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THE PRESIDENT WRITES

This will be my final article written as President of the Institute of Corrosion, as my two-year term will have finished by the time you read this. It has been an honour and unique experience to serve as President and I would like to record my gratitude to Elcombe and Michael Sellers for the very considerable support given to me in this role.

I plan to continue to serve ICorr as the Immediate Past President for the next two years and I will also continue in the role of Chairman of Correx Ltd, the wholly owned subsidiary of ICorr. I am looking forward to seeing some of the recent initiatives taken by the Institute coming to fruition.

I believe that ICorr is in rude, good health, with membership showing an upward trend in both individual and sustaining member categories. However, we are in need of more young people, as student members and young engineer members, and in the 20 to 30 year age group. Please cast around to see if any of your younger colleagues or contacts in the wider industry can be introduced to ICorr. For its part, ICorr is planning to attend a science fair at a school early in February in a joint initiative with the Marine Corrosion Forum, with the intention of raising awareness of the interesting and rewarding careers that are to be had in the field of corrosion.

I would like to close by welcoming Sarah Vasey to her term of office as President and Gareth Hinds as Vice President. I wish them every success in the fast changing professional body environment and offer my continuing support to move things forward and to make ICorr as attractive as possible to future members. I would also like to thank all who have supported my Presidency, you all know who you are and I am very grateful to you all.

Best wishes for the future.

John Fletcher
President – The Institute of Corrosion

THE ICORR WEBSITE HAS A NEW EDITOR

It is with great pleasure that the Institute of Corrosion can announce that a new website editor has been appointed to keep the website, www.icorr.org, both up to date and relevant for both our members and the general public.

Imma Mobbs has been working on the website preparing news items for posting, but will now also provide both a focus for news, and for the management of the information that needs to be available via the website pages.

Imma will work alongside the editor of Corrosion Management to ensure a common approach to both sources of information.

J F Fletcher

OUT WITH THE OLD AND IN WITH THE NEW

At the AGM on Wednesday 30th November 2016, Sarah Vasey was elected to serve a two-year term as President of the Institute of Corrosion when John Fletcher stands down at the end of his term of office.

Sarah and John were photographed together at the end of November at the Sea Hotel in South Shields, before the most recent meeting of the Marine Painting Forum.

The Marine Painting Forum (MPF), founded some 25 years ago to provide a forum for the interchange of information and ideas between companies involved in the manufacture, application and use of paints and related products for the marine industry, is composed of one or two designated representatives from each participating company. The MPF meets at least three times each year and these one-day meetings normally include two or three relevant presentations from those involved in the different aspects of the work. For example, the most recent meeting included reports on an informal trial of LASER Ablation for paint removal, the control of substances on submarines that may affect the atmosphere and the use of wipes in surface preparation work.

More information can be found at, http://www.marinepaintingforum.com/pages/the-forum

ICORR SUSTAINING MEMBERS

Three companies have recently become sustaining members of the Institute. Sustaining Company Membership is rapidly increasing in popularity, and apart from the prestige value and increased exposure that a company or organisation receives from this form of membership, it also offers increased marketing opportunities and other benefits, including nomination of at least two staff as ordinary representatives of the Institute, free use of ICorr logo on your company literature and advertising, and an ICorr crested Certificate of Company membership for public display at your premises. Full details can be found on the Institute’s website.
ICATS UPDATE

The rules for the CSCS (Construction Skills Certification Scheme) cards are changing, from September next year the old CRO (Construction Related Occupation) card will no longer be valid. The Construction Leadership Council has agreed that trade associations, contractors, clients and government should specify and promote card schemes carrying the CSCS logo with no equivalents accepted. ICATS was audited in October and a legal agreement is now in place recognising ICATS as meeting the new requirements for CSCS. In future ICATS registered Applicators, Trainers and Supervisors will not need a separate CSCS card as the CSCS logo will be included on the ICATS cards. We are in the process of designing the new cards which will be issued for successful new and re-certification applicants well before the old CRO cards cease to be valid.

The next ICATS Company Trainer Course is on 24th/25th January 2017 in Northampton, and following three successful Trainer Seminars in 2016 the next will be in Northampton on 26th January 2017.

The new ICATS Supervisor module course is complete and currently being reviewed; we will be announcing dates for the first presentation of the course in the near future.

Keep up to date with ICATS news on the website (http://www.icats-training.org/) or the ICATS group on LinkedIn.

NEW SUSTAINING MEMBER
PITTSBURGH CORNING EUROPE NV

Pittsburgh Corning is a global leader in high performance insulation technology and applied solutions for a wide range of industrial, commercial and building applications. Its FOAMGLAS® cellular glass insulation, effective in the temperature range -265°C to +430°C, is a rigid high-performance cellular glass insulation material that offers exceptional strength, has great energy-conserving characteristics and will not burn. It is totally impermeable to moisture, resists the development of corrosion by minimizing water intrusion and retention, does not contribute to the corrosion of carbon or stainless steels and becomes an integral component of a corrosion protection barrier.

Pittsburgh Corning also offers a full line of complementary accessory products including sealant.

NEW SUSTAINING MEMBER
B.I.G GROUP

B.I.G. Group (International) Limited manufacture and supply specialist advanced corrosion control technology solutions to the automotive, industrial, rail, off-shore marine, government, defence and aviation vehicle manufacturers, with transportation waxes, underbody chassis coatings, storage coatings and cavity waxes. The in-house R&D team can develop bespoke solutions in their laboratories, and the dedicated technical team can assist in creating a process cycle for OEM supplier compliance, with advice on packaging and corrosion protection techniques that include transportation or long-term parts storage.

The Group distributes DINITROL® corrosion protection products and can also provide both salt spray and climatic chamber testing services. The company is also accredited by Bureau Veritas.

CEOCORR 2018

Planning for the 2018 conference in Stratford upon Avon is going well. The conference hotel has been secured and a sponsorship programme is being put together. Full details will be available soon.

Visit the ICATS website
www.icats-training.org
ICORR STALWART CELEBRATES HIS 80TH BIRTHDAY

A surprise birthday party for David Deacon, organised by his family, was held on 24th October at Wendover. This was attended by his son William, his two daughters, Katie and Sally-Ann, together with their families, and David’s three grandchildren. David’s long-time Company secretary, Gill Inwood, who also played a major part in organising the day along with daughter Katie, collected David from his home and brought him into the restaurant to a rousing chorus of Happy Birthday!

Among other guests were three Past Presidents, the Chairman of London Branch and a Past Chairman of the Yorkshire Branch, Rodger Hudson, who with his wife, Christine, had driven that day from York.

David, an Honorary Fellow of the Institute held many important positions over the lifetime of the Institute, including that of President, 2002-2004, and he played a vital role in the survival and subsequent development of the Institute. His many contributions were recognised in 2008, with the presentation of a U. R. Evans Memorial Sword. He celebrates 50 years as a member in December this year.

Over the past two years, David has survived courses of chemotherapy and radiotherapy, but was looking remarkably well on his Birthday. The photograph shows David giving his thank-you speech, before blowing out the candles on the cake.

BENEFITS OF ICORR FOR STUDENTS

One of the main objectives of the Institute is to raise corrosion awareness in all industries and at all levels. To fulfill this purpose, ICorr tries to keep a strong link to the universities by regular communication with new and existing engineering students, as well as graduate engineers.

Every year, Aberdeen branch organises presentations for new and returning students, to ensure that the above link is maintained, and that they are aware of ICorr activities and the benefits of being a part of the Institute. This was held again in September, during the induction week at the local Aberdeen Universities to give presentations to new and returning students.

ICorr University Liaison Officer (Hooman Takhtechian) gave an introduction to corrosion, various damage mechanisms and the methods of control. The students were provided with some examples of the relevance of the subject to their field of studies and professional career options available for them in this field. The students were then introduced to ICorr through presentations covering its core objectives, the various regional branches, available training and certifications, a guide to Continuing Professional Development, benefits of membership, how to apply for membership and a calendar of local Institute activities. Committee members Dr. Yunnan Gao and Dr. Abdulmotaleb Suleiman answered questions regarding how the Institute can assist students in continuous professional development, support them during their studies, chartership, and the benefits of regularly attending the local events.

ICorr Head Office will shut for Christmas at midday on the 23rd December and re-open on the 3rd January 2017.

We would like to wish you all a Happy Christmas and a Happy New Year!

LOCAL BRANCH NEWS

The local branches allow members (and guests) to meet and network with others in the industry. They are a good way of staying up-to-date and learning about the latest developments. Becoming a chartered engineer or scientist is getting more and more important for progression within the international industry, and attending these local meetings contributes to a member’s continuing professional development requirements.

Some detailed information about up and coming meetings is given on page 7, and in the ‘conferences and events’ section of the Institute’s website.
ABERDEEN BRANCH

The first meeting of the 2016/17 session was joint with The Welding Institute (TWI), at which Steve McCoy of Special Metals, gave a presentation on “New Alloy Developments for High Strength and Corrosion Resistant O&G Applications”. He emphasised that composition played an important role in the properties of steels and discussed the functions of elemental composition. With the aid of a Time Temperature Transformation (TTT) diagram for Alloy 718 he explained the process of ageing and annealing to get beneficial properties with an important objective of getting a good microstructure and avoiding the formation of delta phases. High strength and increased corrosion resistance were some of the beneficial properties obtained. The TTT diagrams for other alloys were also presented and compared, to explain the different material properties that could be obtained. Steve concluded by presenting the various practical applications for Alloy 945 and 945X in the oil and gas and other industries, summarising properties and key characteristics.

The October meeting on ‘Water Quality and Impact on Corrosion Control Decisions’, was a very lively and interesting presentation by Dr Eugenia Marinou – Principal production Chemist at Lloyd’s Register Energy. The presentation provided a high-level, but most insightful summary of the challenges associated with obtaining good quality formation water samples. Eugenia emphasised the need to question data and not always take things at face value. It is not always appreciated perhaps, that when an analysis is supplied for ongoing risk assessments, numerous factors could be contributing to an erroneous composition / misleading result, and several examples of these were presented. A keen debate followed the presentation covering topics such as current industry trends, and location, reliability and quantity of samples to be taken. The implications on corrosion and process control of using inaccurate water chemistry can be highly significant and sometimes very costly. Competent and representative sampling, and a thorough review, were the key messages of the evening.

Slides of Eugenia’s presentation can be found in the branch website, https://sites.google.com/site/icorrabz/resource-center.

The first two meetings of 2017 are a joint RGU meeting on 31st January on “Application of Acoustic Emission to detect Corrosion and Cracking” by Dr Ghazi Droubi / Faisal Nadimul, and “High Temperature Corrosion Attack: correlation between Crude Corrosiveness and results from online Corrosion Monitoring” by Ruth Wardman of Permasense, on 28th February. Both meetings are being held at the usual venue, the Palm Court Hotel, 81 Seafield Rd, Aberdeen AB15 7YX, with the evening starting at 18.00 and the presentation at 18.30.

A calendar of local events of interest to corrosion professionals in the Aberdeen area and the opportunity to sign up to the branch mailing list is available at https://sites.google.com/site/icorrabz/home.

LONDON BRANCH

Under the chairmanship of Jim Glynn, the London Branch began their 16-17 season of technical presentations, with a joint meeting with the London Materials Society (LMS) on 13th October at Imperial College. This first presentation was provided by Professor Gordon Blunn of the John Scales Centre for Biomedical Engineering at the Institute of Orthopaedics and MusculoSkeletal Science, UCL, who described the replacement of hip joints, a procedure pioneered in the UK, as one of the most successful procedures carried out. It was obviously important for the joint to have a long life, avoiding the need for the joint to be ‘revisited’, however corrosion has been identified in these replacement joints, causing the development of pain and pseudotumours. Gordon went onto describe the results of in-vitro tests on Titanium 6/4 and Cobalt chrome, the most common materials used, which showed that corrosion was affected by surface finish of the joint fixing tapers and that galvanic corrosion from the use of mixed alloys occured, which can be aggravated by torque levels experienced in use. Gordon finished by explaining that successful methods to reduce this corrosion were available involving ceramic layers and titanium nitriding DLC (Diamond Like Coatings). On behalf of the 45+ attendees, a vote of thanks was given by Trevor Osborne, Past President and Branch Committee member, after which, all enjoyed the traditional hospitality of the London Branch.

The next meeting will be on 12th January, when there will be a panel discussion with Bill Hedges (BP), Steve Paterson (Shell) and Alan Denney (AKD Materials Consulting Ltd) on “The Past, Present and Future of Corrosion”, and on 9th February, George Winning (Element Materials Technology) will give a presentation on “Oil and Gas Corrosion Inhibitor Testing” which will cover corrosion inhibitor testing in the oil and gas industry and how this has advanced over the years. The key characteristics inhibitors need to ensure that they will work in specific systems, and the many tests that need to be carried out to identify the correct product for the various systems, and how these may vary between applications, are among the topics which will be discussed.

Meetings will be held as usual in the Skempton Building, Imperial College, London SW7 2BB, with light refreshments at 18.00, the presentation at 18.30 followed by a buffet and time for networking. Full details of the forthcoming Branch technical meetings can be found on the ICorr website and in the Diary page of Corrosion Management. Enquiries can also be sent to icorr@icorr.org.uk.
EMERSON ANNOUNCES AGREEMENT TO ACQUIRE UK-BASED PERMASENSE LIMITED

Element Materials Technology has invested in a new corrosion facility currently being built within its existing laboratory in Aberdeen. Element Aberdeen is a UKAS and ISO/IEC 17025 accredited laboratory that offers a wide range of materials testing, materials engineering and welding services. With the addition of the new corrosion facility, it will also specialize in sour service materials qualification testing including base material and welding qualifications to ISO 15156 (NACE MR0175), NACE TM0177, NACE TM0316 and EFC 16, 17 methodologies.

NEW CPA GUIDANCE ON CORROSION TESTING

The Corrosion Prevention Association (CPA) has released a new guidance document which highlights the most commonly used corrosion testing techniques for reinforced and prestressed concrete structures. Technical Note 27: Corrosion Testing of Concrete Structures aims to enable the user to better understand how to assess corrosion risk and therefore make informed decisions about repair strategy based upon a broad base of information.

The guide explains that the initial cause of corrosion is commonly the result of a number of interrelated variables, such as changes in the concrete permeability, caused by local differences in composition, compaction and curing; construction errors leading to areas with low concrete cover to reinforcement; and variation in the exposure environment, leading to areas with elevated chloride ion content or high carbonation depth.

Corrosion testing should consider different exposure scenarios, ascertain risk, and develop a repair and maintenance strategy that provides the best technical and commercial solution for the structure. For each type of testing the guide outlines typical methods, advantages and disadvantages, and explains what the obtained results may mean. The document is available for free download from the Corrosion Prevention Association website. http://www.corrosionprevention.org.uk/publications.php

BOOK REVIEW – CORROSION PROTECTION AND CONTROL USING NANOMATERIALS, 1ST EDITION

This book explores the potential use of nanotechnology in corrosion protection and control. Part one looks at the fundamentals of corrosion behaviour and the manufacture of nano-crystalline materials, and covers the impact of nanotechnology in reducing corrosion cost, and investigates the influence of various factors including thermodynamics, kinetics and grain size on the corrosion behaviour of nano-crystalline materials. The electrodeposition, and the corrosion behaviour of electrodeposited nanocrystalline materials are also discussed. Part two provides a series of case studies of applications of nanomaterials in corrosion control, for example, oxidation protection using nano-crystalline structures at various temperatures, sol-gel and self-healing nano-coatings, and the use of nano-reservoirs and polymer nanocomposites in corrosion control.

EMILIOX MATERIAL TECHNOLOGY INVESTS IN NEW CORROSION FACILITY

Element Materials Technology has invested in a new corrosion facility currently being built within its existing laboratory in Aberdeen. Element Aberdeen is a UKAS and ISO/IEC 17025 accredited laboratory that offers a wide range of materials testing, materials engineering and welding services. With the addition of the new corrosion facility, it will also specialize in sour service materials qualification testing including base material and welding qualifications to ISO 15156 (NACE MR0175), NACE TM0177, NACE TM0316 and EFC 16, 17 methodologies.

EUROCORR 2017

The next EFC annual conference will take place in Prague, Czech Republic, from September 3–7, 2017. Uniquely in 2017, Eurocorr will be merged with the global triennial International Corrosion Congress (ICC), thus becoming the largest scientific corrosion event ever organised in Europe. In addition, for the first time, the Process Safety Congress 2017 will be held together with Eurocorr and ICC. It will cover all aspects of corrosion engineering, protection and science under the slogan “Corrosion Control for Safer Living.”

The organisers, Czech Association of Corrosion Engineers (AKI) and DECHEMA, are pleased to invite you to participate in the Joint Congress and have issued a call for papers for which the deadline for submission is 17 January 2017. Further details and a submission form are available on the Congress website: www.eurocorr.org
**COPPER APPROVED AS MARINE BIOCIDES**

The European Union’s recent decision to approve the use of copper in marine antifoulings is expected to deliver significant benefits for both the shipping industry and the environment. Copper, can help meet efficiency, performance, cost savings and environmental performance goals, according to Jotun.

The European Chemical Agency’s (ECHA) Biocidal Product Committee determined that the use of di-copper oxide, copper thiocyanate and coated copper flake is permissible in antifouling substances. According to the EU Biocidal Products Regulation 528/2012, manufacturers of antifouling paints must submit applications to receive formal approval of all of their copper-based antifouling products by Jan. 1, 2018.

“Copper’s efficacy is second to none when it comes to delivering clean hulls,” commented Alfie Ong, vice president of Jotun marine coatings. “And clean hulls are integral to enhancing the sustainability of the shipping industry, both commercially and environmentally.” Measuring hull performance in line with the soon-to-be-published ISO 19030, known as the Hull and Propeller Performance Standard, shows copper performs higher than competing alternatives.

The ISO standard, expected to available to the public in the third quarter of 2016, prescribes practical methods for measuring changes in ship-specific hull and propeller performance; it reportedly has the potential to deliver as much as $30 billion in annual fuel savings to the shipping industry.

**CASE STUDY - PROTECTING CHEMICAL STORAGE TANKS**

A chemical storage tank at a waste reclamation and recycling facility in the south of England, was showing signs of major corrosion damage after 2 years in service, and was in need of relining. As the tank handles multiple chemicals of varying pH in the range 4-10, the choice of the coating system was not straightforward, and was complicated further by the stipulation that grit blasting was not permitted.

The owners approached Tryton Designs (UK), who specialise in supplying solutions to problems relating to corrosion, erosion, wear, chemical attack etc., who recommended using UHP water blasting and a chemical resistant surface tolerable epoxy system from Chemco International.

The suggested specification was that the corroded areas, plus 10% around each area, were to be UHP water blasted to WJ-2/3 standard, and the sound surfaces, high pressure washed to remove all loose material and dirt etc. After this preparation, the cleaned corroded areas were coated by brush and roller with a solvent free, wet & rust tolerant universal epoxy primer at 100 microns dft. A full coat of the same primer was then applied overall after 12 hours. To complete the system, one top coat of a solvent-free, wet tolerant, highly chemical resistant, glassflake epoxy was spray applied overall at 300 microns dft. The tank was examined for pin-holes before being returned to service, and the whole refurbishment took 4 days.

DF Coatings Ltd carried out all the work including UHP water blasting, HP water cleaning and coating application.

According to Graham Wilson at Tryton Designs, the coating selected for this project needed to be able to handle waste chemicals of varying pH values and mixtures of organic and inorganic chemicals, so a broad resistance capability was required and was fulfilled using the Chemco RS 500P/ RA 500M coating system. The chosen system is a hard-wearing, chemical resistant coating, exhibiting good bond strength to most surfaces. At the same time as being surface tolerant, the applied coating needed to be a solvent free system to comply with the safety requirements of this multi-process plant. The RS 500P primer gives high pull-off readings on cleaned surfaces, such as is provided by using UHP blasting, providing the original surface profile was around SA 2.5/ 50microns. (Adhesion measurements carried out on a test piece of mild steel, with a profile of around 50 microns, showed pull-off results of 2000 psi).
EUROCORR 2016 CONFERENCE, MONTPELLIER

A report by Nick Smart, CED chairman

The 2016 Eurocorr conference was held from 12-15 September in Montpellier, in the South of France, at the Corum Convention Centre, which is located on the edge of the old town and surrounded by a large pedestrian area, wide tree-lined avenues and water features, and many attractive sand-coloured buildings.

The conference was opened by Professor Phillipe Marcus (PSL Research University, CNRS - Chimie ParisTech, IRCP/PCS), who announced that this year there was the largest number of attendees with over 1,000 delegates coming from at least 57 countries. Unsurprisingly, the largest number of delegates came from France, with over 300 attendees, Germany with 96 and UK in third place with 67. In a sign of the globalisation of the corrosion community, the Japanese had the fourth largest delegation with 43 attendees, and it was reported that the Chinese national corrosion organisation had recently joined as a member society. The overall theme of the meeting was ‘linking science and engineering’ and this was evident in many of the presentations given. Perhaps this is not unexpected since corrosion is an issue mainly affecting engineering materials!

As usual, the conference was divided into parallel sessions, with 11 sessions running concurrently, each one corresponding to one of the many working parties of the EFC (details can be found at http://efcweb.org/wp.html).

The Young EFC network was announced in the introductory session. This is an initiative started in 2016 by the EFC with the aim of supporting young researchers and engineers in the field of corrosion and protection of materials, with the vision of:

- Building a bridge between young corrosion researchers and senior experts
- Creating a network of young corrosion scientists
- Organising and participating in conferences, workshops and other events
- Promoting the interests of young researchers to the European Federation of Corrosion and the European Commission
- Supporting their career at an early stage

Details can be found at http://efcweb.org/YoungEFC.html.

In addition, the Eurocorr Young Scientist Grant award had been instigated with the aim of stimulating interaction and collaboration within the international corrosion community, by providing financial support to junior corrosion practitioners under the age of 30 to enable them to visit and interact with groups working in other countries. The first set of three awards, consisting of 1500 euros towards the cost of travel and accommodation was presented during the introductory session.

Following this introductory session, the European Corrosion Medal was awarded to Professor Lorenzo Fedrizzi (Università degli Studi di Udine), who presented a wide-ranging lecture on the use of coatings and summarised areas where he had been active, focussing on the use the use of atomic layer deposition (ALD) techniques.

This was followed by a presentation by Gerald Frankel, the multi-award winning Professor of Materials Science at Ohio State University and a member of the Nuclear Waste Technical Review Board. He highlighted the potential effects of the altered surface layer on the corrosion behaviour of aluminium alloys and their possible effect on corrosion investigations on aluminium alloys. He recommended that the altered surface layer should be removed before experiments are started to ensure that there are no unintended experimental artefacts.

The plenary lecture on Wednesday 14 September was given by Professor Nick Birbilis (Department of Materials Science and Engineering, Monash University, Melbourne, Australia) on the topic of aluminium alloys. Remarkable resolution can be obtained with modern high resolution TEM techniques with which it is possible to obtain images of individual atoms in crystal structures and intermetallic phases, and precipitates measuring a few nm across can be identified and characterised. The detailed microstructure characterisation can be used to understand the corrosion behaviour of these materials.

Following the plenary lecture, I attended the nuclear corrosion session, which opened with the presentation of the inaugural Nuclear Corrosion Working party (WP4) Henry Coriou award, given in recognition of achievements by a scientist, an engineer, or group of scientists or engineers, in the application of corrosion science in the nuclear field. This was made by Damien Féron (outgoing Chair of WP4 after 13 years at the helm, and next President of EFC) to my work colleague David Tice (Amec Foster Wheeler). David has had a long and distinguished career in the area of understanding and managing environmentally assisted cracking (EAC) of steels and nickel alloys in the high temperature, high pressure water environments that are used in water-cooled nuclear reactors.

I was also invited to be on the jury for the best oral presentation in the nuclear corrosion session given by a young corrosion scientist or engineer. Overall the presentations were of a high standard and covered a wide range of topics, from nuclear waste disposal to operational corrosion issues in nuclear reactors. At the end of the nuclear corrosion symposium, during which I had the privilege of co-chairing one of the sessions, two winners were announced, Juxing Bai (Paul Scherrer Institut, PSI) for his talk entitled ‘Using tapered specimen to study the effect of hydrogen on SCC initiation in Alloy 182 under BWR condition’, and Cristian Perez (Atomic Energy and Alternative Energies Commission, CEA, France) for his presentation entitled ‘Pitting corrosion modelling by means of a stochastic cellular automata based model’.

An exhibition, with a total of 57 stands, another record for a Eurocorr conference, was held during the event, where there was also a poster session, with 142 papers submitted. The overall winner of the best poster prize was Elke Ludwig, Vienna University of Technology, Austria), for a poster entitled ‘Corrosion testing of polyimide coated copper for semiconductor devices’.

Overall the conference was a rewarding opportunity to meet and hear from corrosion practitioners from around the world, and although the cultures and languages are diverse, the language of corrosion is universal. I was left with the feeling that the underlying corrosion science is making great strides, particularly with the advent of more and more powerful analytical tools and sophisticated models for corrosion, which together with the more traditional techniques, can provide a ‘holistic’ understanding of materials and the corrosion processes that affect them. This can only be good for the development of a sustainable future for mankind. Next year the conference will be held in Prague, a new venue for the Eurocorr conference, and which I can recommend attending!
ELECTROLYTIC RESISTANCE: A GOOD MEASURE OF COATINGS PROTECTIVE PROPERTIES?

Douglas Mills, University of Northampton, UK, and Sina Jamali, ARC Research Hub for Australian Steel Manufacturing, University of Wollongong, Australia.

The importance of resistance as a measure of a coating's protective properties is based on a large amount of short term experimental work done over several decades both on detached films [1–5] and attached films [6–9]. Large scale experimental work using in-situ DC resistance was carried out nearly seventy years ago by Bacon Smith and Rugg [10], who examined over 300 paint systems in sea water. They concluded that coatings with in situ resistances of > 1E8 ohms-cm² were highly protective, those with resistances with resistances of < 1E6 ohms-cm² were not protective, and those with resistances between 1E6 and 1E8 were borderline. To justify this emphasis on DC resistance (or its equivalent measurement i.e. RN from electrochemical noise measurement (ENM) or 0.1Hz Impedance from EIS measurements) as an important property, a small project was recently carried out investigating the long-term resistance behaviour of one particular coating type (alkyd). The results of which are given below.

What is the theory that supports this? The early contention that organic coatings act as a "barrier to water and oxygen" was disputed by Mayne [11] in 1952, who showed that coatings were permeable enough to oxygen and water to support corrosion at the rate it would have occurred if the coating had not been there. The results in Bacon Smith and Rugg paper lend credence to Mayne's view in that the way paint protected against corrosion was due to something else, viz acting as a barrier to ions. The standard Mayne explanation is that the paint provides a high resistance between anodes and cathodes which slows the corrosion reaction to almost zero.

Discussion and calculation of resistance value needed

What value of resistance do you need, and why is this value of 1E7 or thereabouts borderline in sea water? One approach might be to see what resistance value you might need to slow the corrosion rate significantly. This requires knowledge of what the resistance would be if there was no coating there. Therefore if weight loss results are obtained for a metal reacting freely in the environment of interest, a calculation can be made using Faraday's law to obtain the corrosion current (per cm²). The driving voltage is taken as the difference between the SEPs (standard electrode potentials) of the dominant anodic and cathodic reactions (in the case being considered here, iron corroding in sea water - this process is Fe → Fe²⁺ + 2e (SEP = - 0.44V) and the oxygen reduction reaction O₂ + 2H₂O + 4e → 4OH⁻ (SEP = + 0.8V). Hence using this, the resistance associated with the corrosion process itself can be obtained, and a detailed calculation, assuming a driving voltage of 1V is given in the Appendix, which in this specific example gave a resistance value of 2.58 x 10⁸ ohms.cm².

If a much higher resistance is introduced by a paint film, then this could markedly reduce the corrosion rate, for example a resistance 10³ times that calculated for bare steel above, would give a value which was in the borderline region in the Bacon, Smith and Rugg theory. However this hypothesis alone fails to confirm the corrosion rates for different metals and in different situations, and there must another explanation.

Passivation theory

Although agreeing in principle with Mayne's contention about the importance of ionic resistance, the authors suggest that there is another very important function of a paint coating, which is discussed in more detail in a recent publication [12]. The rub of this is that the coating is there to maintain the oxide film under the coating in the best possible condition i.e. to aid passivation. Work which supports this theory includes that by Brook et al [13] who considered the Pourbaix diagram for iron and then combined that with kinetics. They found that when the ionic resistance reached a certain value (around 10⁷ ohms), then passivation "sets in" as long as there is a passivating species in the environment. This passivating species could be oxygen, or even water. It is, of course, generally noted (as with bare metals) that high potentials (e.g. -0.2V SCE or above) for coated iron or steel are associated with an effective, protective paint coating, and that when the paint breaks down, the potential normally falls [14]. Scantlebury and Faidi [15,16] did some interesting work in high resistivity organic liquids which confirmed this.

It is therefore suggested that the appropriate Pourbaix diagram for the situation under the coating needs to be known and that will determine what resistance value is needed to get the metal into a passive state.

D and I areas

Having decided that ionic resistance was very important, Mayne started a major programme of work studying the resistance behaviour of detached paint and varnish coatings [1–5]. This included permselectivity, ion exchange properties, water uptake studies and the mechanism of conduction. One very interesting observation found was that paint coatings are inhomogeneous in their resistance behaviour, particularly thermostos type coatings. There are areas of relatively easy conduction, labelled as D areas, where conduction follows that of the external solution (D for Direct) (Fig 1), however these probably only occupy a small fraction of the film (e.g. <1%). (It should be noted that the conductivity in these areas is still much slower than if they were pores filled with the external solution). The rest of the film is I Type, where conduction in the film runs inverse to that in the external solution (I for Inverse). D areas naturally occur in cross linking polymer coatings and are most often found in single coats applied at a thickness between 20μm and 100μm. Double coats show much less chance of D areas than a single coat at the same thickness [17]. With three coats there is almost no chance of overlapping D areas, so the film becomes I type, i.e. it exhibits a uniform high value of resistance. However even if the whole coating area is almost impermeable to ions (i.e. initially all I type), D areas may occur if the coating is not perfectly uniform.

![Figure 1: Variation of resistance with concentration of KCl solution for I and D type paint coatings from ref 4.](image-url)
form with time due to degradation of the coating reducing its resistance value. Therefore any test programme for anti-corrosive coatings should incorporate measurements to investigate the stability of resistance over time.

Experimental confirmation of importance of in-situ “ionic” resistance measurement

As mentioned above, the classic work by Bacon, Smith and Rugg in 1948, put the emphasis on in-situ DC resistance as an important property. Figure 2 shows their classification of paint protective efficiency with respect to electrolytic resistance over a period of 150 days. More recent results obtained [12] on fifteen alkyd coated samples (each 3.14 cm² area) exposed to 3% NaCl for three years are shown in figures 3 and 4. All fifteen specimens show a drop in the resistance value with some falling below the fail threshold, i.e. <10⁶ ohm.cm², after three years immersion. Only one sample managed to maintain the resistance above 10⁸ ohm.cm² after three years immersion. Note that the resistance value of all samples stayed above 10⁶ ohm.cm² during the first year, and above the 10⁸ ohm.cm² after two years, but only the sample that consistently exhibited resistance above 10⁸ ohm.cm² maintained the high protective characteristic after three years. The appearance of corrosion and blistering on the samples followed within six months from the resistance dropping below the 10⁶ threshold. This suggests that once the resistance drops below the 10⁶ ohm.cm², the coating should be examined more frequently and repaired/replaced in order to ensure effective corrosion protection is in place.

Novel method for examination of free films

As discussed, earlier information regarding the mechanism of ionic conduction through an organic coating can be acquired by measuring the ionic resistance of a coating independent from substrate, or as a detached (free) film. This has traditionally been done by placing detached films between glass tubes filled with solutions at two different concentrations of chloride, and measuring the DC resistance using a solid-state electrometer (or EIS). A description of a novel quick method for determining this, is given in July/August Corrosion Management p 9.

Immersion testing

Normally the substrate is low carbon steel, e.g. Q panel, which is coated, either by spray or KBar with the coating being tested. It is very important to know the thickness of the coating when measuring ionic resistance, due to the impact of thickness on this parameter, e.g. a doubling of thickness might lead to many orders of magnitude change in the resistance. The test can be conducted using either full panels blanked off with say beeswax/colophony resin and immersed in glass beakers, or by using cells defining controlled smaller areas (e.g. 10cm²), stuck on and filled with solution (see figure 6 - this was the way the work reported above confirming the B S and R criteria was done). These are left for various lengths of time (typically say 6 weeks).
with the beakers/cells loosely covered, but open to laboratory air. The resistance can be measured by any of variety of the techniques mentioned earlier such as Electrochemical Noise Method (ENM), Electrochemical Impedance Spectroscopy (EIS), Current Interrupter (C.I.) or DC resistance. [18, 19]. For continuous monitoring of numerous samples, ENM, in either the standard salt bridge electrode arrangement or one of the more practical electrode arrangements such as single substrate [20] or no connection to substrate (NOCS) [21], would be the preferred method. To acquire mechanistic information about breakdown of paint in a lab environment, EIS and/or C.I are suggested. Following on from Bacon, Smith and Rugg and the experimental work described earlier, it is recommended that the resistance is measured as a function of time (only at 0.1 Hz if using EIS [22]). Note that if the paint film is protecting the metal substrate effectively, the measured “R” is normally dominated by the ionic resistance of the coating.

**Cabinet tests**

These attempt to simulate outdoor conditions in a laboratory environment, e.g. by closely controlling levels of ions, humidity, UV level and temperature. Although test samples in cabinet tests are not normally measured continuously, it is strongly recommended that electrochemical methods (like DC or EIS or ENM) are used to assess the state of the samples during and after these types of tests, which can provide quantitative information, i.e. values of $R_{dc}$ (DC resistance), $R_{inc}$ (Impedance value), $R_{n}$ (Noise resistance).

**Future work in relation to resistance measurement**

Situations can be envisaged where the through-film resistance is high but the coating is either semi-detached from the substrate (although not obviously) with no sign of corrosion, or the coating is detached with corrosion occurring under the coating. Further work is needed to see whether ENM or EIS can detect these situations either directly or indirectly (e.g. by inference). Secondly, in order to help unify measurements, the best electrochemical methods for particular situations, both for lab testing and in the field, need to be defined. This could be based on extensive multi-laboratory investigations. On a more practical note, the development of a hand-held resistance measuring equipment for field use would be very useful.

**Appendix - Example of an approach to determine the value of resistance required of a protective paint**

The weight loss of steel samples in 3% NaCl and 1.5% NaCl were determined (table 1) over a period of one week at 22 °C. Using Faraday’s Law, the corrosion current and hence resistance associated with the corrosion reaction (equation 1) was calculated based on a driving voltage of 1Volt (see text). Experiments were conducted in triplicate and the weight losses were within +/- 2%.

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$E_i = \frac{0.082 \times 96500 \times 2}{55.8 \times (24 \times 60 \times 60 \times 7)}$  
Dividing the corrosion current by the surface area, gives the corrosion current density (amps per cm$^2$) 

$I = \frac{4.689 \times 10^{-4} A}{12.1} = 3.87 \times 10^{-5} A/cm^2$

Assuming the driving force (V) is 1 volt, the resistance R can be calculated:

$$R = \frac{V}{I} = \frac{1}{3.87 \times 10^{-5}} = 2.58 \times 10^4 \Omega/cm^2$$

**References**


**Table 1 Results of corrosion rate experiments for steel in NaCl solutions**

<table>
<thead>
<tr>
<th>Name of Solution</th>
<th>Letter Code</th>
<th>Average metal loss (mg)</th>
<th>Average corrosion area (cm$^2$)</th>
<th>Average metal loss per unit area (mg/cm$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5% NaC1</td>
<td>A</td>
<td>82</td>
<td>12.1</td>
<td>6.77</td>
</tr>
<tr>
<td>3% NaC1</td>
<td>B</td>
<td>73.2</td>
<td>11.8</td>
<td>6.2</td>
</tr>
</tbody>
</table>

$$m = \frac{(M \times t)}{(96500-n)}$$  
Equation 1

where m is mass loss (g), M is the atomic mass (Fe = 55.8), i is the current density (A), r is the time (s) and n is the number of electrons involved in the anodic reaction (for Fe=2). The 96,500 is the Faraday, which is the number of coulombs of electricity needed to dissolve the equivalent weight of the metal.


PREVENTING MISTAKES IN CORROSION MONITORING AND CHEMICAL TREATMENT AT OIL AND GAS RECOVERY AND PROCESSING FACILITIES

Tata LN Murthy, Gujarat State Petroleum Corporation Ltd, India.

In the control of corrosion, the important structures/process are taken care of by experts and technologists. Technology has developed a lot, with the help of software and instrumentation most types of corrosion can be identified and prevented in the initial stages, however there are still many failures due to corrosion. One of the reasons may be that what are considered minor parts of the plant or processes are ignored or overlooked by technologists and engineers. These can have high potential to cause severe corrosion, and the result may be moderate to heavy losses to the industry. This article discusses the types of mistakes that can occur in oil and gas facilities.

Corrosion Management System
The key to preventing failures is to have a management system which should follow the cycle of PDCA (plan, do, check and act) followed by a continuous improvement process. Entire activities can be categorized into such a plan, however care should be taken to ensure the following points are considered.

Pipeline flow conditions
Corrosion monitoring personnel should be vigilant of the upstream conditions at the facility, including where the fluid in the pipeline originates. The corrosion monitoring and chemical treatment programme can be tailored depending on the upstream conditions, eg when the corrosive nature of the fluid flowing in the line is lower, or higher, than normal or when a new well is lined up, or there is a choke or or zone change in the well. All these scenarios should be carefully monitored by qualified personnel.

Sample testing
In addition to collecting samples for laboratory testing, samples should also be tested in situ, as this gives real time data for decision making. Field testing machines and field test kits can be used, with the main aim of identifying the corrosivity of the fluid.

Operational parameters
Knowledge of water content, pressure, temperature, flow rate, frequency of flow etc. of a line are required for decision taking. If flow rate reduces, water may accumulate in many areas of pipeline, causing corrosion. Similarly other fluid parameters may change, and the corrosion monitoring team should be aware of the current operational parameters of the fluid inside the pipeline, to ensure proper control of corrosion.

Corrosion Management in Different Phases
Normally corrosion monitoring of an oil & gas installation only takes place during the operational/production stage. But each and every stage of the project (Design, Construction, Commissioning, Operations and Maintenance Phase/Shutdown Time) is vital for the integrity of these oil & gas installations. The design phase is the most important part in any project, and if care is taken in this stage almost one third of the corrosion problems can be eliminated.

In the commissioning phase of a project, the main priority is given to production start-up, but corrosion monitoring systems functionality should also be checked with the vendor at this time.

Sample points are fixed at the time of design and during construction, normally at these stages there are no chemists or chemical treatment staff available. Only after starting production will these people begin corrosion monitoring and by then, difficulties with sampling points may become evident. One of the main problems may be that there are too few sample points for a detailed study of corrosivity or other corrosion monitoring activities to take place, or maybe the sample point is in the wrong position, or there are no sample points in key locations. The corrosion monitoring team has then to manage with the existing facilities to carry out corrosion monitoring tests.

Maintenance
Often during maintenance/shut down, the separators and other vessels, which are coated with produced sand from the wells are washed out. The main reason for this is only to get rid of sand, and the fire-fighting water supply is used. This water will have all types of bacteria present, and washing will cause contamination of these separators. After starting production again, these bacteria start to multiply in the system due to optimum temperature conditions. As flow direction is towards the storage tanks, this will lead to contamination of them also. Normally this is the only difficult system in oil and gas production facility to treat for bacteria.

The water used for washing the inside of oil and gas production vessels should be treated with biocides, scale inhibitors & corrosion inhibitors to avoid contamination of the separators, lines, wash tanks etc.

Corrosion inhibitor addition
Corrosion or chemical treatment staff will decide the correct dosage rate of the inhibitor, but many will pay little attention to what the actual dosage rate being used is. Due to poor maintenance of the chemical injection pumps, they may not inject correctly, so continuous inspection, with preventive maintenance of the chemical injection pump is required, as too little pumping will not control corrosion.

Regularly checking the level of corrosion inhibitor in the fluid also gives a good idea about its performance (it will also reduce wastage of chemicals). Injecting corrosion inhibitor into a pipeline and checking the amount at the other end gives an idea of the pipeline protection. The residual amount should not be zero, nor too high. If no corrosion inhibitor is detected, or is less than the value specified by the chemical treatment specialist, then the injection programme needs to be checked and the rate increased. If the residual amount is more than the expected, then the difference between the injected dosage and residual amount at the end of the pipeline should be calculated, and the dose optimised. Sometimes the chemical may not work and does not form a protective film but is just transported with the fluid, in this case the chemical needs to be changed.

Selection of suitable corrosion inhibitor
Often many specialists will concentrate less on selection of suitable chemicals and prefer to use readymade chemical packages which are available in market. The most suitable chemical should be selected, or tailor-made chemical blends should be prepared based on the operating and process conditions only.
Corrosion models and simulations can be used for this selection. Corrosion inhibitors should be stored as per the manufacturer’s recommendations otherwise their effectiveness may be reduced.

Real time data
In oil and gas field corrosion monitoring, there are many techniques which give data, ranging from active corrosion occurring to the identification of corrosion initiation. Real time monitoring techniques will help identifying the initiation of corrosion, which is very useful in preventing corrosion failures before they happen. A dynamic approach is thus essential for good corrosion prevention and for this real time data collection is needed.

Test Methods and Instruments used
Corrosion monitoring personnel should only use standard test methods. Nowadays, many monitoring instruments are available on the market, but the corrosion monitoring team should be vigilant and only procure instruments which are developed on the standard test methods. Ensuring the accuracy, reliability of data, maintenance of instruments as per the recommendations are vital for good corrosion monitoring.

Competent Persons
In many companies corrosion monitoring is being carried out by unskilled or semi-skilled people without the advice of a professional person. There are companies who have recognised professionals from corrosion institutions like ICarr and NACE, but although many companies spend money on corrosion monitoring, they still lose money due to corrosion failures as they prefer not to spend this on qualified staff.

People working in corrosion should keep their knowledge updated by attending training, seminars & conferences and reading journals, and companies should encourage them in doing so.

Conclusion
To prevent mistakes in corrosion monitoring, it is essential to develop a flawless corrosion management system.

Acknowledgement
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About the Author
Tata LN Murthy has 15 Years of experience in Chemistry and Corrosion of Oil & Gas Production Operations. He is experienced in establishment of chemistry laboratory and corrosion monitoring system. He is currently the Assistant General Manager – OGT of the Gujarat State Petroleum Corporation Ltd. He has a MSc (Applied Chemistry) and is a C.Chem, a member of the Royal Society of Chemistry and a NACE Corrosion Technologist.
According to the company, non-destructive measurement of dry film thickness on concrete is now more accurate, faster and much easier than ever before with the new Elcometer 500 Coating Thickness Gauge for coatings on concrete. The new gauge is easy to use, has a robust and ergonomic design, menu driven colour display, user selectable statistics, memory and USB & Bluetooth® data transfer to PC or mobile devices. It can accurately measure the thickness of dry films on concrete and other cementitious substrates up to 10mm thick, for example with epoxy coatings.

The coating thickness gauge can be used in accordance with: ASTM D61322, SSPC PA9 & ISO 2808.

METALLIC ANTI-CARBONATION COATING

Flexcrete Technologies Limited has launched Monodex Metallic, an elastomeric, decorative, single component water-based structural coating, believed to be the world’s first metallic anti-carbonation coating. It cures without the release of strong odour or hazardous solvents, and is ultra-fast drying, enabling two coat application on the same day by brush, roller or airless spray.

Whilst remaining highly protective against the harmful effects of carbon dioxide diffusion, the new product incorporates metallic particles which reflect more light than solid colours, giving the coatings a luxurious sheen. It is designed to be applied as a feature finish over an anti-carbonation base coat from the same product range.

Due to the ability to create special metallic colours, the product was recently used to repaint the exterior of the iconic 170-metre Emirates Spinnaker Tower in Portsmouth, which soars above Portsmouth Harbour.

NEW ORGANIC MIGRATING CORROSION INHIBITOR

According to Cortec, their new corrosion inhibitor can reduce construction time and costs and extend the life of concrete structures. MCI®-2008 ViaCorr, is a patented, organic-based concrete admixture in powder form which combines Cortec’s Migratory Corrosion Inhibition Technology with a polycarboxylate based, superplastisising, viscosity modifier.

CP POWER SUPPLY

Cathodic Protection Co Ltd (CPCL) has introduced a new switch mode power supply (SMPS) designed and developed specifically for cathodic protection installations. The SMPS converts the available unregulated AC or DC input voltage to a regulated DC output voltage. According to the company, it can provide stable, accurate outputs from a few millivolts and milliamps, up to a maximum of 24V and 6A or 12V and 12A, making it ideal for steel in concrete applications. It supports simultaneous switching of an unlimited number of units in less than 10 milliseconds, and can take instant “off potentials” on large systems, and is also designed to be fully compatible with remote monitoring and control systems. It has an operating temperature range of -20 to +70 C and is designed and built to meet applicable EMC and safety standards, as well as the requirements of BS EN 12696.
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Monsal House, 1 Bramble way, Alfreton, Derbyshire, DE55 4RJ
T: 01773 631100

Underhill Engineering Ltd
Plymbridge Road, Estover, Plymouth, PL6 7LX
T: 01752 752480

Universal Coatings & Services Ltd
Port Clarence Offshore Base, Port Clarence, Middlesbrough, TS2 1RZ
T: 01642 540060

Vale Protective Coatings Ltd
Building 152 – Langar North Industrial Estate, Harby Road, Langar, NG13 9HY
T: 01949 869784

Wardle Painters Ltd
Unit 5, Wimborne Building, Atlantic Way, Barry Docks, Glamorgan, CF63 3RA, UK
T: 01446 748620

Wescott Coatings & Training Services Ltd
9b/Cc Tyne Point, Shaftsbury Avenue, Simonside Industrial Estate, Jarrow, Tyne & Wear, NE32 3UP
T: 0191 497 5550

W G Beaumont & Son
Beaumont House, 8 Bernard Road, Romford RM7 6HX
T: 01708 749202

William Hare Ltd
9b/Cc Tyne Point, Shaftsbury Avenue, Simonside Industrial Estate, Jarrow, Tyne & Wear, NE32 3UP
T: 0191 497 5550

Wood Group Industrial Services Limited
Kirkstone House, St Omers Road, Western Riverside Route, Gateshead, Wear, NE11 9EZ
T: 0191 4932600

Xervon Palmers Ltd
331 Charles Street, Royston, Herts, SG8 7JA
T: 01462 784279

Woodside Industries Limited
Globe Industrial Park, Jarrow, Tyne & Wear, NE32 3UP
T: 0191 497 5550

Xervon Palmers Ltd
331 Charles Street, Royston, Herts, SG8 7JA
T: 01462 784279

Yazaki Coatings Ltd
Woolston Road, Gorton, Manchester, M12 7NG
T: 0161 837 2000

Zeta Intercos Ltd
Barnes Business Park, 20 Meadowfield Lane, Gateacre, Liverpool, L25 7RZ
T: 0151 724 5555

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T: 0151 724 5555

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T: 0151 724 5555
Mapei’s products are recommended for protecting against the corrosion of reinforcement rods in new structures and also structures requiring repair such as balconies, bridges, jetties and columns.

**Mapeshield I** - pure zinc anodes coated with a special conductive paste, for galvanic cathodic protection against corrosion of reinforcement rods in new structures and in structures requiring repair.

**Mapeshield E 25** - self adhesive zinc plates applied directly on the surface of structures for galvanic cathodic protection against corrosion.

For further information on using Mapei’s anti-corrosion products please contact Mapei. Call 0121 508 6970 or Email: info@mapei.co.uk
DIARY DATES 2017

Thursday 12th January 2017
London Branch Meeting
Speaker: Bill Hedges, Steve Paterson, Alan Denney
Venue: Skempton Building, Imperial College, London, SW7 2BB
Event starts at 18.00; presentation starts 18.30

Tuesday 31st January 2017
Aberdeen Branch Meeting
Topic: NDT – Application of Acoustic Emission to detect Corrosion and Cracking
Speaker: Dr Chazir/Faisal Nadimul – Joint RGU presentation
Venue: Palm Court Hotel, 81 Seafield Rd, Aberdeen AB15 7YX
Event starts at 18.00; presentation starts at 18.30

Thursday 9th February
London Branch Meeting
Topic: Oil and Gas Corrosion Inhibitor Testing.
Speaker: George Winning
Venue: Skempton Building, Imperial College, London, SW7 2BB
Event starts at 18.00; presentation starts at 18.30

Tuesday 28th February
Aberdeen Branch Meeting
Topic: Monitoring High Temperature Corrosion Attack: correlation betweenCrud Corrosiveness and results from on-line Corrosion Monitoring.
Speaker: Ruth Wardman
Venue: Palm Court Hotel, 81 Seafield Rd, Aberdeen AB15 7YX
Event starts at 18.00; presentation starts at 18.30

Thursday 9th March 2017
London Branch Meeting
Topic: Presidents talk and Branch AGM – see website for more details
Speaker: Sarah Vasey
Venue: Skempton Building, Imperial College, London, SW7 2BB

Tuesday 28th March 2017
Aberdeen Branch Meeting
Industrial visit – Cosasco HQ (BOD). Latest Advances in Real-Time Monitoring and Safe Retrieval
Cosasco, Bridge of Don, Aberdeen. Details to be advised. Event starts at 18.00

Thursday 13th April 2017
London Branch Meeting - Joint with NACE
Details to follow
Speaker: Chris Fowler
Venue: Skempton Building, Imperial College, London, SW7 2BB

Tuesday 28th April 2017
Aberdeen Branch Meeting
Topic: Cathodic Protection – Using Simulation Techniques to help Assess CP Current of Buried Subsea Pipeline Anodes from Field Gradient Measurements.
Venue: Palm Court Hotel, 81 Seafield Rd, Aberdeen AB15 7YX

Tuesday 30th May 2017
Aberdeen Branch Meeting
Venue: Palm Court Hotel, 81 Seafield Rd, Aberdeen AB15 7YX

Wednesday 25th January 2017
Marine Corrosion Forum
1. Technical presentations:
   - ‘Optimisation and Validation of Internal Corrosion Direct Assessment – Prediction vs Reality’, Lewis Barton, ROSEN Group
   - A New Risk-based Method for Assessing Microbiological Induced Corrosion’, Matin Momeni, DNV-GL
2. MCF News & Open Forum – Discussion of topics of interest to members
Buffet lunch at 1:00pm
3. Annual General Meeting
4. Technical presentations (continued):
   - ‘Designing Marine Reinforced Concrete Structures to Achieve Best Possible Up-throw of Current from Immersed Anodes to Bars above the Water Level’, John Baynham, BEASY
   - ‘Corrosion Failure Investigations and the Role of an Expert Witness’, Phil Munn, Midland Corrosion Services Ltd
Venue: Lloyd’s Register, 71 Fenchurch Street, London EC3M 4BS. Please use the old entrance on corner of Fenchurch Street & Lloyd’s Avenue
Members
Buffet lunch at 1:00pm
3. Annual General Meeting
4. Technical presentations (continued):
   - ‘Designing Marine Reinforced Concrete Structures to Achieve Best Possible Up-throw of Current from Immersed Anodes to Bars above the Water Level’, John Baynham, BEASY
   - ‘Corrosion Failure Investigations and the Role of an Expert Witness’, Phil Munn, Midland Corrosion Services Ltd
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London Branch publish a monthly Newsletter; to be included on the circulation list please contact Sarah Vasey sarah.vasey@sherwin.com

ICorr Head Office will shut for Christmas at midday on the 23rd December and re-open on the 3rd January 2017.

We would like to wish you all a Happy Christmas and a Happy New Year!