joints.

Gary explained the many different lining types that protect against internal corrosion, their application systems and

different geographical needs, in a very informative manner that was appreciated by all.

Both January and February talks generated many questions from the audience, which were well responded to by the speakers. The talks will be the subject of follow-up technical papers later in *Corrosion Management*.



Branch Chair Dr. Yunnan Gao presents a Certificate of Appreciation to Gary Carswell of Aegion.

Dr Yunnan Gao, the ICorr Aberdeen Chair, congratulated all speakers and presented them with Certificates of Appreciation.

The next technical evening, which will be run jointly with the Marine Corrosion Forum, will be held on Tuesday 30 April, when Dr. Ian Carpenter of Scaled Solutions, will present a talk

on 'Corrosion Inhibitor Screening: Impact of Test Approaches' For the convenience of MCF conference attendees, this event will be held at ICorr's old home, the Palm Court Hotel, starting at 5.30 pm.

Prior to this, a large range of papers will be presented by MCF commencing at 10.30 a.m, including;

- Oilfield reservoir souring; Forecasting of Microbiological sour gas production using the DYNAMICTVS© model, by Matt Streets of Rawwater Engineering.

- A comprehensive approach to Integrity assessment of Critical structural components operating in Marine environments with ASPIRE™ by Sebastian Hartmann, Payam Jamshidi, Innospection and TWI.

- CP inspection and monitoring of Subsea pipelines by Ross Fielding of Impalloy Ltd.

A full list of upcoming presentations can be found at <https://www.marinecorrosionforum.org>

Looking further ahead, the branch will be hosting its annual full-day Corrosion Awareness course on 27 August 2019, comprising of a number of lectures / presentations focusing on microbiologically influenced corrosion (MIC) in pipeline systems. This year's CAD programme will include talks by ROSEN specialists and other visiting speakers, on their MIC experiences from global operations covering - Sampling, Analysis, Monitoring of Pipelines for MIC damage, Chemical Mitigation / Cleaning Strategies and finally Inspection, Modelling and Monitoring approaches.

Most certainly this event will provide a very comprehensive introduction, to this very significant and often troublesome area of Corrosion Control / Prevention.

As usual, all branch presentations can be found on: <https://sites.google.com/site/icorrabz/resource-center>, and full details of future events can be found on the diary page of the magazine and on the website, or by contacting, ICorrABZ@gmail.com

London Branch



Bijan with Trevor Osborne, who presented him with a token of appreciation from London Branch.

The February talk was by Dr Bijan Kermani of KeyTech, on corrosion, the outlook, challenges and future of the discipline, particularly in regards to hydrocarbon production. Having briefly touched on the economics of corrosion in the oil and gas industry, Bijan went on to present an overview of the projected global energy mix over the next two to three decades, highlighting

that there is an increasing global energy demand and that hydrocarbons will contribute the majority of this. He emphasised that technology continues to play a fundamental role for the hydrocarbon industry sector's business success, reducing capital and operational expenditure, environmental, safety and reputational risk, and increasing reliability. He emphasised that innovative materials, corrosion and

integrity management technologies play a significant role in supporting this. He argued that while significant progress has been made over the years in understanding the root causes of integrity management threats with advances in technology and expertise, there still remains major challenges.

The talk covered three themes including (i) a technology outlook in energy, (ii) corrosion and materials challenges facing hydrocarbon production industry sector, and finally (iii) what is required to move the corrosion and metallurgy discipline forward. In this, a brief reference was made to the corrosion discipline with respect to future priorities to attract a new generation of high calibre professionals. It was said that our contributions to all aspects of social, environmental, safety and security are clear and that the discipline has had significant achievements. The key achievement is the provision of public welfare; a 'positive image' rather than the reduction of failures which may convey a negative image of our discipline. By this change of focus we can attract even a better generation of young students.

Bijan concluded that the future is bright, although many challenges remain and there is a growing requirement for innovative solutions with timely implementation to achieve next level performance.

Midland Branch

The January meeting was joint with TWI, when Neil Gallon & Michael Young of Rosen presented a talk on Preferential Weld Corrosion (PWC).



This was the first of its type in the North East aimed at creating some synergy between ICorr and TWI. A good crowd of over 20 came to hear the presentation which went into in detail about the differences and complexity of welds in pipelines, and the possibility of galvanic

corrosion causing the metal adjacent to the weld being consumed. The heat affected zone (HAZ) can be attacked preferentially to the weld because of changes in morphology and differing galvanic potentials. Potential issues are very difficult to diagnose and therefore a lot of work has been done to understand the effect of adding corrosion inhibitors, for example when they are added to water injection/production pipes to protect the base metal, however this can also cause issues as they do not protect the weld. In these cases the weld can become anodic and preferential weld corrosion can occur.

One very interesting question was asked about the potential 'double whammy' of PWC and CUI occurring at the same time. It was confirmed that this could potentially occur if the insulation system was damaged allowing water to enter the system and causing electrolytes to leach from the insulation and gather at the weld.

In summary the evening was great success and this type of joint meeting will be used again.

Industry News

MAJOR GALVANIZING COMPANIES LEAD-FREE SWITCH IS FIRST FOR INDUSTRY

Wedge Group Galvanizing Ltd has completed a unique conversion to lead-free galvanizing at all 14 of its plants across the UK, and is thought to be the first of its type in the country to become 'lead-free'.

Small amounts of lead have been used to facilitate the galvanizing process for decades and it continues to be widely used today, however the challenge for Wedge Group Galvanizing was to develop the metallurgy and overcome technical challenges while maintaining and improving on the quality of the finish expected by its customer base.

Chris Woolridge, Managing Director of Wedge Group Galvanizing Ltd, said: "The amount of lead used in a traditional galvanizing process is very small but we wanted to remove it from our processes completely and made a firm commitment to do that 10 years ago. We have put a significant amount of time and effort into perfecting a methodology that produces even better results than before".

The initiative was made particularly timely by the 2018 reclassification of lead by REACH, which could turn into a major headache for some customers, who might have to meet exceptionally tight tolerances or demonstrate exacting procedures. Some might even review the use of any process that involves lead as a result.

David Nobes, Technical Services Director at Wedge Group Galvanizing Ltd, said that despite the challenges, we've been running a lead-free galvanizing process in our plants for some time and we are very pleased with the results. It takes a very long time for background levels of lead to be removed from existing baths, but levels are monitored regularly and the fact we now achieve indicative levels of less than 50 parts per million (or 0.005%) within the bath melt means we can proudly claim our process is lead-free."

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FORTH ROAD BRIDGE REPAIRS COMPLETED

High-level bridge works specialist Spencer Group, has completed a challenging £10 million project to replace truss end links that connect the bridge deck to the towers on the Forth Road Bridge.

The project stemmed from the discovery in December 2015 of a major fault on the crossing, which spans the Firth of Forth, connecting Edinburgh to Fife. One of the eight truss end links on the bridge was found to have fractured, and the bridge had to be closed for nearly a month while urgent repairs were carried out, by applying a temporary splint to the fractured link, followed by a permanent structural repair to that area. Bridge owner, Transport Scotland subsequently decided to replace the other seven key links, and Spencer Group won the tender for the works.

The repairs involved cutting out the truss end links and replacing them with a unique new sliding bearing system. It has required a series of complex works to be delivered to a part of the bridge which has limited accessibility and was never designed with replacement in mind.

To deliver the works Spencer Group installed temporary stairs and platforms below the bridge deck, allowing access to each bearing arrangement. Challenges included working in confined spaces within the main towers and manoeuvring large new structural components to precise tolerances.



Replacement involved working in confined areas. Photo courtesy of Spencer Group.

The replacement bearings were delivered to the bridge from a workboat, so the works had to be co-ordinated with tide times within the busy Forth estuary. Ensuring effective communication via two-way radios was crucial, with engineers working below the bridge deck having to contend with significant noise and vibration as traffic passed above them.

As well as installing the new bearing arrangements, Spencer Group introduced modifications that will make future works easier, including new permanent access stairs and platforms.

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www.icats-training.org

Intercrete® Products Used for Over 300 Areas of Concrete Repair at Hinkley Point B Power Station

AkzoNobel have announced that its range of Intercrete concrete repair materials have been used by specialist contractor CSC Services to complete the 2018 Concrete Spalling Remediation Programme at Hinkley Point B Power Station for client EDF Energy. *(Editor's note: The Intercrete range was expanded following AkzoNobel's acquisition of Flexcrete Technologies Ltd in July 2017 with Flexcrete products becoming known as Intercrete, part of the International brand).*

Before and after repair.



The concrete remediation work has involved the completion of more than 300 significant repairs at the power station over a six-month period, and this follows on from the 2017 programme also undertaken by CSC Services.

There were widespread areas of spalled reinforced concrete across the power station, and the work was planned to mitigate any potential health and safety issues, alleviate any impact on plant reliability and to ensure that there was no impact on ongoing nuclear safety. The concrete had spalled due to the age of the buildings involved and their environmental exposure, as well as some areas where water ingress had accelerated degradation.

Defective concrete was broken out to allow for exposed reinforcement to be prepared and treated. Intercrete 4871, which according to AkzoNobel forms a highly alkaline coating which not only protects the steel from aggressive acid gases, moisture and chlorides, but passivates the steel surface chemically to prevent further rust formation, was used to protect the steel rebars prior to the application of an Intercrete high-strength, waterproof, class R4 structural repair mortar.

All concrete repair works were completed by CSC Services with a 15 year service life guarantee, to satisfy the operational requirements of Hinkley Point B Power Station, and in accordance with BS EN 1504, the pan European standard for concrete repair.

Industrial Physics Acquires C&W Specialist Equipment

Test and measurement equipment manufacturer Industrial Physics Inc. (Boston) has announced the acquisition of C&W Specialist Equipment Ltd., (Craven Arms, England) which specialises in developing corrosion test chambers.

With the acquisition, C&W will become part of TQC Sheen B.V., a major manufacturer of surface coating inspection and test equipment.

“With a large installed base of test chambers and strong brand recognition in the industry, we are very excited to add the C&W product line to the TQC Sheen product portfolio,” said Antoon van Osch, Managing Director of TQC Sheen B.V.

C&W was founded in 1978 by Nigel Cremer.

Study of Solutions for Internal Pipeline Coatings

Offshore project technical services firm Crondall Energy (Hampshire) has commenced a study, in collaboration with Heriot-Watt University, The Oil & Gas Technology Centre and The Oil & Gas Innovation Centre, and lead by Crondall Energy's in-house Flow Assurance team in Aberdeen, to improve industry understanding of the potential flow assurance benefits of internal pipeline coatings.

The research methodology will consist of a three-tiered approach; data mining of previously published data, paired

with expert knowledge, to develop computational models of the behaviour of polymeric coatings, which will then be examined; an experimental phase looking at correlating wax deposition behaviour with coating surface parameters and flow characteristics; and finally the study will look at potential alternative polymer materials for improved internal coatings. The results of the study will be available to the industry and will present the laboratory testing data to allow any new projects to assess the use of internal coatings more confidently.



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Latest Literature

CorrCompilations, Coating Failure Analysis



In the latest CorrCompilations book, corrosion and coatings expert Jon Cavallo discusses a wide range of coatings failures — from abrasion and adhesion failure to peeling. The book is a compendium of technical information to be used as guidance for coatings inspectors in a number of industries. Readers will gain an insight into the causes of coating failures and how to properly analyse them by learning how to determine the root cause of a coating failure,

whether it's a mechanical flaw or human fault, and how to approach coating failures from the perspective of a coating supplier. The book includes an in-depth look at common pipeline coating challenges ranging from handling external polymeric coatings to dealing with trenchless pipeline coatings, and analysing failures of tank lining coating systems, as well as reviewing case studies of coating failures within offshore and marine environments, and understanding laboratory analysis tools for coating evaluations and failure prediction.

Coating Failure Analysis is available in a spiral-bound print format or as a downloadable e-book and can be ordered at <https://store.nace.org>

STANDARDS UP-DATE ISO

These documents have obtained substantial support within the appropriate ISO technical committees during the past two months, and have been submitted to the ISO member bodies for voting, or formal approval.

ISO/FDIS 12718 Non-destructive testing — Eddy current testing — Vocabulary (revision of 2008 standard).

ISO/FDIS 15549 Non-destructive testing — Eddy current testing — General principles (revision of 2008 standard).

ISO/DIS 3233-1 Paints and varnishes — Determination of percentage volume of non-volatile matter — Part 1: Method using a coated test panel to determine non-volatile matter and to determine dry film density by the Archimedes principle (revision of 2013 standard).

ISO/FDIS 9514 Paints and varnishes — Determination of the pot life of multicomponent coating systems — Preparation and conditioning of samples and guidelines for testing (revision of 2005 standard).

ISO/DIS 22462 Metallic and other inorganic coatings — Test methods of friction coefficient measurement of chemical conversion coatings.

New International Standards published during the last two months.

ISO 16836:2019 Non-destructive testing — Acoustic emission testing — Measurement method for acoustic emission signals in concrete.

ISO 16837:2019 Non-destructive testing — Acoustic emission testing — Test method for damage qualification of reinforced concrete beams.

ISO 16838:2019 Non-destructive testing — Acoustic emission testing — Test method for classification of active cracks in concrete structures.

ISO 2063-1:2019 Thermal spraying — Zinc, aluminium and their alloys — Part 1: Design considerations and quality requirements for corrosion protection systems.

ISO 21683:2019 Pigments and extenders — Determination of experimentally simulated nano-object release from paints, varnishes and pigmented plastics.

ASTM

ASTM International has announced a new test method, to be published as D8243, to aid in the detection of corrosion-inducing bacteria in water.

According to ASTM International, the enzyme-linked immunosorbent assay is able to detect the sulphate-reducing bacteria, which are a major contributor to microbiologically induced corrosion. The proposed method allows for significantly faster and easier detection of the bacteria versus conventional test methods, and thus could lead to faster remedial action to be taken, lowering the costs associated with this corrosion damage.

Innovative Products

New Paint Stripping Product

The Birmingham-based Indestructible Paints Ltd has launched IPStrip 500 paint stripper. According to the company, IPStrip 500 addresses the increasing restrictions on the supply and use of paint strippers that contain the hazardous substance 'dichloromethane' (DCM) which, in Europe, requires training to a professional level before use. The gel-based paint stripper is ideal for brush application, particularly where immersion is either cost-ineffective or impractical. It is non-toxic and biodegradable, and is characterised by low VOC emissions and is non-ozone depletive. It can effectively remove a long list of paint coatings — from urethanes and latex paints to alkyd, varnish and most twin-pack epoxy coatings, and is suitable for a range of substrates including steel, aluminium and die-cast metals as well as a number of plastics and composites. Because the product can achieve deep penetration, it is well suited to the removal of multiple layers during a single operation, enhancing both its practicality and cost efficiency, concluded the company.



IPSTRIP-500 in process after 24 hours.

New Military Coating Standard Products

A new range of military standard paint systems has been introduced by coatings specialist Indestructible Paint Ltd. in direct response to the introduction of Def Stan 80-225 towards the end of 2018. Importantly, the new products, which replace a series of previous standards, are free from Chrome VI and meet low VOC requirements.

Def Stan 80-225 is designed for use with military vehicles and non-aircraft equipment in a range of colours specified by the military. The new products comprise a choice of primer and top coat options – making the system suitable for both ferrous and non-ferrous substrates – the paint can be supplied to provide either a near matt IRR or gloss non-IRR finish. Application is by spray system with the coating requiring only a simple drying stage, concluded the company.



New CP Junction Box

Dairyland Electrical Industries has launched an innovative modular CP junction box, the UltraBox™. This provides cathodic protection personnel with easy access to all components and enables them to add, remove or reposition shunts, resistors and terminals at any time. It features an adjustable DIN rail mounting system and snap-in modules using industry standard shunts and adjustable resistors, which gives designers and field personnel complete control over the present configuration and future expansion of their product.



This box is available in one of two types of corrosion-resistant enclosures, lightweight polycarbonate or 304 stainless steel. Each enclosure type and size features mounting channels that allow one or more rails to be mounted in horizontal or vertical orientations, providing the most flexible arrangement, considering the type and quantity of components as well as the ease of cable entry and termination, concluded the company.



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Digital/Paperless Quality Reporting

Ian Patterson, Paint Technology Solutions



Carrying out record keeping on all the aspects of a painting project, either during the execution of the work, or during a subsequent inspection, involves detailing all of the essential information such as labour and shift details, ambient conditions, surface preparation, application sessions, test data, plant and equipment and photos, and all on a daily basis.

So how do we currently collect our site data? Well the answer will most probably be an A4 daily work sheet taken from a Lever Arch site file. In today's technological world doesn't that sound a bit dated for an industry striving forward with new advances.

The days of using paper to complete our reports surely must be numbered, let's be honest, it's time consuming, paper goes missing, reports have to be written and then scanned, and all those historical files that have to be kept for years.

It's time for a change: Embracing Technology

The last decade has seen a huge increase in new technology coming into the market. It doesn't seem that long ago that we thought mobile phones were impressive for just allowing us to make and receive calls on the go.

Who would of thought that in such a short time our phones would revolutionise our lives, providing us with social media; music; banking etc and a handy GPS map to guide us should we require it, and oh yes - we can still make and receive those handy phone calls if we wish.

The question is, has our Industry embraced technology? - Well yes it has in certain quarters. An example being the paint and equipment manufacturers where manufacturing processes are generally automated, and with the digital testing equipment

and Bluetooth technology. Traditionally however, the Protective Coatings Industry has relied on paper to generate daily reports; time sheets; data sheets; rams & cosh etc, enough paper to fill countless Lever Arch files. Could our industry as a whole consider reducing its dependence on paper and look at a new technology alternative?

So why change from the traditional ways? Let's look at the advantages and start by saving on paper and printing, reports completed on the go using your mobile device, time saving, professional outputs, data linked to industry standards, visibility of the data, cloud based storage.

There are different digital systems used by mobile phones on the market but these are based to two operating systems, IOS (Apple) and Android.

As a company, we looked at the market as a whole and found that there are just as many android devices as IOS in the UK. So when looking to build a digital remote system for recording inspection data (an App), there can't be limiting factors, and any development would need to be compatible with both mobile phone operating systems. With this in mind we decided to set about building a fully versatile system which meets the needs of all potential users.

So how do you build a fully versatile system?. Well a number of factors need to be taken into account, such as, incorporating Industry Standards, a remote system which also works off-line, it has to be easy to use (too complicated will put potential users off) and support pretty much all mobile devices from phones to tablets.

Our development and time has finally produced a fully working system called IRIS (Intelligent Reporting Inspection Software)



which meets the needs of Painting Contractors and Inspectors.

The system will mean that the size of the site files are hugely reduced in the amount of paper that needs to be filed, basically the system will allow uploading of any PDF document from Paint Data Sheets, COSHH Assessments and Standards etc.

The system is basically managed from a desktop dashboard, but the remote users (Painting Managers/ Supervisors/Inspectors) have unlimited access to creating different type of reports which allow site data to be collected



(Labour/Shift details, ambient conditions, surface preparation, painting application etc) and loaded back to the desktop. This process builds professional reports which can be sent from either the desktop or remote device.

Overall the big advantage of using a digital paperless system is the effectiveness and professionalism of delivering a quality report to a client promptly and giving the Project Managers total control of who can monitor and view reports remotely as they are being filled with the site data input.

The system is available to all painting contractors, although bespoke platforms can be tailored to individual needs. Other comparable systems are also available from different suppliers.

The Industry is changing and it won't be too long before we are all using digital paperless reporting on our phones and tablets.



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Non Destructive Testing Methods to Assess Corrosion under Insulation

Kristian Hampson, IMechE Argyll Ruane

Radiography can be used to determine defects.

Corrosion under insulation (CUI) is a major problem in the Oil and Gas Industry. If undetected, the results of this corrosion can lead to the shutdown of a process unit, a pipeline or an entire facility, and in some cases lead to a safety incident. The cost associated with mitigating this problem can get huge. It is one of the most difficult problems to prevent, and historically about 60% of leaks occurring in process pipes in the Oil & Gas industry can be attributed to CUI.

Last month in Corrosion Management (1) we discussed the testing of protective coatings to reduce CUI, however, preventing CUI is almost impossible as guaranteeing that moisture cannot permeate the insulation, and any protective coating, and come into contact with the metal surface. This article describes the various techniques available to determine if CUI is present on a process pipe or equipment.

How do we inspect for CUI?

The corrosion is difficult to determine, as the insulation (and cladding) mask the problem. Conventionally, this would be stripped off the surface, which is an expensive and time consuming process, and then a visual inspection would need to be carried out. Once the inspection has been carried out, new insulation and cladding needs to be applied, increasing the cost of inspection further. However there are several non-destructive test methods which can be used to detect the presence of any CUI, without removing the insulation. No one method is suitable for all occasions, so it is necessary often to use several different technologies, which complement each other, to allow an accurate assessment to be made of the problem.

These include:

Neutron Backscatter

This method is designed to detect wet insulation around pipes. A radioactive source emits high-energy neutrons to penetrate

the insulation. If there is moisture present, the hydrogen nuclei attenuate this signal which can then be detected. The advantages of this method are that it is relatively quick, no scaffolding is necessary for accessing elevated areas, it is lightweight and versatile and suitable for use in confined areas. The disadvantages however are that it is only a screening tool, it cannot detect or measure corrosion and it can generate false readings.

Real-Time Radiography

This can provide a profile of a pipe's outer diameter through insulation. The equipment has a built in radiation source and image detector/intensifier. The main advantages are real-time digital imaging/ archiving and traceability. The analysis is fast and should mean less need for repeat testing, however there are safety concerns due to the radioactive source, it has poor contrast and resolution, and as the diameter of the pipe increases, the performance reduces. Also its use is limited to small structures and access to both sides of the pipe are required.

Computed Radiography (CR)

This technique uses equipment very similar to conventional radiography except that instead of a film to create the images, a phosphor imaging plate is used. This plate is developed in a CR reader and digitised by software for easy analysis. The method is fast, the digital images can be stored easily and a wide range of thicknesses can be measured. The downside is that the image plates are expensive and easily damaged, they are sensitive to fogging/over exposure which reduces the contrast and there is again a health and safety concern over the radiation.

Ultrasonic Thickness (UT) Measurements

UT can measure local thicknesses of a solid element based on the ultrasound wave's time of flight. It is very effective but limited to small areas, and small pieces of insulation need to be

2

removed increasing the cost of using the method. During initial installation plugs can be inserted into the insulation at critical areas or at fixed intervals so that spot measurements can be taken later. This however damages the integrity of the insulation and they are places where water can easily ingress. The advantages are that wall thickness can be accurately determined (to 0.1 mm), readings can be made through any protective coating and it does not need access to both inside and outside of the pipe. The disadvantages are that it is limited to small areas, it requires good contact with

the pipe surface and the instrument needs to be calibrated for each situation. Also repair to the insulation needs to be done quickly and properly.

Pulsed Eddy Current (PEC)

This is an electromagnetic method to determine the wall thickness of an electrically conductive material. The probe is placed on an insulated pipe or vessel, a magnetic field is created by an electric current flowing through a coil in the probe. This field penetrates the cladding and magnetises the pipe wall. The current in the coil is switched off causing a sudden drop in the magnetic field and as a result eddy currents are generated in the pipe wall. These eddy currents diffuse inwards and decrease in strength. This is monitored by the PEC probe and used to measure the pipe wall thickness – the thicker the wall, the longer it takes for these eddy currents to decay to zero (*editor’s note: a diagram showing this technique can be found in Corrosion Management, November/December 2018, page 24*). The benefits of this method are that gives real time results, does not require contact with the test surface and can be used through insulation, coatings and linings, and has good accuracy. It is however only a screening tool and there can also be edge effects from adjacent components which affect the result.

In summary, CUI can be a serious problem in the oil and gas industry. The inspection methods described in this article are only tools for finding and monitoring CUI. No method covers all situations, and some complement each other.

One hopes that as technology advances, a definitive NDT methodology will be developed to determine the presence of CUI, and that further research can more or less eliminate the problem altogether.

Editor’s Note: This article is based on a presentation given at the Midland Branch November 2018 technical meeting.

References

1. Corrosion Management, no 147, January/February 2019, 19-22.

UT measurement meter, courtesy of Elcometer.



ISO 12944 - THE standard for coatings for corrosion protection

Trevor Fielding (BCF, Regulatory Affairs Manager) and Malcolm Morris (Sherwin Williams Marine & Protective Coatings, and Chair of the BCF's High Performance Coatings committee)

The global industrial protective coatings market celebrated a significant achievement last year in the important field of standards development, with the publication of the new (2017-18) revision of ISO 12944 'Paints and varnishes — Corrosion protection of steel structures by protective paint systems'. This latest version is composed of nine parts, and is the culmination of several years of focussed effort by a working group set up under Subcommittee SC 14, of the main International Standards Organisation's (ISO) Technical Committee for Paints and Varnishes, TC 35.

ISO 12944 - what's new

ISO 12944 is nowadays regarded as the primary global paint standard covering the corrosion protection of steel surfaces exposed to atmospheric conditions, especially for those locations in more extreme environments, such as bridges over estuaries and off-shore oil platforms. It has become the primary reference for all players across the supply chain involved with the specification, product selection, application and inspection of protective coatings for all environments. The European protective coatings community are actively promoting this standard throughout the sector. This is to ensure that the correct product recommendations are made, and that everyone is 'speaking the same language' with regard to the performance and corrosion resistance requirements, both for a new build and for the maintenance of existing assets.

Several parts to the new revision of ISO 12944 have introduced some more significant changes since the last major revision (1998), which is the primary focus for this article, viz.

Part 2: Classification of environments

Part 5: Protective paint systems

Part 6: Laboratory performance test methods

Part 9: Protective paint systems and laboratory performance test methods for offshore and related structures

C5 Classification Changes (Part 2)

Architects, specifiers, contractors and sourcing managers are strongly encouraged to study in detail the revised environmental categories in part 2, to ensure that the correct classification is clearly defined at the start of the project for the location of the surface to be protected. The introduction of the new CX classification to replace the former C5M (Marine) classification, and similarly the re-labelling of C5I (Industrial) to the new C5 classification, are key changes. This brings more clarity to the identification and classification process, and will help to establish the correct requirements for more extreme environments.

C5 is now therefore the most severe category for general use on-shore, representing industrial areas with high humidity and aggressive atmospheres, as well as coastal areas with high salinity. CX is for highly corrosive off-shore marine environments, thus allowing the incorporation of the new part 9 into the standard, a 're-badging' of ISO 20340 with minor changes (see below). In addition, a 'Very High' (equivalent to 25+ years) durability classification has now been introduced into ISO 12944 for C5, which includes the requirement to test coating systems for 16 cycles (2688 hours) of cyclic accelerated weathering performance testing

Obligatory number of coats and minimum coating thickness (Part 5)

The revised Part 5 introduces several new aspects. The previous version covered dry film thicknesses of coatings, and the minimum numbers of coats, as 'informative', so optional rather than mandatory. The new part 5 now stipulates these as 'normative' requirements, so these must now be respected during application and testing, to ensure sufficient corrosion resistance. This additional requirement under ISO 12944 is a distinct divergence from the current approach taken by the



Category	Low (>5yrs)	Med(5-15yrs)	High (15-25yrs)	Very High (25+yrs)
C2	Non Cyclic Testing Durations as 1998(E) revision ISO6270/ISO9227			Non Cyclic Testing: Linear Durations TBC ISO6270/ISO9227
C3				
C4				As C5 High: phased cyclic testing 10 cycles
C5	Non-cyclic testing Durations as 1998 (E)	Phased introduction of ISO20340 Cyclic Testing: 10 cycles Non-cyclic testing valid for 5 years	Immediate introduction of Cyclic Testing: 16 Cycles ISO20340 (with freeze)	

NORSOK committee, specifically their Standard M-501 e.g. System 1, where a minimum coating film thickness is not specified.

Part 5 also now covers situations when introducing new innovative coating technologies, referring to the need for independent test results and in-the-field performance data to justify the approval. The requirement for this additional test data also applies to higher performing systems which are recommended by the manufacturer to be applied below the stipulated film thicknesses /number of coats now contained within the standard.

Revised laboratory performance test regimes (Part 6)

The changes to Part 6 (which covers the paint test methods and regimes) are probably the most significant changes introduced across the whole of the new ISO 12944, and this part required the most effort and discussion within the working group, to achieve consensus.

The new version includes the following significant changes:

- The introduction of accelerated cyclic ageing weathering tests (to ISO 20340) for the highest durability classifications, e.g. 16 weeks for C5 Very High, 10 weeks for C5 High (optional).
- The cyclic and non-cycling testing has been summarised in the table at the top of the page.
- The limit of rusting is now set at 3.0mm, the result should be given as an average of 9 values along the scribe with a precision of 0.1mm.
- The requirements for inter-coat adhesion have been removed, and the adhesion failure to the substrate has been reduced to 0%. The minimum requirement of 2.5 MPa remains unchanged.
- The reduction of the pre-test curing period from 3 to 2 weeks.
- The requirement to include photos in test reports.

CX Environments - ISO 20340 with some minor changes (Part 9)

Finally, part 9 represents the testing requirements for coatings suitable for marine off-shore environments. This part is based on, and incorporates ISO 20340:2009, with some minor changes to the assessment methods and reporting relating to adhesion and corrosion resistance. Part 9 should therefore not be used or referred to for any on-shore environments.

The specific details on changes to Part 9 are as follows:

- The test methods remain as the current ISO20340, with a 4200 hours / 25 cycles ageing test, incorporating hot salt spray / Freezer / QUVA for atmospheric only.
- The addition of immersion and cathodic disbondment testing for splash zone and immersion scenarios.
- The use of ageing performance criteria based on area of use and chemistry type.
- The different scribe creep requirements according to location and test:
 - Atmospheric = maximum of 3mm scribe creep

- Heavy duty areas such as decks, splash zones, tidal zones = maximum of 8mm scribe creep
- Immersion testing (9 point average) with seawater @ 40C = maximum of 6mm scribe creep
- The minimum requirement for the pull-off adhesion test has been set at 5 MPa. For a one-layer system, this has been defined as 8 MPa minimum.

Market introduction - how this standard relates to the previous version and to NORSOK M-501

All the major European protective coating manufacturers are now introducing the new revision into their testing protocols and systems, and any new test reports or product launches will reference this new version. From the beginning of 2019, newly certificated products (e.g. through 3rd party certification) should be referring to the new version of the standard. It is not expected for any coating systems to be tested to the old 1998 version from now on, although ISO 12944:1998 certificated products will of course be expected to remain in the market for the foreseeable future (dependent on individual company product portfolio management decisions).

When referring to ISO 12944, care should now therefore be taken to consider whether the coatings specified conform with ISO 12944:1998 or with the 2017-18 revision. It is important to emphasize that the existing products with certification to the 1998 version of the standard still perform to those requirements as established at the time of testing, and still meet the specification requirements as set when they were first recommended. There is no intention to re-test these products to the new version of the standard, unless the differences specified above are deemed to be essential to the performance of the coating, for the specific application in question.

Questions have also been raised with regard to the relationship between the new ISO 12944 and the Norwegian standard NORSOK M-501. The requirements for approval to 'System 1' under the latter scheme include passing a cyclic accelerated weathering test of 25 cycles. It may, therefore, be tempting to assume that a coating approved to these requirements would be considered automatically to meet the requirements for ISO 12944 C5 Very High (which requires 16 cycles of testing). However, this is not necessarily correct as this NORSOK standard differs in other respects to ISO 12944, including not having the same requirements for number of coats and minimum dry film thickness. Care should therefore be taken when cross-referencing test results between the two standards, and using these to confirm conformance with requirements.

Conclusion

The new ISO 12944:2017-18 (parts 1-9) is now the principal reference standard for categorising and specifying industrial protective coatings for steel structures and surfaces prone to any corrosion. The European construction industry and other relevant players in the supply chain are strongly encouraged to research and use this standard in future, to ensure that the appropriate coatings are specified and used to match the correctly-classified environment in which they are intended to perform.

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BRANCH DATES

30th April 2019

Aberdeen Branch

5:30 - 8:00
Venue: Room N242, Sir Ian Wood Building, Robert Gordon University, Aberdeen, AB10 7GJ
Corrosion Inhibitor Screening: Impact of Test Approaches
Speaker: Dr. Ian Carpenter of Scaled Solutions

28th May 2019

Aberdeen Branch, joint meeting with NACE.

6:00 - 8:00
Venue: 3 Commercial Park, Venture Dr, Westhill, Aberdeen, AB32 6FQ
NACE Presentation and Demo (Material Loss from Surface Preparation) and Evaluating the Effect of Surface Preparation Standard on Zinc Rich Epoxy Primers
Speakers: AIS Training - NACE Presentation and Demo & Simon Daly of Hempel

26th September 2019

London Branch, joint meeting with SCI

18.00 - 21.00
Venue: SCI HQ, 14 Belgrave Square, London, SW1X 8PS
Topic to be confirmed.

ADDITIONAL DIARY DATES

21st - 22nd May 2019

Oilfield Corrosion Science & Engineering

Venue: University of Leeds
Oilfield Corrosion Science & Engineering - short course
Contact: www.engineering.leeds.ac.uk/short-courses/

21st - 24th May 2019

CEOCOR 2019

H.C Andersen Castle (Tivoli), Copenhagen, Denmark
Contact: www.ceocor2019.com

9th -13th September 2019

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