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INSTITUTE OF CORROSION
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I write this in Amsterdam while waiting for my flight to Atyrau in Kazakhstan, this is a business trip not a holiday. During the wait I have been contemplating two things upon which we have become totally dependent in our daily lives, that is hydrocarbon fuels and electricity, both largely inseparable; imagine life, after knowing it with these two commodities, without them, the list of negatives goes on into infinity and might include life without computers (that might suit some including me), cars, aircraft, buses, trains etc. as we presently know them, and of course my long awaited flight to Kazakhstan would never arrive or leave. This list naturally covers other more direct and personal inconveniences, the heating of our homes, cooking facilities and even the summer barbecue, if you rely on bottled gas as I do. At a recent corrosion related forum which I attended on behalf of ICorr I was impressed by the deliberation and planning behind the liquefaction and storage of natural gas, this was done to hedge against loss of the main transmission supply in one relatively small area of the UK, it takes eighteen months to fill the available storage capacity to maximum levels and only five days to draw it down, not long on the outgoing side but enough to provide valuable time to reinstate supply and provide continuity of delivery during the down period. However this strategic planning requires that the source supply is reinstated and if it’s not then the lights will go out or dinner will be uncooked, let’s hope the interruption is short-lived and readily reinstated.

How is any of this related to corrosion? Well there are many ways our supplies of essential energy can be interrupted including depletion of stocks, geopolitical issues, very concerning presently, and the damage caused by corrosion which requires constant vigilance and attention. This applies not only to gas and oil transportation systems it also applies to roads, railways, bridges and other key infrastructure. In the last two months I have attended a number of events on behalf of ICorr where the requirements for protecting this infrastructure have been at the forefront of discussion, it is excellent that groups of like minded persons gather to discuss the subject of infrastructure integrity and preservation and that ICorr members and others are fully engaged in taking that challenge on, we all need to continue to do so.

Without energy and the infrastructure that delivers it life would be radically changed, and not for the better, well not initially, maybe we could adapt but that would take time and there would be a lot of pain. We all need to be aware that the work done by our members is of key importance to keeping our world turning in the same day to day manner that we have come to enjoy through the uninterrupted supply of energy.

I hope to see you all again soon at one of our many regular meetings and events to continue this discussion.

Trevor Osborne,
President of the Institute of Corrosion
On 10th April 2014 The London Branch met for a joint meeting with NACE UK for their last technical meeting of the season, at The Naval Club, Mayfair. The evening proceedings commenced with presentations of awards and certificates to a number of candidates who had taken part in the New Entrant Engineers Program held in 2013. Candidates also received a free year’s subscription to ICorr.

After completion of the presentations and under the Chairmanship of Trevor Osborne, ICorr President, attendees were treated to a technical fact filled joint presentation by Andrew Sturgeon, Materials Engineering Manager and Mark Perrin, Senior Project Manager, of Genesis Oil & Gas.

Andrew and Mark’s presentation outlined the impact on technical requirements from subsea design from a materials engineering prospective. It was made clear that offshore oil in especially deep water was becoming key for the future, with a consequential increase in CAPEX for harsh and remote locations.

Subsea design therefore had many ‘drivers’ such as difficult fluids, high pressure and temperature reservoirs, the need to develop enhanced oil recovery and not least to accommodate economic challenges. The presenters highlighted the latest flexible pipes for ultra deep water. These pipes of up to 200 mm dia and with a bend radius of 2m or less are being produced for very sour service with an ‘anti H2S sheath’ manufactured using a composite polymer and metallic oxide. These pipes were undergoing a qualification programme to operate at up to 200 Bar and 15% H2S.

Where difficult reservoir fluids have been encountered, active flowline heating solutions have been developed including electrical trace heated pipe within a pipe and direct electrical heating using the passage of AC current along the carrier pipe. Questions from the audience were taken and comment was made on the problems of AC corrosion with the direct electrical heating and more generally, a plea was heard that development in NDT methods had not kept up with the technical innovations being used.

On behalf of the attendees, a vote of thanks to Andrew and Mark was then given on behalf of NACE by Mike Surkein, Snr. Corrosion and Materials Consultant to ExxonMobil Development. The meeting then adjourned to enjoy the traditional hospitality of the London Branch.

Future Branch technical meetings to be held at The Naval Club, 38 Hill Street W1J 5NS are detailed in the magazine diary. All are welcome, but please note that The Naval Club requires gentlemen to wear jacket and tie when attending evening meetings.
LONDON BRANCH NEWS

AGM & GAS INDUSTRY PAST AND FUTURE

On 13th March 2014 The London Branch met for their traditional March meeting at The Naval Club, Mayfair. The evening proceedings commenced with the London Branch AGM and reports were presented by Branch Chairman, John O’Shea and Branch Treasurer, Jim Glynn. Reports confirmed that the Branch was in good health and had completed through last year, a full and successful meetings programme which included both technical and social occasions. Jim Glynn provided details of the Branch accounts which indicated judicious use of the monies allocated from Sustaining Membership fees and healthy surpluses arising from the Annual Golf Day and Christmas Lunch.

The Branch accounts were accepted nem com and the Branch Committee were encouraged to continue in the same vein for the next year. The Committee is made up of, Chairman John O’Shea, Hon Treasurer, Jim Glynn, Hon Secretary, Mike Moffat, Paul Brooks, Mike Allen, Brian Goldie, Geoff White, Derek Hoskins, Andy Taylor, Sarah Vasey, Mash Biagioli, David Deacon, David Dore and David Mobbs.

After completion of the AGM, under the Chairmanship of Jim Glynn, attendees were treated to an entertaining presentation by John O’Shea, based on his life’s work in the Gas Industry and involvement with the Institute. John now retired, worked for over 40 years in the gas industry and is a Chartered Scientist, Past President and Honorary Life Fellow of the Institute.

John outlined his early days at the South East Gas Research Laboratories, a time which included the introduction of plastic pipe for the ‘new’ natural gas supplies. The problems which arose from the change to the dry natural gas were described and to the surprise of all, John noted the inherent permeability of PE pipe to natural gas; although he did not offer this as an explanation of the ever increasing high cost of gas supplies.

The presentation then detailed the history behind the full scale testing, selection and use of a water based vinyl acrylic paint system for gas holders throughout the country, to provide an environmentally friendly system with excellent performance. John also discussed the first major programme to totally refurbish the external surfaces of LPG tanks at five UK gas storage sites, which involved, for the time, the state of the art enclosed grit blasting of structures.

On behalf of the attendees, a vote of thanks to John was then given by David Deacon, Consultant to SPC and Branch committee member. David advised that he has known John from the early days and wanted to emphasise the significant impact John had had with the Institute, whilst serving as President. In particular John drove the acquisition of Corrosion House which turned into a significant investment for the Institute and the recognition of ICorr by the Engineering Council as an affiliate member and the Science Council as a corporate member. Appropriately, the meeting then adjourned to enjoy the traditional hospitality of the London Branch.

Future Branch technical meetings to be held at The Naval Club, 38 Hill Street W1J 5NS are detailed in the magazine diary. All are welcome, but please note that The Naval Club requires gentlemen to wear jacket and tie when attending evening meetings.

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CED Annual Meeting:
COATINGS FOR THE CORROSION PROTECTION OF ANCIENT AND MODERN STRUCTURES

By David Nuttall and Douglas Mills

The Corrosion Engineering Division (CED) holds an annual one-day meeting and this year it took place at the Royal Armouries Museum, Leeds on Thursday, 8 May. One aim of the meeting is to enable the CED working parties to meet, but it is also provides lectures in a particular topic area and this year the theme was coatings. The museum, which is free entry to the general public from 10am to 5pm most days, contains a very comprehensive collection of items associated with English wars and battles over the last two millennia. Originally housed in the Tower of London, the bulk of the museum moved to the current site about fifteen years ago. The meeting attracted thirty eight delegates and took place in the Wellington Suite of the Armouries Conference Centre. Three organisations, Corrocoat Engineering, Taziker Industrial and Sherwin-Williams Paints exhibited. Thanks must be expressed to these three companies for supporting the CED day. Lectures ran throughout the morning, followed by lunch. There were then meetings of CED Working Groups paralleled by conducted tours of the museum’s conservation laboratories. The two major working party meetings that met were the Nuclear Corrosion and Coatings groups and useful business was conducted in both of these (on this occasion the numbers involved in the other working parties viz. monitoring, water treatment, CP and corrosion in concrete were rather too small to be active). About two thirds of the delegates attended one or other of the conservation laboratory tours organised by Nyssa Mildwaters. These provided a fascinating insight into the work of a conservator.

Delegates were welcomed by Nick Smart, the Chair of CED. Then Nyssa Mildwaters (Royal Armouries) presented a talk entitled “Corrosion, conservation and coatings: Dealing with corrosion in museum collections”. The Royal Armouries is a purpose-built museum, dating from 1995, allowing the overflow of artefacts from the Tower of London collection (dating from the 1400s), but also housing weapons etc. from the modern era. Conservation may be defined as “Preservation in perpetuity objects of cultural significance”. The Royal Armouries deals with a wide range of artefacts and the general philosophy is that although corrosion cannot be stopped altogether, it is best to attempt to prevent it in the first place. There are also ethical considerations requiring expertise and judgement (for example about the final appearance of artefacts after treatment). Conservators strive to maintain as much of the original structure as possible. An interesting, but as yet unexplained, phenomenon that affects iron artefacts in the displayed collection at Leeds, but also in other museums around the world, is known as Concentric Ring Corrosion (CRC). The Leeds conservators would welcome interaction/input from corrosion engineers with a view to solving this problem. Finally, the “Oddy” test (an Accelerated Ageing Test) was described for silver, copper, iron and lead. Conservators tend to only trust tried and tested methods. Only by building relationships with scientists and engineers specializing in the fields of corrosion and corrosion protection can conservators improve their effectiveness.

Next up, David Deacon (SPC) delivered a lecture on “Steel bridge painting – achieving the optimum, long life performance”. SPC has advised on the painting of the Thames Barrier in the late 1970s and of over 100 bridges in India and Nepal and over 250 bridges in the UK. In addition, they carried out failure analysis on the Eurostar bridge, Liskard viaduct and A19 bridge in Teeside. Together with D A Bayliss, David Deacon wrote the textbook: “Steelwork Corrosion Control” (Spon Press, 2002). This provides a comprehensive treatment of the...
subject. The ICorr Scheme for Quality Inspector Levels I, II and III was described, together with the relevant ISO Specifications. On the subject of paintwork surveys, six main factors were described: existing paint properties, metal coating condition, steel condition, the extent of remedial work, new coating systems and the re-painting specification. A novel approach is to consider "whole life costings", which is now possible for 1,500 steel bridges. These previously required maintenance every 12 – 15 years, but now with improved techniques 25 – 30 year maintenance periods are possible. This implies that for a total structure life of 120 years, only four interventions would now be required.

Steve Walters (NNL) spoke on, "Current coatings issues in the nuclear industry". He described the context of this work as being for high value assets where no corrosion failures can be tolerated. The environment is challenging including: (1) Radiation, which breaks up molecules, limiting the use of organic coatings. However, the stability of the benzene ring enhances the properties of certain polymeric coatings.; (2) Chemicals: for example fluorine gas is used to make UF6 for isotopic separation by gaseous diffusion; (3) Physical: temperatures of several hundred degrees Celsius, pressures of tens of bars and very high radiation fields, render plant inaccessible for maintenance, and complex geological disposal environments. Various case studies were described including underground buried pipework, nuclear fuel cladding, spent fuel transport, storage and disposal.

David Eyre (ICATS) spoke on, "Coating Applicator Training – an Introduction to the ICATS scheme". Starting in 2002 to overcome the skill shortage in the coatings industry and the lack of formal training for industrial operatives, ICATS is wholly owned and managed by ICorr through CORREX and provides training for ICorr, Highway Agency, National Rail, Coating Consultants/ Suppliers, Paint Contractors, Fabrication Contractors and General Suppliers. Presently, there are more than 240 Trained Trainers, 140 Registered Companies, 3,000 personnel trained and 150 qualified supervisors. The ICATS training is comprised of 64 mandatory core modules for Industrial Coating Operators (5 days), Abrasive Blast Cleaning Operators (3 days) and Paint Spraying Operators (2 days).

David Horrocks (BAM Nuttall) lectured on "Coating defects, a contractors real life view of coating defects being witnessed in the field today". He described a coating failure on a metal bridge maintained by Network Rail, where the bridge had ballast on it and since this remained wet, the coatings system broke down. A significant part of the cost of inspection and repair (with the total running into £100,000s) resulted from the access problem, which meant that boats and crews had to be hired to enable bridge access. The aim was to provide a 15 yr service life expectancy in accordance with NR/CIV/ L3/039-040 Protective Treatment (XM92/ M24) – 158. Subsequently, failure of some lock gates was analysed. Again, access was difficult. Overthick primer was the problem. The moral here was to use the best paint, the best surface preparation and the best applicator in the first place. Subsequent maintenance activities are hugely expensive (access, etc.) without guaranteed longevity. David Horrocks' philosophy was that "It is the partnership of the future in our battle against preventing corrosion; corrosion and quality are made for each other".

And so ended a productive and enjoyable day. The minutes of the working parties meetings will be available soon in the members area of the Institute of Corrosion website, together with copies of the slides from the talks. Every member is welcome to get involved with the activities of CED. Please contact Nick Smart (the chair of CED, nick.smart@amec.com) for further information.

The authors would like to thank Nick Smart for checking this report. And to Ruth Bingham for kindly providing the two Royal Armouries pictures.

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**OUR RATES REMAIN THE SAME AS LAST YEAR!**

**MEMBERSHIP SUBSCRIPTION RATES 2014/2015**

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<td>The annual rate from 1st July 2014 is £695.00 (plus VAT)</td>
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A TRIBUTE TO THE LATE FRED PALMER
THE PASSING OF AN “ICON”

In the absence of a formal obituary, which I am sure he would not have liked anyway, I have been asked by our President–Trevor Osborne, to write a few reflections on the life of Fred Palmer as far as it involved the Institute of Corrosion and the coatings world.

Fred passed away peacefully, on the 12th November 2013 and his funeral was held in Liverpool on Friday the 22nd November 2013. The Thornton Garden of Rest Chapel was packed with friends and family. ICOR was represented by Vice President John Fletcher and also present were Bill Cox (Past President, 96-98), Richard Horner from Abu Dhabi and David Deacon (Past President, 02-04) from the ICOR London Branch. Fred’s three sons, Stephen, Geoffrey and Michael gave moving tributes, to their Dad and our friend, Fred. Derek Mortimore also added a tribute, from Fred’s, “North Sea Friends”

Trevor referred to him as the, “Passing of an Icon”. I looked up the dictionary definition of an Icon and it stated, “a person that people look up to/admire for the things they do/ have done, this is nearly always someone famous”. Yes, “Our Fred”, as he was known to his ICOR family and all those, he met outside during the course of his work, would definitely, describe him as, an Icon. Fred was born in St Helens, Merseyside in February 1930 (he was always very proud of the St Helen’s rugby union team). Then after graduating from Liverpool University in chemistry he joined the Goodlass Wall paint company as a Chemist to support the Technical Service Department, providing technical support to that company’s sales force. During his work with Goodlass Wall he came in contact with many of their customers, amongst who was British Petroleum and it was therefore not surprising that in the 70’s, BP “head hunted” him and he joined BP Engineering to provide them with corrosion advice and guidance on a worldwide basis.

Although I knew Fred vaguely from his Goodlass Wall days, it was not until he moved to BP’s Britannic House in London that I really got to know him as a Client, an ICOR colleague and indeed, a friend. I was retained by BP at that time, as a coating consultant and we were providing them with coating inspectors on a number of projects both in Europe and also through our Houston office in North America in the Gulf of Mexico and from our Middle East office in the Arabian Gulf countries so we had dealings with Fred on a worldwide basis. In my business dealings with Fred at BP Engineering he asked me about the Institute of Corrosion and when I told him back in the mid 70’s that the ICOR London Branch rarely met and when it did the maximum attendance was only 10 – 12 dedicated people. Fred immediately put plans in place to change this and we arranged for a number of ICOR members to join the next London Branch AGM and to vote, to change the membership of the Branch Committee to revive that flagging part of the ICOR organisation.

Fred was unanimously voted in as London Branch Chairman and he appointed the Branch Committee of active London based members and the events he put in place, now 35 years ago, have gone on from strength to strength. The current London Branch Chairman - John O’Shea gave me the privilege of giving a brief tribute to Fred so we could toast his memory at the December 2013, London Branch Annual Luncheon, which Fred had first set up and targeted an upper number of 50 guests and members and it is now approaching 200 and is probably the most successful ICOR social event in the entire ICOR calendar – Well done, Fred and the London Branch Committee.

At the time of Fred’s first involvement with the London Branch, there were active attempts by one or two disillusioned ICOR members to form a separate UK NACE Section and they approached Fred to join the Committee. I personally was very much against this and through my connections with NACE in Houston I discussed with senior NACE management that a working arrangement should be established rather than two competitive organisations.

I am pleased to be able to say that at that time they acted along this request and in 1979 set up, “the Corrosion Control Engineering Joint Venture” (CCEJV). The first of these joint CCEJV annual technical meetings was held at the Imperial Hotel in Russell Square, in October 1980 which was Chaired by Fred Palmer where he set out the aims and objectives of the joint venture to the over 250 delegates who attended, together with strong representation from NACE Management, Houston and the NACE International Relations Committee.

Well done Fred.

This CCEJV, joint venture with NACE became very successful and tripled the membership of the Institute in the UK. Regrettably the NACE officers felt that this was becoming dominated by the Institute of Corrosion, they then set up a separate UK NACE Section, which finally ended the CCEJV activities and the two professional bodies continued to support their membership separately with occasional joint meetings. ICOR set up the Corrosion Engineering Division to continue the technical working parties and Fred was naturally appointed the first Chairman.

Following the split between NACE and ICOR, our Fred continued actively to support not only the London Branch, but the Institute on a national basis. He established a Conference organising committee to continue to run, major events. At the UK Corrosion Conference in 1989 he presented a special plenary lecture in the ballroom of the Norbreck Castle Hotel in Blackpool, entitled, “The Life and Times of a Practising Corrosion Engineer”. The ballroom was packed and over 350 delegates who attended that event heard one of the most interesting and technically amusing presentations that have ever been given at any international corrosion conference. – Well done Fred.

Fred went on to become President of ICOR in 1995/96 and during that time he retired from BP Engineering and joined Kemira Coatings. At the UK Corrosion Conference in 1995 (the 15th of these events), Fred Chaired the Pipeline Protection Session and also gave a technical paper on Corrosion Protection of Subsea Pipelines.

Fred retired in 2000 at the age of 70, mainly due to problems with his arthritic knees, however, when I was President in 2003 I was able to persuade him to return to the UK Corrosion Conference entitled, “Harrogate Revisited 2003”. Fred gave a paper entitled, “A Lifetime of Changing Coating Types.” It inevitably started with red lead and went through all of the coating systems that Fred had a vast knowledge and experience of, ending up with the most modern three component systems for refinery and pipeline protection. Fred also joined a Discussion Panel for questions and

Continues on page 10
answers at that event, with such coating luminaries as Derek Bayliss, Roger Hudson and David Storey. – Well done Fred.

Although Fred had come back out of retirement at the age of 73, it was a most memorable event that all the delegates who attended will remember for his sharp and humorous technical responses to a diverse range of questions on all coating subjects. Regrettably that 2003 event was the last time that Fred was able to attend any major, public ICorr event and although I was in contact with him about the 50th ICorr anniversary, which was held at the Thames Barrier in 2009, he was unable, and too ill to attend.

Fred was not only very sharp technically, throughout his career, but an extremely engaging personality, he was also a dedicated winner. When the CCEJV with NACE was in its early days, Fred organised a golf tournament between ICorr and NACE and this ran annually for four years, the first three years were held in the UK in conjunction with the UK events and after ICorr had won these first three, the NACE members said that their best golfers were not present in the UK and ICorr should go to America and play them on their own courses, where they were certain they would win. We therefore took up the challenge and Fred organised for a strong ICorr team to visit New Orleans to play the Americans at golf on their own ground, needless to say Fred’s ICorr team won the day, then the joint venture broke up and we have never played them at golf since, but at least we got to keep the trophy!! – Well done Fred and his team.

A second challenge that I remember well, was from the Institute of Metal Finishing where as many members will remember, the administration of ICorr was run from the IMF, Birmingham office. At one meeting ICorr learned that IMF held an annual quiz night, which was extremely competitive with between 12 and 15 teams of four people all registering and attending and fighting for the annual trophy, Fred was very keen to put in an ICorr team, despite being told by the IMF Council that the quiz subjects were very diverse and ICorr would not do well because they thought we were all just academics! I knew Fred could not resist the IMF challenge and being a winner he would not go along with a team that he had any doubt could only come second.

We arranged for three key members, Stewart Crow an SPC retired coating inspector who had informed me that he had once come second on the BBC radio, ‘Brain of Britain’ and in the final he only lost by 2 points, (so he became the second cleverest man in the UK) Fred also arranged for two members of the BP Sunbury staff to join, one was Graham Clayton, who had been runner up on TV’s Mastermind and had only lost again by 2 points in the final on his specialist subject, although he had got full marks on his general knowledge questions, they were all paid up ICorr members.

With an ICorr team like that Fred knew that we would out class any team from IMF and although it was the biggest ever IMF quiz night turnout with 17 four people teams present, the ICorr team won the trophy and when it was presented we offered to buy all of the IMF contestants a drink from the ICorr winners. However, not surprisingly only three of them, out of the 70 plus people attending, accepted our drinks offer and we have never been invited to defend our winner’s trophy, which we still hold!! - Well done Fred and his team.

So yes, in the corrosion and coatings world our Fred was a true Icon and he was also a real winner. Fred you will really be missed, not only by your family, but also by the many members who shared your company in both technical and social events, over many, many, years, Thank you, “Our Fred”.

David H Deacon, a past colleague and friend of, “Our Fred”.

Fred’s sons – Stephen, Geoffrey and Michael

Richard, John and DHD

John, Richard and Bill

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On the 25th of March, Aberdeen branch members visited the Element Materials Technology facilities in Aberdeen. Ian Farquharson and Martin Green gave a brief description of the services offered by the group stating that it provided services across various industries such as Aerospace, Automobiles, Nuclear, Oil and Gas among others.

Martin gave a brief history of the company explaining that the Element brand was “founded on technology” and gave some detail on relevant services provided to the oil and gas industry such as Mechanical Testing, Metallurgical Analyses, Fracture Mechanics Testing, Engineering Criticality Assessments (ECA) and Corrosion Testing.

Daniela McAdam explained how Element performed material component failure analysis and explained the typical steps in failure analysis including data gathering, visual examination, detailed examination using scanning electron microscopy, Energy Dispersive X-Ray Analysis (EDX), X-Ray Diffraction Analysis (XRD) etc.

Andy Barron gave an introduction to Fracture Mechanics explaining types of fractures with details of the various geometries, terminology and tests performed. He introduced various specimen configurations touching on the test samples such as SENT, SENB, CT, CCT, SCT, CC etc. and explained why each type were used with a summary of what results to expect. He also explained how graphs were generated with particular emphasis on key aspects of CTOD and JR curves.

After the presentation session, delegates were divided into groups and taken to various sections of the facility. Delegates were shown the specimen preparation workshop area where material samples are cut using a state of the art equipment. Delegates were also taken to the material and mechanical testing workshops. During the tour, subject experts described various equipment used for Mechanical Testing, Material Properties Testing, Stress-Strain Analysis, Fracture Mechanics Testing, Corrosion Testing and Weld Failure Analysis and Testing. At each stage, a detailed explanation of the equipment used, work processes, disciplines, result retrieval, data representation and how information is fed back to the client were explained.

It was a fascinating evening overall, so much so, that delegates extended the evening to twice its planned length.

For information about the Aberdeen branch actives please contact the branch secretary via icorrabz@gmail.com. Alternatively a calendar of local events of interests 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.

For all the latest news, events and debates join us on LinkedIn.
The April 2014 branch meeting was a joint session with the Marine Corrosion Forum (MCF). Dr Eugenia Marinou of Senergy was the guest speaker and presented a series of case studies highlighting various integrity management problems that could lead to asset failure. She covered the importance of interaction between production chemistry and corrosion management/integrity assurance with emphasis on the importance of communication between disciplines.

The first case study was related to a failure due to corrosion experienced in a Produced Water Re-Injection (PWRI) system. The speaker explained that analysis from and deposits retrieved showed evidence of Microbiologically Influenced Corrosion (MIC). Eugenia noted that the main lesson learned was that system cleanliness was essential in maintaining a successful scale and corrosion management strategy.

The second case study covered the failure of downhole chemical injection lines. She explained that following well completion, procedures were not followed leading to inadequate flushing of these lines which ultimately resulted in gunking and localised pitting corrosion. Admittedly a difficult issue in the industry, the speaker posed the question to the audience requesting ideas of how this challenge can be addressed.

For the next case study, the affected line experienced excessive metal loss with evidence of Preferential Weld Corrosion (PWC) and Flow-Induced Corrosion even though it was being treated with corrosion inhibitors. Failure investigation revealed that poor material selection and further issues with the efficacy of the chemical applied for inhibition were responsible.

Further case studies presented were on the failure of water injection systems due to macro-fouling and inadequate oxygen control. Failures cases relating to poor corrosion monitoring practices and poor practices in trending of Key Performance Indicators (KPIs) were also discussed.

Eugenia concluded by stating that integrity problems were typically due to inadequate technical understanding, ineffective procedures / quality control and poor data trending. She stated that most integrity problems were the result of inadequate communication and recommended that professionals should ask experts the right questions whenever clarification is was required. There was a Q&A session at the end of the session.

Corrosion Management magazines and continuous professional development certificates were distributed to members immediately after the meeting. For information about the Aberdeen branch activities please contact our branch secretary, Frances Chalmers, ICorrABZ@gmail.com. Alternatively 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.
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Brian Wyatt writes on CEOCOR

Some months ago I wrote to ICorr Members in this journal with information on CEOCOR. Since then I have attended meetings of CEOCOR in Florence and Brussels; these visits were not just culinary delights (they were this also!); they were the most exciting and stimulating technical meetings that I had been to in many years.

I found researchers and practitioners in the corrosion control of buried pipelines, drawn from throughout Europe, at the highest level of technical expertise, who were prepared to share their skill and knowledge in open forum. ICorr have been Members of CEOCOR for some years....but we have not been good at telling you, our Members, about this European gem. I have also joined in my own right and one of the major UK cathodic protection companies has joined. I am encouraging other ICorr Members and Sustaining Member Companies with interests in internal and external corrosion of pipelines to consider the benefits of joining this not for profit organisation and to allow the UK corrosion community to better participate in CEOCOR; we will add our strengths and expertise but we will also gain from the strength and expertise of others.

The next meeting of CEOCOR is in Weimar starting with Committee work on Monday 19th May 2014 and the formal Conference starting early Tuesday 20th May and throughout Wednesday 21st; there are more technical Committee work meetings on Thursday. Some of these committees are preparing pre-standards that are expected to go into the CEN European Standard system; they will influence the practice in our market place. Our ICorr President Trevor Osborne will participate in the Weimar meeting.

I encourage all of you who have interest and expertise related to internal and external pipeline corrosion and its control in the fields of oil, gas, water and waste water to assess the benefits to you of participation in CEOCOR and to benefit CEOCOR with more input of expertise from the UK and in particular from ICorr members. If you participate you will be surprised by the high quality and what you gain from it.

The following gives more details of CEOCOR:

CEOCOR is an independent scientific non-profit organization that addresses issues dealing with the problem of corrosion and corrosion protection in the fields of water- and gas- supply systems, waste water disposal systems, oil pipelines, building installations and cement based covers in facilities. Currently, experts from 14 different European countries are involved in the development of guidelines, recommendations and studies dealing with the resolution of problems resulting from corrosion of metallic pipes, non-metallic pipes, installations and facilities. The participants of the individual working groups come from national associations, companies in the supply sector, universities, research institutions as well as from the private sector, such as consulting companies and product manufacturers.

This ensures a high level of objectivity and neutrality as well as a breath of practical experience. The current state-of-the-art of technology is considered in the development of recommendations and for the European standardization (CEN). National interests and requirements of all involved countries are taken into account in the working groups.

The activities of CEOCOR support the protection of pipeline systems, building installations and facilities and thus helps to sustain the Asset Value. They further support the documentation and analysis of the condition of these systems and the development of measures for their rehabilitation and renewal.

A central objective of CEOCOR is to share the experience of its members, to make it applicable in all involved countries and to document it in concrete recommendations, studies, guidelines and publications. The expertise is further shared in congresses, symposia, meetings and working groups. A close cooperation with national associations as well as their experiences and guidelines are the basis for the elaboration of all CEOCOR documents.

CEOCOR is structured into two commissions:

1. Internal corrosion of pipe materials and facilities

Documentation of the condition of metallic and non-metallic pipes, fittings, building installations and facilities, damaged by corrosion in water systems. This documentation serves as basis for the development of rehabilitation and renewal measures and is a prerequisite for sustaining Asset Values. In the field of drinking water supply, a special emphasis is laid on the interaction of transported an stored water with metallic and nonmetallic pipes as well as cement based materials in pipes and water reservoirs. In the field of waste water disposal, the condition of pipes, installations and facilities are evaluated and recommendations for the right choice of materials and technologies are developed based on the more and more corrosive of the waste water.

2. External-corrosion

External corrosion protection of metallic pipelines, gas-transfer stations, installations and facilities following state-of-the-art technologies for metallic pipe systems, installations or reinforced concrete, water reservoirs and pumps, waste water treatment plants, industrial facilities. Special emphasis is laid on external interference from A.C. and D.C. systems and on mitigation measures such as cathodic protection. A holistic view on the corrosion protection ensures an optimal protection of pipes, facilities and buildings.

Working groups

Within these two commissions, working groups develop recommendations, publications, manuals and guidelines based in European and national guidelines.

The working groups are staffed with CEOCOR members.

Following working groups are currently active and planned.

Continues on page 14
Technical support
Support for implementation and using the guidelines and recommendations for practical works. Service and qualification for using the actual technologies and applications. Qualified service and consulting for water plants, building installations, selection of materials, fittings and technologies for installation - and rehabilitation works.

Commission 1: Internal corrosion of pipe materials and facilities
Management for construction and rehabilitation strategies concerning water- and gas supply systems

The pipes and fittings of supply systems for water and gas have a limited service life time and must be renewed (replacement by constructions works or rehabilitation of pipes) at the right time. The network management for the improvement of the technical and economical situation covers the reduction of damages, the optimisation of reservoir management and the reduction of supply risks for infrastructures and private properties. In the field of water supply, the level of water losses, the number of damages and the energy management are performance indicators for the quality of the network systems. The base are network data and the condition data of pipes together with local, technical, hygienic and economical influences are parameters for maintenance and rehabilitation planning and must be include in the corporate management. The goal is the preparation of a decision support guideline for planning and organize the operation-, inspection- and maintenance activities and also the rehabilitation rate of transport - and supply pipes with the right materials and technologies under efficient and long term conditions.

- definition of the water- and energy- balance
- evaluation and analyse the condition of the pipe system
- investigation of the local influence factors for pipelines
- investigation of hydraulic and hygienic factors of the pipes
- selection of priorities for rehabilitation works
- selection of rehabilitation techniques for pipelines
- recommendation of a efficient inspection-, maintenance -, rehabilitation - and investment strategy

Influencing of water quality by water reservoirs
According to the European Standard EN 1508 there are different possible construction systems for drinking water reservoirs in order to obtain water hardness and construction design. Operating, designing, construction and expert companies are in many cases uncertain to select the right technical parameters and the right materials for the inner surface of the drinking water reservoirs. The main objective of this group is the preparation of a best practice guide for the planning and rehabilitation of reservoirs with respect to a general framework of technical and hygienic aspects

- like the influence of the water quality on the reservoir surface
- corrosion of steel in concrete
- effects of electric current on the concrete characteristics
- analyze the processes of the damage mechanism
- recommendation for the operating and reservoir cleaning

Strategies for reasonable and successful use of chemical disinfectants in drinking water systems prevention of damages of construction products

Chemical disinfection of drinking water with chlorine, chlorine hypochlorite and chlorine dioxide as a commonly used method and state-of-the-art against the biological load. Efficiency of disinfection depends not only on the type of disinfection agent and the dosage concentration but also on the water quality (pH, turbidity etc.), on structural and hygienic conditions of the transport- and distribution systems, the domestic installations and on the operation conditions (temperature and flow regime etc.). Disinfectants might have unfavourable effects on the water quality (formation of harmful THM, change of odour and taste) and on the degradation of installation materials or on localized corrosion, which can result in serious damages of metallic and non metallic pipes and construction products. From that reasons the use of disinfectants should be minimized and all processes should be optimized what should include water treatment and disinfection processes, construction and rehabilitation of water supply systems, improvement of operation conditions and selection of suitable installation materials. The main objective of this working group is the collection of information and data based on the available knowledge the
creation of guidelines concerning determination of requirements and optimization of all involved processes.

In canalisation systems and waste water plants a lot of serious damages at pipes, concrete constructions and metallic installations are caused by the aggressiveness of the transported and treated media. This can lead to malfunctions and often cause high maintenance and repair costs. The goal of a guideline is to decrease these costs as on the one hand the corrosion and damage mechanisms are explained and on the other hand recommendations for corrosion protection in sewerage systems are made. Both preventing measures and possibilities in rehabilitation will be described. Rather it is to serve owners, planners and operators with many illustrations and concrete problem solutions as a practical manual.

Commission 2: External corrosion

Coupons

The scope of the working group is to prepare a document that covers the application of coupons and probes for cathodic protection monitoring purposes. These are particularly useful for IR free potential measurements and for monitoring the cathodic protection effectiveness in areas with DC or AC interference as specified in EN 12954, EN 13509, EN 50162, and prEN 15280. The document seeks to give advice on several factors considered important for the successful application of coupons and probes; including issues like selection of test sites, parameters to be measured, design and geometries, installation procedures, and commissioning.

Remote Monitoring

The aim of the working group is to merge and describe various national specifications and experiences into a general recommendation in the field of Remote Monitoring and Control of cathodically protected structures. The primary focus are buried steel pipes equipped with cathodic protection, but issues related to tanks and immersed structures are also addressed.

Certification of cathodic protection companies

Many European standards in the field of the cathodic protection require that the staff who undertake the design, supervision of installation, commissioning, supervision of operation, measurements, monitoring and supervision of maintenance of cathodic protection systems shall have the appropriate level of competence for the tasks undertaken. Competence of cathodic protection personnel to the appropriate level for tasks undertaken should be demonstrated by certification in accordance with EN 15257 or by another equivalent prequalification procedure. But there are gaps of EN 15257 in the coverage of the contracting rules. To be in accordance, it is necessary to cover all criteria needed to prove the qualification of the whole company and not only its personnel. CEOCor has drawn its conclusion to start a new initiative to create a quality assurance system for companies dealing with CCP covering all criteria for qualitative selection of the European Directives 2004/17/EC and Directive 2004/18/EC.

Membership

Membership in CEOCor allows for an active participation in the above mentioned working groups, presentation at CEOCor congresses as well as free access to all CEOCor guidelines, publications, regulations, manuals and documents.

To apply for membership, please send a letter or email to ceocor@synergrid.be, indicating your complete contact details, company and field of activities.
THE PROBLEM WITH MEETING PAINT SPECIFICATIONS

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Introduction

Over recent years there have been interesting developments in the way coatings and linings are specified that have unwittingly resulted in a situation that can make it impossible to meet a paint specification as currently written.

The increase in demand for offshore structures and the move by many shipyards into the offshore market has seen owner paint inspectors moving into shipyards, which has often resulted in much tighter subjective and objective requirements being placed on the yard during the build process.

Firstly, there has always been a problem in terms of meeting a paint specification because of the subjective nature of some of the inspection assessments such as a visual assessment of surface cleanliness, rust and mill scale removal, dust, and profile height when using a surface comparator.

It is well known that the surface appearance of a steel substrate can change markedly depending on the nature of the abrasive media used, thereby making an assessment of surface cleanliness particularly subjective.

Secondly, up to 2008, the shipbuilding boom and the strong market for shipping has seen a considerable demand for ships and the attractive charter rates had encouraged owners to accept ships as quickly as possible. Many of the Chinese yards and some of the second tier South Korean yards were established in this boom time and therefore developed systems and processes in line with what owners were then willing to accept in terms of vessels that were perhaps of a lesser standard than may have been accepted if there was not such a boom.

Now that market conditions have worsened, owners are more circumspect and have become more cautious about what is and what is not acceptable. As a result standards have tightened. This has posed difficulties to yards that grew up in the boom time (including many of the larger and new Chinese yards). These yards have developed their systems based on owner’s expectations during the boom period and are now struggling to meet the higher expectations. In the meantime Owners are being frustrated by what is now perceived as poor quality performance that although acceptable in the boom time, is not so acceptable during the recession.

Clearly this is not the case for all yards and all owners, but there does seem to be inconsistencies that the industry should work to overcome.

In addition to these changes the advent of the International Maritime Organisation (IMO) Performance Standard for Protective Coatings (IMO PSPC) has seen an increased focus on protective coating for all areas of a vessel but specifically for ballast tanks. In particular the PSPC introduced the concept of a minimum Dry Film Thickness based on the 90:10 rule.

This paper will focus on an example of the problems currently being faced in meeting specified Dry Film Thickness (DFT), which is deemed the best understood and most objective element of application. The paper will show that even this most basic aspect of the paint specification is neither well understood nor well specified.

If the coating process cannot achieve the specified DFT then to some extent the coating system performance through-life will be compromised. How could any such reduction in performance manifest itself? In many ways as exemplified by an increased chance of corrosion for a low DFT and increased chance of cracking for a high DFT or an increase in time to service or solvent entrapment.

The DFT

One of the key elements of any paint specification is the Dry Film Thickness that is required to be achieved for individual coats that make up the whole system and for the system as a whole. The figures introduced into the specification are usually taken from the Technical Data Sheet (TDS) for the product being used. The TDS normally provides a value or a range of values, e.g. 125µm or 125-150µm and usually refers to a single coat. Thus if a scheme is 2 x 125µm, then the Specified DFT (SDFT) is 250µm.

The Specification

First of all let us consider a typical specification as required by the IMO PSPC for Water ballast tanks for the majority of areas (rather than repairs and erection joints):

Surface preparation: To Swedish Standard 2.5 (Note: This is a requirement for mill scale and rust removal and does not cover the specification of profile height.)

Paint Scheme: Multi-coat system to a Nominal Dry Film Thickness (NDFT) of 320 µm with up to two stripe coats.

In most cases this is interpreted as 2 x 160 µm and one stripe coat.

Requirement: Minimum DFT: defined by the 90:10 rule

Maximum DFT: in accordance with manufacturer’s recommendations.

In general, there is also wording in the PSPC that indicates that the coating is to be applied in accordance with manufacturer’s recommendations.

This may seem fairly straightforward, as may a specification for the underwater hull such as:

The scheme specified:

2 x Epoxy anti-corrosive 250 µm
1x Modified epoxy 100 µm
3 x Self-polishing anti-fouling 390 µm

Total scheme DFT 740 µm

The fact that reality can vary dramatically from the specification as can be seen in Figure 1 below for this example of an underwater hull coating system specification:

Figure 1. DFT and scheme

The scheme as applied

2x Epoxy anti-corrosive 209 µm
1x Modified epoxy 317 µm
3 x Self-polishing anti-fouling 213 µm

Total scheme DFT 739 µm

If the scheme applied was assessed based on two inspections:

• Surface cleanliness and
• Final DFT

Then the scheme would likely be accepted (if
these were the only hold points), despite the low epoxy anti-corrosive and self-polishing anti-fouling layer thicknesses.

Keeping in mind that many of the major commercial shipyards procedures now only afford owners representatives the opportunity to assess cleanliness, and final DFT as a standard procedure, then there is ample opportunity for the as applied system to bare little, or no relation to the specified scheme. This combined with a total lack of as applied records (even with the presence of a coating technical file as required by the PSPC) results in considerable problems when trying to determine causes of a failure.

This deviation from the scheme specified, in many instances, will of course result in a reduction to the performance of the total scheme in service. The degree of reduction in performance can vary substantially depending on the type of product and its performance requirements.

Standards

One of the first problems faced in determining the achieved DFT of a coating application is to determine how many readings should be taken to get a good overall view of the structure in question.

Francis [Ref 1] provided a very good analysis of the needs of the various key standards:

The table across also from Ref 1 shows how the various standards require the readings to be taken and their minimum DFT requirements. Francis also went on to show how the number of readings can influence the overall results as shown in Figure 3:

This shows that while the likely mean DFT readings for coating specified at 85 µm may be approximated by a relatively few readings, the minimum and maximum values (more so the maximum rather than the minimum) are influenced considerably by the number of readings.
Guidelines
Of course the immediate reply is that there are guidelines and standards. The most critical ones are those recommendations that the manufacturer makes. Often the key document used is the Technical data sheet (TDS). When the TDS for ballast tanks coatings from the major paint suppliers are reviewed then a number of interesting observations can be made:

a. The TDS

b. Guidelines/Recommendations for systems

Of these it is the TDS that is most commonly used. The latter are rarely provided to field personnel or referred to, unless a problem arises when the user is then referred to some statement within them. For instance a typical example for cargo hold coatings would be the time period before loading a first cargo, especially for coal. This information is rarely on the TDS or the specification but in the guideline.

This raises the issue of the true purpose of the Technical Data Sheets and exactly what information should be included on them (for example many anti-corrosive paints would be specified for non-cargo hold use and hence the time to load a first cargo of, say coal is not relevant to such specifications).

The net result would be an increase in the number of data sheets required or the length of the data sheet, or at least a requirement to identify clearly some reference to a system guideline document in a prominent position (i.e. this data sheet should be read in conjunction with a marine systems guideline).

Technical data sheets
The DFT provided on the data sheet generally takes into account a number of things including:

- Typical thickness
- Recommended dry film thickness
- Film thickness
- Indicated film thickness
- Recommended systems dry film thickness (with a minimum and maximum)

What is interesting is that none of these terms match the “nominal DFT” term as used in the IMO PSPC.

However for more general use it is also not unusual that the specification can deviate from the DFT as set out in the TDS. For example in cargo holds for bulk carriers, a typical system as set out in the specification may be 2 x 150 µm DFT and the TDS may give a range for the DFT of 125-150 µm, while for the ballast hold of a bulk carrier the specification itself may give 3 x 100 µm DFT. Thus a DFT is specified that would appear to be below the minimum value given on the TDS.

It is clear from the content of the data sheets that the data sheets themselves are advisory and often they carry a legal disclaimer at the end indicating that the values given on them are based on laboratory testing that may be updated based on practical experiences.

What is not at all clear is the role of the DFT indicated. Is it a minimum, a nominal, an average or what? What does typical mean. If it is a recommended DFT how will performance of the coating change if the application deviates from the recommended value? What does any range given mean? Is it a maximum, minimum or simply some guideline values?

These ambiguities are often not always resolved in the paint company guidelines for the use of TDS or application. This can leave the end users with difficulties in the event of a subsequent failure (of course from a cynical perspective one could argue that providing relatively vague data in this matter may suit the paint supplier as it makes subsequent claims in the event of a failure harder to assess).

What is the specified DFT?
When the paint specification only gives a value that recommends 2 x 160 µm, what is this specified value? Is it the minimum, the mean, the mode or the maximum?

It would seem that most people would interpret this figure to be a “nominal” or an “average (mean)” value i.e. it is not an exact number to be hit and it is understood that there will be some variation. A maximum may be set by the good practice indicated in the guidelines and recommendations (typically at x 2 the specified DFT) and a minimum set either by the physical ability of the paint film to coalesce or the adoption of a minimum rule such as the IMO 90:10 rule. However, the authors have encountered inspectors (from shipyards, owners and paint companies) that often consider it as a minimum value. This cannot be the case if a minimum rule is then applied.

Interestingly, the Chambers dictionary includes some of the following terms:

Nominal: pertaining to, or of the nature of, only in name, so called, but not in reality.

In an engineering sense the term “nominal” is often used in association with a dimension and is normally accepted to mean:

The nominal DFT may not match any DFT reading of the scheme applied. The nominal DFT may correspond to an aggregate over many readings.

This implies that a nominal dimension must be accompanied by a tolerance. In shipbuilding then we can already see that the maximum recommended in Paint Company guidelines is x2 the DFT. Thus we have an upper limit on a nominal dimension.

While for the minimum a rule is normally applied such as the 80:20 rule or the 90:10.
Let us consider then what this means for a specification of 2 x 160 µm
It has first to be assumed that the 160 µm is a nominal DFT; perhaps it should be the mean or the mode.
The mean would require that the average reading taken in a given sample (for sample sizes see: SSPC PA2, ISO19840, IMO PSPC, [Ref 2, 3 and 4]) would be given by the arithmetic mean, while the mode is the value that occurs the most often of the set of readings taken.
For example take the following set of numbers: 1,2,3,3,3,3,5,5,6,7,10,10
Sample size n = 12: Mean = 4.83: Mode = 3.00
The difference between mean and mode can also be shown diagrammatically as shown in Figures 3 and 4.

The Mean

In the normal distribution, the mean is the value above which you would expect to find 50% of your DFT readings and below which you would expect to find 50% of your readings. DFT gauge software assumes you have a normal distribution when they provide a statistical summary that often includes:
- Average DFT
- Maximum
- Minimum
- Standard deviation
- Range
The average is then simply the mean of the readings taken, the maximum is the highest reading taken, and the minimum is the lowest reading taken, while the range is the difference between the maximum and the minimum.
The standard deviation (σ) is a measure of the spread of the curve. A low standard deviation would indicate a tight process that can perform accurately and a low value for the range (the difference between the maximum and the minimum values). A large standard deviation would indicate a poorer control of the application resulting in a larger range.
For a normal distribution the following approximate values are used:
- 66.6% of all values lie within the range ± 1 σ
- 95.4% of all values lie within the range ± 2 σ
- 99.75% of all values lie within the range ± 3 σ
The mode can be below or above the mean depending on the readings taken and would generate a “skewed” distribution with the majority of readings being at the mode not the mean (see Figure 3).

Process stability and control
Accuracy in all processes is critical in shipbuilding. It has been stated that “The successful application of accuracy control technologies to shipbuilding is quite fundamental to achieving high levels of productivity [Ref 5] Perfection is not often possible, especially when it comes to applying coatings on board ships. This is as a result of many factors that create an inherent variability in the process, making it difficult to control [Ref 6].
The variability of any process comprises two elements:
- Assignable causes
- Random variations
Examples of these for coating application work may be:
Assignable causes
- Use of the wrong or a worn spray gun tip
- Using the wrong pressure
- The wrong stand-off distance
- The addition of a cosmetic coat to the scheme
Random variation
- The size of the atomised particles
- The workers physical capabilities
- Wind gust and temperature changes
- Available air pressure
While assignable causes can be addressed and managed, the inherent variability of the process can only be improved by a change in process technology. Thus improved process capability is critical as many assignable causes as possible must be identified and managed.

The assessment of process stability/performance is often made using control charts. There are a variety of control charts, the simplest of which is shown in Figure 5 below:

Figure 5. Simple control chart
The key elements of the control chart are the setting of upper and lower tolerance limits and a mean value (this would normally be the specified or target value).
An example is as shown in Figure 5. Here the specification limits or tolerances are set outside the capability limits. If this is the case, the process can be said to be capable of undertaking the work to tolerance. If however the specifications limits are inside the upper and lower capability limits, then the process would not be capable of carrying out all work to within the required tolerance. Obviously the further inside the capability limits the specification limits can be set, the greater the probability of being able to meet the specification. Just because the capability limits are within the specified tolerance, this does not automatically mean that no readings will be obtained beyond the specification limits, just that there should be a low probability of this happening.
Often however there is a lack of appreciation of the process capability that results in the specification limits being set so as they fall outside the capability limits.
It is important to note that it is normal in most processes for the tolerance limits to be set around a mean value e.g. a typical value may be 150 µ ± 50 µm.

Impact of minimum and maximum values
The practical impact of the minimum and maximum values needs to be carefully understood. To demonstrate this, a number of samples of coating inspections have been taken to get an understanding of what is generally practically achievable and these are presented in the following sections.
Control of DFT is dependent on many factors, such as worker skill, equipment, access considerations and the complexity of the structure to be coated.
Performance is likely best on a flat surface [Ref 8] while more complex surfaces will tend to increase the range. The size of the area to be coated will also have an influence.

Data presented in Ref 1, indicated that, for small areas, the achieved DFT readings on a nominal DFT of 85 µm for a single coat of inorganic zinc silicate would give a range of 240 µm with a minimum of about 20 µm and maximum of about 260 µm.

On larger areas, work carried out on the underwater hull of US Navy carriers gave the following results:

**USS Nimitz:**
- Specified scheme DFT: 680 µm
- Mean: 720 µm
- Standard deviation: 220 µm
- Range: approximately 1000 µm
- Ratio of standard deviation to the mean: 0.44
- Process capability to 3σ: 0.29
- Mean: 720 µm
- Standard deviation: 220 µm
- Range: approximately 1000 µm
- Ratio of standard deviation to the mean: 0.18

**USS Lincoln**
- Specified scheme DFT: 680 µm
- Mean: 850 µm
- Standard deviation: 250 µm
- Range: approximately 1000 µm
- Ratio of standard deviation
  - to the mean: 0.29
  - Process capability to 3σ: 0.19

Thus assessment of the US Navy figures cannot be made without knowing the specification for the system that was applied (e.g. how many coats of paint). Also these coating projects were in a refit scenario rather than a new build scenario.

Figures from work carried out by the authors for the outer hull for a new build commercial ship for the same ratio gave a mean of 0.18 for the ratio of standard deviation to the mean (also known as the coefficient of variation):

- **Specified DFT:** 610 µm
- **Average DFT:** 990 µm
- **Standard Deviation:** 170 µm
- **Process capability to 3σ:** 0.44

**USS Gary**
- Specified scheme DFT: 680 µm
- Mean: 900 µm
- Standard deviation: 250 µm
- Range: approximately 750 µm
- Ratio of standard deviation to the mean: 0.28
- Process capability to 3σ: 0.19

Thus even on the relatively uncomplicated area of the underwater hull there is a considerable range of the achieved the required DFT with the ratio of standard deviation to the mean ranging from a relatively good 0.11 to a relatively poor 0.44 for the US Navy. In simple terms, the closer the standard deviation value is to the mean value (the higher the ratio) the greater the spread of the curve. Hence, as the process is not well controlled, over or under application is more likely to occur for a number of reasons, such as:

- Weather/wind conditions
- Worker skill
- Equipment capability/maintenance
- Roughness of the surface to be coated

This would indicate a process that is not well controlled which could easily result in excessive over application of coatings, which can penalise a yard in a number of ways:

- Increased cost of paint and thinners/cleaners
- Increased application time
- Increased curing/drying time
- Increased emissions
- Increased waste
- Delay to build schedule
- Increase in utilisation of facilities

In more complex areas, research by the authors has shown these results for Cargo holds gave a mean of: 0.19 for the ratio of standard deviation to the mean.

**USS Robert E Lee**
- Specified DFT: 250 µm
- Average DFT: 649 µm
- Standard Deviation: 133 µm
- Process capability to 3σ: 0.21

Thus while the process for cargo holds does show a greater variability (higher standard deviation) than that for the outside shell, the ratio of mean to standard deviation is about the same (0.18 to 0.19).

The reason for this is relatively simple. The outer hull scheme typically comprises 4 or more coats of paints as compared to 2 coats in the cargo hold. The variability in the DFT of each coat is additive, thus the more coats of paint applied the greater the variability.

Thus the more steps in a process (i.e. the more coats of paint in the scheme) the greater the variability that should be expected, irrespective of the complexity of the surface to be coated.

Results for ballast tanks, which are also generally two coat schemes and are more complex areas, should therefore offer a better comparison to the cargo holds.

These give a mean of 0.26 for the ratio of standard deviation to the mean.

**USS Gary**
- Specified DFT: 320 µm
- Average DFT: 602 µm
- Standard Deviation: 162 µm
- Process capability to 3σ: 0.19

Considering ballast tanks despite having only two coats of paint (as is the case for cargo holds) both the standard deviation and the ratio to the mean is considerably higher as a result.

This would imply that design complexity has a much greater influence on the variability of the coating process rather than the number of coats.

Furthermore, this would also imply that to maximise the probability of a good coating application, both the design complexity and the number of coats should be minimised. Notwithstanding, the simplification of design would offer the greater benefits.

In practice, the problem is aggravated further because not all the coating work in one location will be carried out by the same team and the skill/ability and equipment, as well as local conditions may vary to a considerable degree.

Of course the process capability is also likely to change for different ship sizes, with smaller vessels providing more complex/tighter structures. The authors suggest that perhaps the Compensated Gross Tonnage Coefficients [Ref 8] could be utilised to help establish the complexity of different ship types and sizes.

**Impact on a coating scheme**

Let us consider a specification of 2 x 160 µm as required by the IMO PSPC and as shown on most paint supplier data sheets. In this case the value on the TDS is the "nominal value" which the authors have interpreted as a target value or the mean/average.

**Maximum DFT**

Good practice from paint company guidelines would mean that the maximum DFT applied should be x2 the specified DFT for each coat and for the total scheme. These would give a maximum scheme of 2 x 320 µm.

**Minimum DFT**

While applying the 90:10 rule or the 80:20 rule would give minimum values of:

- 90:10 rule - 2 x 144 µm or 288 µm total:
- 80:20 rule - 2 x 128 µm or a 256 µm total.

The standard deviation for water ballast tank (WBT) application has been calculated at 162 µm. Thus if the minimum acceptable value is 288 µm as per the IMO PSPC, then 3 standard deviations would provide a mean of 774 µm [given by: 288 + 3(162) µm] and the maximum value that could be expected would be 1260 µm [given by 774 + 3(162) µm].

The mean that is likely to be achieved will itself exceed the recommended guideline of most paint suppliers which is set at x2 the specified DFT (640 µm in this case) and also surpasses
the x3 value in ISO 12904 [Ref 9].
To achieve the required specification:
- Minimum 288 µm
- Maximum 640 µm
Then the standard deviation would have to be 58.7 µm or about 36% of that being achieved in the field based on the authors research.
The problem of excessive DFT is compounded even further. If during inspection areas of low DFT are identified e.g. an area of 250 µm thickness is identified. This would then be marked for touch up. If this is done by airless spray, it will not be brought up to 288 µm or 320 µm but likely by an additional 160 µm to 410 µm. If the coating is applied by brush an additional 80 µm could be added. Therefore any application of “touch up” coats to achieve the minimum DFT is likely to increase the mean DFT and push the scheme further out of the recommended guidelines provided.

Practical distribution
In practice however, the applied DFT data does not result in a normal distribution but rather a skewed distribution as indicated in Figure 4. An actual set of data from a ballast tank is presented in Figure 6 below.
This ballast tank coating was specified according to IMO PSPC and thus should have a nominal DFT of 320 µm. Analysis of the data gave the following results:

<table>
<thead>
<tr>
<th>Total number of readings</th>
<th>566</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum DFT:</td>
<td>272 µm</td>
</tr>
<tr>
<td>Maximum DFT</td>
<td>1326 µm</td>
</tr>
<tr>
<td>Range</td>
<td>1100 µm</td>
</tr>
<tr>
<td>Mean</td>
<td>611 µm</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>not relevant as this is not a normal distribution</td>
</tr>
</tbody>
</table>

Given that the recommended practice (maximum of 2 times the DFT specified) would give a maximum of 640 µm then 193 (34%) of the readings taken exceeded the maximum, while very few readings were below the minimum, this despite the mean and the mode being below the 640 µm maximum.
Thus the actual distribution of the DFT readings will be greater than the expected specified values. In particular the actual distribution will tend to be skewed towards higher DFT values and this is aggravated by the use of a minimum DFT rule.
In a nutshell, as soon as a minimum rule is introduced then the mean DFT achieved will result in considerably higher than the specified DFT. This combined with a space with complex geometry results in the mean DFT being close to or greater than the x2 DFT maximum cited in paint company guidelines.

DFT Gauge readings
DFT gauges are set up to assume that the readings being collected are represented by a normal distribution and provide the statistical results associated with such a distribution. However, as demonstrated, the DFT readings for a ship tend to fall into a skewed distribution, which potentially would raise concern about how the data from a DFT gauge is presented. However all is not lost. A little more statistics can come to our aid. Basically it requires a review of how we collect DFT readings.
If instead of taking individual readings, the requirements of SSPC PA 2 are considered, then there is a requirement to take 3 readings for a spot measurement. This “grouping” of readings will tend to result in the data being forced to form a normal distribution (this occurs as a result of the Central Limit Theory – CLT) and is why the SSPC PA2 method results in a requirement for fewer DFT readings. If you do not group the readings in that way you require more readings to invoke the CLT to generate a normal distribution. This is the basis of Control Chart Theory [Ref 10].
Therefore if in doubt, the more readings that can be collected the better the overall picture you will obtain of the coating of a particular area, however, where time is limited, a smaller set of data if collected correctly can give you a reasonable overview.

Conclusions
The variability of the coating process, the number of coats of paint, the complexity of the surface and the use of a minimum DFT rule, result in a mean DFT far greater than that specified. The shift in the mean can be close to or exceed the x2 DFT maximum value that paint companies generally recommend as good practice.
Clearly, it is easier for a shipyard to apply more paint to make up for low DFT than to remove paint in the event of excessive DFT. While it is important to achieve a certain minimum DFT for the coating to perform, there is a real danger that the use of minimum DFT rules will lead to higher than expected DFT readings and this can also lead to performance drop off or even failure of the coatings.
The problem for the shipyard is that the application of this extra paint not only increases the man-hours and cost of coating the area but also extends over-coating and drying times as well as increasing VOC emissions.
For the owner the problem faced is that the DFT provided may be in excess of that recommended by the paint supplier as good practice and the impact (if any) of the excessive DFT on the performance of the coating may not be well understood.
The reality is therefore that unless current coating application techniques are improved, then the range of readings that will be obtained in practice for any given specification will depend on several factors such as;
The number of coats
The structural design complexity
The skill of the applicator
The condition of the equipment used.

The TDS’s provided by paint suppliers need to be very specific as to the DFT value that is being quoted. It is likely to be preferable to simply quote a range from the minimum to the maximum acceptable for each coat, rather than some vague value that could be interpreted as a minimum, a mean or some other measure such as nominal.

It is the author’s contention that paint suppliers would be prudent to test their products performance at expected DFT’s that may be achieved in the field and provide data on the TDS for the elevated thickness expected.

Thus the IMO PSPC specification may be better written as a range for example; 288 µm – 640 µm, this would imply a mean of about 464 µm.

Even with a range consideration must be given to the structural complexity of some parts of a ship. The range must be achievable with the current process capabilities. It is suggested that the maximum value would need to be at least 3 x3 the nominal value of 320 µm, thus giving a range of 288 – 960 µm. The latter would imply a mean of 624 µm (assuming a normal distribution).

Of course, this is only used as an example. It is known to the authors that for ballast tank coating in particular, the maximum limits set in South Korean yards are 2000 µm. While this seems high, it is clearly an attempt to push the upper specification limit well beyond the capability limit of the application process to ensure that there is never any need for re-work in the form of removing excessively thick paint.

The introduction and use of minimum value rules in a specification (such as 90:10 or 80:20), will tend to excessively increase the mean DFT excessively values. The outcome will tend to move the whole distribution to the right. The process variables tend to also lead to a non-normal distribution and result in a skewed distribution. The most significant of those variables is the touch up process that takes the lower DFT values and moves them significantly to the right by the addition of more paint through brush or spray application.

Implications for Paint Specification

It would seem that the way that coatings are currently specified is inadequate and how the DFT is provided on the TDS can be quite misleading.

It is recommended that the TDS should simply contain a maximum and minimum value for DFT rather than some individual ambiguous value. This would leave each paint supplier to determine the DFT range over which their products will provide the claimed performance. Of course this would add some complications, in that drying times, cure times and other data that may be affected by DFT (such as time to service) will need to reflect the range that is provided.

Those developing coating specifications should also consider the range of DFT as more important than a specific DFT value (nominal, mean or otherwise) the range would then reflect any minimum/maximum values recommended by the paint supplier.

The challenge will be to achieve a range that is achievable by the application process.

Other sources of variability

It would be nice to be able to conclude that the problem stops there. However there are other sources of variability that also have an impact on results and even these can be significant when measuring the DFT achieved. These can be summarised as follows:

• Sampling regime: How many samples are taken? Were they are taken; does everyone follow the same sampling regime? If not there can be significant differences in the results as shown in Figure 2.
• Accuracy of DFT gauge/repeatability of readings: This can also result in a different result even for people using the same sampling regime, an observation highlighted by Ault [Ref 11].
• Operator capability: The skill of the operator is critical and can also affect the readings taken.
• Location of readings and substrate: Are the readings taken across a representative sample of the structure (as per IMO PSPC requirements). Is the substrate condition known to enable allowances for the profile to be made?
• It is a well-known adage that the more you inspect the more you will find wrong and so in part the inspection process needs to be well defined to assure that it is not punitive, while achieving the required assurance.
• Given a range of DFT’s to achieve, the obvious question will be: what if some few points are outside the range either way, what is acceptable? The authors are of the view that the range on the TDS should define the absolute minimum and maximum for various end service uses for any given product.

The range to assure the required in-service performance (assuming drying/cure times and over-coat intervals etc. are adhered to. The problem with ships in particular is if 1 or 2% of the readings are accepted to be outside the range provided the total area equating to such a small percentage can still be quite large. For example 5% out of specification (equating to ±2 for a normal distribution) of 30,000 m² of cargo hold would mean that 1,500m² would be outside the range. This is not an insignificant area.

In the final analysis it is clear, that variability should be minimised and technical documentation needs to better reflect the in service practicalities of process variability and capability so that applicators and end users understand the limitations that may be imposed on them and how if at all coating performance may be affected by the real life conditions, rather than the laboratory conditions which are used to generate the information for the TDS.

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DENSOBAND AIDS CRASH BARRIER INSTALLATION ON ERSKINE BRIDGE

Winn & Coales Densoband has been chosen for use in the installation of new crash barriers on the A898 Erskine Bridge, Glasgow. The volume of HGV traffic has greatly increased since the bridge was opened in 1971. Consequently the existing barriers in the central reserve will not provide appropriate levels of protection to the bridge towers and cable anchorages against impact from the largest HGVs. Similarly, nearside barriers are being replaced in this project due to be completed by May this year.

The new barriers were designed by Flint & Neil, specialist bridge consultants. The work is being carried out for Transport Scotland who appointed Highway Barrier Solutions (HBS) as Principal Contractor. Scotland TranServe is the Engineer and manage the work.

The Glasgow branch of Briggs Amasco, specialists in industrial roofing and surface waterproofing, recommended the use of Winn & Coales Densoband in the reinstatement of the road asphalt surface adjoining the steel posts of the new crash barriers. Working in conjunction with Scotland TranServe, Briggs Amasco applied all the asphalt reinstatement as well as the Densoband.

Densoband is approved by the Department of Transport in the Manual of Contracts 7th Edition for use in asphalt wearing course joints for asphalt and asphalt to concrete interface as an alternative to the previously commonly used bitumen. Because water, salts, pollutants and weed seeds etc cannot penetrate the sealed joint, it remains unaffected by extremes of temperature and further deterioration.

For further information contact: Winn & Coales (Denso) Ltd., Chapel Road, London SE27 0TR
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ARCHCO-RIGIDON PROTECTS INJECTOR SPOOLS, PIPEWORK AND VESSELS

Painting and Labour Ltd of Immingham are long-term users of Winn & Coales (Denso) Ltd’s Archco-Rigidon 403D and 503D glass flake vinyl ester coatings. The company has been regularly contracted to line internal surfaces of pipework, tanks and vessels and also injector spools with these specialist interior protective coatings, following shot blasting to the Swedish Sa 2½ standard near white metal.

Cristal Pigments, also of Immingham, is a leading customer for Painting and Labour’s services for protection of injector spools, pipework and process tanks. Pretreatment and Archco-Rigidon application of injector spools and pipework was carried out at Painting and Labour’s workshop. The specification was as follows:
Following blast cleaning of internal surfaces to Sa 2½, the first coat of Archco-Rigidon 503D was applied to approximately 1000 microns. A second coat consisting of Archco-Rigidon 403D was applied to 1000 microns thickness to achieve an overall thickness of 2000 microns. A final 250 microns coat of Archco-Rigidon Blue Wax Topcoat was then applied. Final thickness readings were taken and full Holiday detection was carried out to ensure the work was in line with the specification requirements. Whilst carrying out the lining work Cristal Pigments representatives carried out inspections of the processes and reported their full satisfaction with the work meeting the specification requirements. Painting and Labour also lined two small receiver vessels onsite at Cristal Pigments – one of them only required coating with Archco-Rigidon 403D on the bottom dish end after blast cleaning. The full vessel specification was: blast cleaning to Sa 2½ followed by multiple brush applied coats of Archco-Rigidon 403D to achieve 1000 microns overall thickness. On completion of lining both vessels were checked for film thickness and Holiday detection readings.

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Bagnalls, one of the country’s leading painting, decorating and coatings contractors is delighted to announce its strategic partnership with Reset Certification Scheme Limited, the competence management solutions provider.

Bagnalls were first approached by Leeds Teaching Hospitals NHS Trust to join the Reset scheme and it has to be said that, initially, there was a feeling of scepticism as to the uniqueness of the card. As members of a wide range of accreditation schemes Bagnalls thought that this was yet another registration that had to be achieved in order to work for the Trust. It was therefore decided to only put a few operatives through the Reset Individual process and the Leeds branch through the Reset Company accreditation.

It wasn’t long before Bagnalls started to receive further requests from other customers to comply with the Reset scheme and it was soon realised how Reset could also help the company comply with HSE and CDM legislation by demonstrating that employees are competent and qualified for their roles. For these key reasons it was decided to roll out the Reset Certification Scheme on a national basis and make all employees Reset Individual Cardholders.

One of Bagnalls key differentiating factors is that the company directly employs all its operatives. However, demonstrating the individual competence of operatives, to a wide range of customers, has often been a logistical challenge. Now customers, who have Verifier status, can check the qualifications and competences of any cardholder due to attend site. They can view their individual profile and see original copies of each and every certificate on screen, in a matter of minutes, using the Reset website or their Smartphone App.

David Sunderland, Bagnalls Group Technical and Training Manager has led the Reset process and said “As a contractor, we have a commitment to continuously invest in the long term training and development of our employees. The automated notification system provided by Reset provides an ideal training tracker, by alerting us with timely reminders of when individuals’ competences are expiring. It allows us to schedule the required training in line with our work schedule to ensure that we continue to deliver high levels of customer service with a skilled and competent workforce.”

Gary Duce, Reset’s Managing Director commented “We are proud to work with Bagnalls on a national basis. Our systems allow Bagnalls to demonstrate the skills and competences of each of their directly employed operatives in an efficient and cost effective manner. Bagnalls’ customers benefit from knowing that they have complied with their legal obligations by checking the competence of contractors attending site.”

Moreover, Bagnalls is committed to delivering the highest levels of health and safety, reflected by Bagnalls receiving a fifth consecutive Gold RoSPA (Royal Society for the Prevention of Accidents) award in 2014. It was therefore decided to also register each branch of Bagnalls as members of the Reset Company Certification Scheme. Reset Company provides a quick and simple way to carry out full pre-qualification procedures online and also provides continual monitoring of the company’s status. Reset monitors and tracks everything from insurances to waste transfer notice, making it easy for Bagnalls to keep their record current and up to date.

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### ICATS REGISTERED COMPANIES

**ICATS REGISTERED COMPANIES WITH QUALIFIED APPLICATORS**

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfred Bagnall &amp; Sons</td>
<td>6 Manor Lane, Shipley, West Yorkshire, BD18 3RD</td>
<td>T: 01302 853259</td>
</tr>
<tr>
<td>AlpAccess s.r.l.</td>
<td>J.L. Caragiale, 21 Ploiesti, 100015, P.H. Romania</td>
<td>T: +44 (0) 722140858</td>
</tr>
<tr>
<td>APB Construction (UK)</td>
<td>First Floor Offices, Orange Business Centre, River Works, Grange Lane, Sheffield, SS ODP</td>
<td>T: 01709 541000</td>
</tr>
<tr>
<td>APB Group Limited</td>
<td>Ryandra House, Ryandra Business Park, Brookhouse Way, Cheadle, Staffs, ST10 1SR</td>
<td>T: 01538 755377</td>
</tr>
<tr>
<td>A &amp; B Painting Services Ltd</td>
<td>Marwood House, Riverside Park, Bromborough, Wirral, CH62 3QX</td>
<td>Tel: 0151 445 3589</td>
</tr>
<tr>
<td>Armourcote Surface Technology Plc</td>
<td>15/17 Calvilles Place, Kelvin Industrial Estate, East Kilbride, Scotland, G75 0PZ</td>
<td>T: 01355 248223</td>
</tr>
<tr>
<td>Austin Hayes Ltd</td>
<td>Carlton Works, Cemetry Road, Yeadon, Leeds, LS19 7BD, UK</td>
<td>T: 0113 250 2255</td>
</tr>
<tr>
<td>B&amp;A Contracts Ltd</td>
<td>Dale Road, Hubberston, Millford Haven, Pembrokeshire SA73 3PR</td>
<td>T: 01646 693489</td>
</tr>
<tr>
<td>BAE Systems Surface Ships Support Ltd</td>
<td>Room 213, Naval Base Headquarters, 1/100, PP127, Portsmouth, PO1 3LS</td>
<td>T: 01469 553800</td>
</tr>
<tr>
<td>Barrier Ltd</td>
<td>Stephenson Street, Wallisend, Tyne &amp; Wear, NE28 6UE, UK</td>
<td>T: 0191 262 0510</td>
</tr>
<tr>
<td>Beaver Limited</td>
<td>Little Goldharbour farm, Tong Lane, Lamberhurst, Kent, TN3 8AD, UK</td>
<td>T: 01892 890045</td>
</tr>
<tr>
<td>Blu hull Marine Ltd</td>
<td>Orange Grove Birbal Street, Badan, BZN 9013 MALTA</td>
<td>T: +356 21444807</td>
</tr>
<tr>
<td>Border Coatings (Scotland) Ltd</td>
<td>Unit 7, Station Road Industrial estate, Earlston, Bervickshire TD4 6BZ</td>
<td>T: 01896 823106</td>
</tr>
<tr>
<td>Briton Fabricators Ltd</td>
<td>Watnall Road, Hucknall, Notts, NG15 6EP</td>
<td>T: 0115 963 2901</td>
</tr>
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<td>Cape Industrial Services</td>
<td>Cape House, 3, Red Hall Avenue, Paragon Business Village, Wakefield, WF1 2UL</td>
<td>T: 01224 215800</td>
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<td>Chemcem Scotland Ltd</td>
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<td>Cleveland Bridge UK Ltd</td>
<td>Cleveland House, Yarm Road, Darlington, DL1 4DE</td>
<td>T: 01325 502345</td>
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<tr>
<td>Coating Services Ltd</td>
<td>Partington Street, Mumps Bridge, Oldham, OL1 3RU, UK</td>
<td>T: 0161 665 1998</td>
</tr>
<tr>
<td>Collis Engineering Railway Contracts</td>
<td>Salcombe Road, Meadow Lane Industrial Estate, Alforth, Derbyshire, DE5 7RG</td>
<td>T: 01773 833255</td>
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<td>Community Clean</td>
<td>11 Old Forge Road, Ferndown Industrial Estate, Ferndown, Wimborne, Dorset, BH21 7RZ, UK</td>
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<td>Corrocoat</td>
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<td>D&amp;D Rail Ltd</td>
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<td>T: 01268 520000</td>
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<td>Denholm Industrial</td>
<td>21 Boden Street, Glasgow, G40 3PU</td>
<td>T: 0141 445 3939</td>
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<td>Doyal Engineering Ltd</td>
<td>Hobson Industrial Estate, Burnopfield, Newcastle Upon Tyne NE16 6EA</td>
<td>T: 01207 270909</td>
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<td>DRH Coatings Ltd</td>
<td>Suite 5, 3 Shawcross Industrial Estate, Ackworth Road, Pontymoor PO3 5JP</td>
<td>T: 023 9266 6165</td>
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<td>Dyer &amp; Butler Ltd (Rail)</td>
<td>Mead House, Station Road, Nursling, Southampton, SO16 OAH, UK</td>
<td>T: 02380 676749</td>
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<td>Excel Contractors Ltd</td>
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<td>F A Clover &amp; Son</td>
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<td>Forth Estuary Transport Authority</td>
<td>Forth Road Bridge, Administration Office South Queensferry, EH90 9SF</td>
<td>T: 0131 319 1699</td>
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<td>GABRE (UK) LTD</td>
<td>9 Holme Road, Drmore, Omagh, Co Tyrone, BT78 3BX</td>
<td>T: 02882 897950</td>
</tr>
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<td>GPL Civil Engineering Ltd (Special Projects Division)</td>
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<td>H&amp;B Painting Contractors Ltd</td>
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<td>HBS Protective Coatings Ltd</td>
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<td>Herrington Industrial Services Ltd</td>
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<td>T: 0191 5160634</td>
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<tr>
<td>Hi-Tech Surface Treatment Ltd</td>
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<td>T: 023 80611789</td>
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<td>Hyspec Services Ltd</td>
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<td>48-49 RCM Business Centres, Sandbeds Trading Estate, Dewsbury Road, Ossett, WFS 9ND</td>
<td>T: 01924 272606</td>
</tr>
<tr>
<td>Company Name</td>
<td>Address</td>
<td>Phone Number</td>
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<tr>
<td>International Energy Services Ltd</td>
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<td>T: 014615636</td>
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</tr>
<tr>
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<td>T: +2348055297828</td>
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<td>T: 028 8776 7722</td>
</tr>
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<td>T: 028 8776 7722</td>
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<td>Port Painters Limited</td>
<td>Unit 3, Ringside Business, Hoe-Y-Rhosog, Cardiff, CF3 2ZB, UK</td>
<td>T: 029 2021 7770</td>
</tr>
<tr>
<td>PPC Ltd</td>
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<td>Pyrolyt Limited</td>
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<td>Royal Edinburgh Limited</td>
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<td>Severn River Crossing Plc</td>
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<td>T: 01454 633355</td>
</tr>
<tr>
<td>Shutdown Maintenance Services Ltd</td>
<td>Kingsnorth Industrial, Hoo, Rochester, Kent, ME3 9ND</td>
<td>T: 01634 256969</td>
</tr>
<tr>
<td>Solent Protective Coatings Ltd</td>
<td>Tredgar Wharf, Marine Parade, Southampton, Hants, SO14 5JF</td>
<td>T: 02380 221480</td>
</tr>
<tr>
<td>South Staffs Protective Coatings Ltd</td>
<td>Tolkien Road, Tipton, West Midlands, DY4 9EE</td>
<td>T: 0121 522 2373</td>
</tr>
<tr>
<td>Specialist Painting Group Ltd</td>
<td>Padholme Road East, Fengegate, Peterborough PE1 5XL</td>
<td>T: 01773 309500</td>
</tr>
<tr>
<td>Stainless Restoration Ltd</td>
<td>Unit M1, Adamson Industrial Estate, Croft Street, Hyde, Cheshire, SK14 1EE</td>
<td>T: 01253 838901</td>
</tr>
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<td>Standish Metal Treatment Ltd</td>
<td>Potter Place, West Pimbo, Skelmersdale, Lancs, WN8 9PW, UK</td>
<td>T: 01695 455977</td>
</tr>
<tr>
<td>Stobbarts Ltd</td>
<td>Tarn Hows, Lakes Road, Derwent Hows Industrial Estate, Workington, Cumbria CA14 3YP</td>
<td>T: 01900 870780</td>
</tr>
<tr>
<td>Tees Valley Coatings</td>
<td>Riverside Park Road, Middlesbrough, Cleveland TS2 1UT</td>
<td>T: 01642 228141</td>
</tr>
<tr>
<td>T I Protective Coatings</td>
<td>Unit 6, Lodge Bank, Crown Lane, Horwich, Bolton, Lancs, BL6 5HU</td>
<td>T: 01204 468080</td>
</tr>
<tr>
<td>TEMA Engineering Ltd</td>
<td>S 6-6 Curran Road, Cardiff, CF10 5SF, UK</td>
<td>T: 020920 344556</td>
</tr>
<tr>
<td>Vale Protective Coatings Ltd</td>
<td>Building 152 - Langar North Industrial Estate, Harby Road, Langar, NG19 9HY</td>
<td>T: 01949 869784</td>
</tr>
<tr>
<td>Walker Construction (UK) Ltd</td>
<td>Park Farm Road, Folkstone, Kent, CT19 5DY</td>
<td>T: 01303 851111</td>
</tr>
<tr>
<td>Wardle Painters Ltd</td>
<td>Unit 5, Wrenborne Building, Atlantic Way, Barry Docks, Glamorgan, CF63 3RA, UK</td>
<td>T: 01446 748620</td>
</tr>
<tr>
<td>Wescott Coatings &amp; Training Services Ltd</td>
<td>The Quadrus Centre, Woodstock Way, Boldon Business Park, Boldon NE35 9PF</td>
<td>T: 0191 5197380</td>
</tr>
<tr>
<td>W G Beaumont &amp; Son</td>
<td>Beaumont House, 8 Bernard Road, Romford RM7 0HX</td>
<td>T: 01708 492021</td>
</tr>
</tbody>
</table>
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T: 0161 609 0000

Xervon Palmers Ltd
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A McKie Building & Engineering Ltd
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BAM Nuttall Ltd
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BSM Consulting
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T: 0161 609 0000

Celtic Specialist Treatments Ltd
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T: 01482 329007

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CE Pittaway & Son Ltd
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Corroless Eastern Ltd
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T: 01362 691484

Darcy Spillage Manufacture
Brook House, Larkfield Trading Estate, New Hylte Lane, Larkfield, Kent ME20 6CN
T: 01632 715100

DF Coatings Ltd
Unit 17, Willments Ind. Estate, Hazel Road, Woolston, Southampton SO19 7HS
T: 0238 044 5634

E G Lewis & Company Ltd
Suite 5, 5 Shawcross Industrial Estate, Ackworth Road, Portsmouth PO3 5JF
T: 01792 323288

Farbuild Ltd
Trelawn Lodge, Vicarage Road, Wingfield, Diss, Norfolk IP21 5RB
T: 01379 640670

FMC Technologies NIGERIA
No. 22 Gerrard Road
Ikeji, NIGERIA
T: +234 (0) 8039740023

Forward Protective
Vernon Street, Shoebrook, Mansfield
Notts, NG20 8SS
T: 01623 748323

Gemini Corrosion Services
Brent Avenue, Forties Road, Montrose, Angus, DD10 9PB
T: 01674 672 678

Galldriss Construction Ltd
Galldriss House, Pavillon Business Centre, Kinetic Crescent, Innova Science Park, Enfield EN3 7FJ
T: 01992 763000

Hayes Engineering Services Ltd
Brindley Road, Off Hadfield Road, Cardiff CF11 8TL
T: 029 2022 608B

Hempel UK Ltd
Lantarnam Park, Cwmbran, Gwent, NP44 3XF
T: 01633 874024

Kaefer C&D Ltd
Riverside House, Rolling Mill Road, Viking Industrial Estate, Jarrow, Tyne & Wear NE32 3DP
T: 0191 428700

Livis Ltd
Livis House, 50 Victoria Park
Dartford, Kent, DA1 5AJ
T: 01322 200509

Malakoff Limited
North Ness, Lerwick, Shetland, ZE1 0LZ, UK
T: 01595 695544

Matthew James Services
Unit 4, Shibdon Business, Coxen Road, Blaydon, Newcastle-Upon-Tyne, NE21 5TX
T: 0191 414 5700

Moore Steel Developments Ltd
Station Road, Thorney, Peterborough PE6 0QE
T: 01733 270025

Optimal Rail Ltd
Unit 5, Moorgate Crofts Business Centre
Alma Road, Rotherham
S60 2DH
T: 01709 331153

Paint Inspection Ltd
Milton House, 7 High Street, Fareham PO16 7AN
T: 0845 4638680

Parks Fabrication Ltd
Park Farm, Holme-upon-Spalding-Mar, York, YO43 4AG
T: 01430 861628

Posilpark Shotblasting Co Ltd
Dalmarkock Works, 73 Dunm Street, Glasgow, G40 3PE
T: 0141 556 6221

R.L.P. Painting
Heathfield House, Old Bawtry Road, Firlington, Doncaster, DN9 3DD, UK
T: 01302 772222

SCA Group Ltd
Woodbridge Ind. Park, Three Legged Cross, Dorset, BH21 6FA
T: 01202 820820

Sherwin-Williams Protective & Marine Coatings
Tower Works, Kestor Street, Bolton, Lancs, BL2 2AL
T: +44 (0)1204 527717

Shirley Industrial Painters & Decorators Ltd
Grand Union House, Bridge Walk, Ackcock’s Green, Birmingham, B27 6SN
T: 0121 706 4000

Specialist Blasting Services Ltd
Smiths Quay, Hazel Road, Woolston, SO19 7GB
T: 023 80438901

Stamford Construction Limited
Barham Court Business Centre, Teston, Maidstone, Kent ME18 5BZ
T: 07912037033

Stream Marine Training Ltd
Kintyre House, St Andrews Crescent, West Campus, Glasgow International Airport, Paisley, PA3 2TQ
T: 0141 212 8777

Story Contracting Ltd
Burgh Road Industrial Estate, Carlisle, Cumbria CA2 7NA
T: 07730 764414

Tinsley Special Products
Enterprise House, Durham Lane, Eaglescliffe, Stockton-on-Tees TS16 0PS
T: 01642 784279

Torishima Service Solutions Europe Ltd
Sunnyside Works, Garsheirne Road
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T: 01238642390

Transvac Systems Ltd
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Email: enquiries@squareone.co.uk
April 2015/2016

London Branch Golf Day
Venue: Silvermere GC, Guildford, Surrey
Details from Derek Hoskins
dhoskins@akzonobel.com

North West Branch Golf Day
Venue: Eccleston Park Golf Club, Prescot, Merseyside L35 4PG
Details from Brenda Peters 01706 871700
brenda.peters@analysis-scientific.co.uk

DIARY DATES 2014/2015

Thursday 5th June 2014
London Branch Golf Day
Venue: Silvermere GC, Guildford, Surrey
Details from Derek Hoskins
dhoskins@akzonobel.com

Thursday 5th June 2014
North West Branch Golf Day
Venue: Eccleston Park Golf Club, Prescot, Merseyside L35 4PG
Details from Brenda Peters 01706 871700
brenda.peters@analysis-scientific.co.uk

Tuesday 17th – Wednesday 18th June 2014
Institute of Corrosion and NACE, Great Britain Section, present a joint conference
Royal Overseas League, St. James
London for more information email to: admin@icorr.org

Thursday 9th July - Wednesday 16th July 2014
Insulation Inspector and Fire-proofing Inspector Training
Argyll-Ruane Ltd., the Institute’s training and certification scheme provider, is planning to hold
an ICorr training course and examination session in conjunction with CUEL Ltd., Thailand.
The event is to run 9th thru’ 16th July and will be dedicated to Insulation Inspector and Fire-proofing
Inspector training.
More information from Dave Griffiths, ICorr Scheme Manager, dave.griffiths@argyllruane.com or
the ICorr International Assistant at icorr@btinternet.com

Sunday 2nd - Thursday 6th November 2014
Call For Papers - 19th International Corrosion Congress
Venue: Jeju Island, Korea
For more information visit: http://www.19thicc.com

Thursday 13th November 2014
London Branch joint meeting with W&J
Speaker: Hesham Mahmoud, 'Top of line corrosion and mitigation.'
Venue: Naval Club, 38 Hill Street, London
17.45 for 18.15 start.

Thursday 11th December 2014
26th London Branch Christmas Luncheon
Venue: Royal Over-Seas League, Park Place, St James Street, London, SW1A
Contact: Mike Allen mike.allen@btinternet.com

Wednesday 9th July - Wednesday 16th July 2014
Insulation Inspector and Fire-proofing Inspector Training
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More information from Dave Griffiths, ICorr Scheme Manager, dave.griffiths@argyllruane.com or the ICorr International Assistant at icorr@btinternet.com

Tuesday 30th September - Thursday 2nd October 2014
Corrosion Control in the Oil & Gas Industry
Learn to Anticipate and Control Corrosion Problems in a Regulatory Environment.
Venue: Amsterdam
For further details contact: Coln Britton, cbrit79727@aol.com, Tel:-44 (0)1480-860943

Thursday 12th February 2015
London Branch meeting
Speaker: David Deacon; 'Iconic London structures and their corrosion maintenance.'
Venue: Naval Club, 38 Hill Street, London
17.45 for 18.15 start

Thursday 12th March 2015
London Branch meeting and AGM
Speaker: John Fletcher, ICorr President’s Lecture
London Branch meeting
Thursday 12th February 2015
London Structures and their corrosion maintenance.
Venue: Naval Club, 38 Hill Street, London
17.45 for 18.15 start

Thursday 9th April 2015
London Branch meeting
Speaker: Hesham Mahmoud; 'Top of line corrosion and mitigation.'
Venue: Naval Club, 38 Hill Street, London
17.45 for 18.15 start

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20 May 2014
London Branch Golf Day
Venue: Silvermere GC, Guildford, Surrey
Details from Derek Hoskins
dhoskins@akzonobel.com

May/June 2014 No. 119

London Branch publish a monthly Newsletter; to be included on the circulation list please contact Sarah Vasey sarah.vasey@akzonobel.com