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The President Writes

This edition finds me recently back from the barren wasteland that is Norfolk and preparing to set off for the barren wasteland that is Dubai. Actually, that’s being a bit rude and hugely inaccurate about both places, although probably not about the specific areas I’m visiting. Why does corrosion never happen in nice, well kept locations with deep carpets and room service?

Anyhow, my Norfolk stint finds me working on an old railway bridge, hence the orange gear in the photo. As is normal in such tasks, there were dozens all working furiously on different aspects of the job at the same time, similarly attired. Had a spy satellite passed over it would have looked like a band of seriously lost Dutch football supporters or the result of a particularly audacious escape from Guantanamo Bay.

The more knowing amongst you will have noticed my blue helmet (stop sniggering at the back), denoting my lowly status as one who cannot be trusted not to wander off into the path of an oncoming express. I’m actually very impressed with the safety procedures adopted on rail jobs. While I think we generally do very well with regards to health and safety, it certainly never harms to learn from others.

Because of the nature of our chosen profession, many of us have to work in difficult environments and worst of all, ones we may not be fully familiar with. It can be quite worrying when you think of all the dreadful stuff we’ve had to deal with, particularly in older and less aware times when substances like carbon tetrachloride were household items and sloshed about like cheap bodysplash in a sports centre changing room (not one of my snappiest analogies - but you know what I mean).

So there we find ourselves, wandering around an unfamiliar industrial landscape filled with remnants of lead, mercury, cadmium, chromates and, of course, health giving asbestos. It is important that younger people coming into the business are made aware of the way things were and what may still be out there. Modern life seems to work on a principle of, if you’re allowed to do something, it must be inherently safe.

A few years ago I was visiting Malta (work, well, a conference) and I was watching the predominantly British tourists paragliding behind a speedboat. I was particularly interested as they habitually flew over the rugged stone and concrete breakwater and wondered what happened if they stalled and came down at that point. On returning home I did some digging on t’internet and found that around three people were seriously injured or worse every year due to such accidents; just can’t imagine that being allowed in Great Yarmouth, can you?

All too often, we find ourselves working in the time machine of old and defunct industry where nasties that saw off our predecessors still hide in the nooks and crannies, just waiting for us to remove some insulation or part a flange.

So, in the words of Sgt. Esterhaus in Hill Street Blues, ‘Hey, let’s be careful out there!’

London Branch Golf Day

London Branch held another successful golf day event at Silvermere, Surrey on 10th June and this year the weather was mercifully kinder, being less hot and with a threat of rain although not enough to halt proceedings. Silvermere is not without its challenges as can be seen by the potentially precarious stance of Brian Dunsterville (Winn & Coales) on the 18th green!

Prizes were presented by London Branch Chairman Brian Goldie, the morning Texas Scramble for the Denso Cup being won by the Coastal Preservation Services team of Darren Richardson, Neil Gritton, Tony Rance and Andrew Sheppard with 29 points. The afternoon stableford for the Len Townsend Memorial Trophy was won by Winn and Coales’ team of John Burton, Terry Capps, Brian Dunsterville and Barry Tunnell with 86 points. The second place trophy of the ICorr Shield went to the JPV1 team of Gary Carter, Dave Ellis and Bob Chisholm who scored 82 points. The Ameron Tray for best individual score went to Barry Tunnell of Winn & Coales for his 39 points on count back. Andy Stubbs (PPG2) hit the longest drive and Peter Young (Jotun) was nearest the pin. Thanks are due to Mike Moffat and Derek Hoskins for organising the event and to Dawn White for officiating.
The meeting was welcomed and an introduction and an overview of the IOM3 was given by Professor Robert Akid (Sheffield Hallam University).

He pointed out that the meeting was co-sponsored by the Institute of Corrosion. The IOM3 has now some 19 000 members worldwide and a history of some 140 years.

Licensed by the Engineering Council to award Eng Tech, IEng and CEng, lately it has added CSci and CEnv. The papers in this Seminar will be available to delegates via the IOM3 website.

John Thirkettle then gave a review of ‘Corrosion Under Insulation Forum/CP of Industrial Plants’. He pointed out that the ethos of this forum is: open debate amongst members, to share experiences, hold regular Technical Workshops and liaison with HSE.

The long-range aim is to develop methods for inspection of coatings under thermal insulation (ICUT) without the need for Removing Insulation. Unfortunately, there is still no non-intrusive method; insulation still has to be removed. Activities of the Thermal Insulation Coatings Association (TICA) include EFC Guidelines for CUI, personnel certification, a textbook available for best practice and a website (cuiform.org).

Soils and other Buried Media were then described, including variance in soils, earthing systems, crossings, stray currents, bacteria and soil contamination. Barrier coatings, cathodic protection and complex pipe-work systems, whether or not to isolate systems, standards and cathodic protection potentials with respect to a copper/copper sulphate reference electrode were then all considered.

Dr Gareth John of UMIST gave a presentation on 'Limitations of Soil Investigations for Corrosion Assessments of Buried Steel'. He pointed out that the corrosion of cast iron, ductile iron and steels may lead to a range of failures of pipelines/buried storage tanks by through wall pitting, general corrosion or fracture. As is usual with all corrosion, metal loss may result in minor water leaks, total washout or gas leaks leading to explosions. Subsequently, the complexity of the subject was outlined, ie. the soil in which the component is buried (type, resistivity, chemical composition and external factors as described by Romanoff in the USA during the 1950’s).

A detailed discussion was provided on soil characterization and the various mathematical equations relating pit depth and weight loss to time, as developed by Romanoff. Finally, an appreciation of other approaches was given; more widely used is the AWWA 10-point system.

Louise Robinson, HSL, Buxton, Derbyshire then addressed the meeting on ‘Corrosion of Buried LPG Pipe’. She described LPG as a propane/butane mixture, denser than air and an asphyxiating gas. Items covered were: explosions from fractured mains, industrial installations, domestic installations and a survey of failures. Factors affecting corrosion rates were listed as: under: temperature, protection, type of ground; moisture content variation, age, pipe material, protective coating and condition, cathodic protection and the free corrosion potential (Ecorr).

In order to avoid future problems, it was recommended that the pipe route and layout with respect to the surface and pipe depth should be documented. Duties of care include ownership, suppliers and industrial inspection/maintenance.

The next speaker was Dr Colin Argent, MACAW Engineering Ltd who gave a lecture entitled ‘In-Line Inspection as an Audit for Corrosion Control’. He concentrated his talk on three causes of corrosion: under-protection, CP shielding and stray currents/interference.

Excellent strategies for reducing the risk of under-protection by stray currents as: measuring potentials as accurately as possible, considering probes or coupons, avoiding CP shielding, focussing on NDT methods, total reporting on coating loss, excavation and measuring the pipe depth.

Mirko Smuk, Rosen HQ, RTRC, Switzerland gave a presentation on ‘Inspection Solutions for Short Pipelines in Plant Facilities’. The reasons for pipe-line incidents include: corrosion, metallurgical defects, cracking and third party damage.

The scope of instrument used at the investigation of a large diameter natural gas line by SCC which occurred at Brookdale, Manitoba, 14 April 2002 was then described. Features included: 1.5 D bend back-to-back, multi-diameter, vertical portions, self-propelled, wireless, geological & camera, 8 - 30 ins. diameter to small scale.

The Ro-Helix concept was then outlined as having a payload of 200 Kg. It is a rotating tool, giving full coverage with 3 MSL self-propelled sensor units. For 30 ins. upwards, it gives 100 % coverage of the pipe-line; at 40 ins, it has been successfully tested in Saudi Arabia, using external supply. The next generation of instruments will turn in different directions.

In conclusion, Electro-magnetic Acoustic Transducer (EMAT) and Magnetic Flux Linkage (MFL) were then described and the speaker informed the audience that Rosen is actively working on other solutions.

Dave Harvey, Pipeline Maintenance Ltd. then gave a presentation on ‘Applications and Limitations of Cathodic Protection within Plants’. He indicated that the design and installation of CP systems for buried structures for plant facilities presents a unique challenge to the corrosion engineer. Materials involved are pressed carbon steel pipe, carbon steel and ductile iron drains. Two basic earthing systems were then discussed: isolated and non-isolated together with their advantages and problems.

In summary, CP is not a simple process. It is best to establish a CP philosophy at the outset. A CP co-ordinator is needed (Certificated to Level 5 CP Engineer or NACE qualified). CP may interfere with magnetic measurements during which it is necessary to isolate the CP system.

Next, Chris Lynch, Corrpro delivered a paper on ‘Use of Isolation Joints within Plants’. The purposes of electrical isolation, the pros and cons of Isolated Joints (IJ’s) and Isolated Flanges (IF) were discussed. Appropriate test procedures for IJ’s and IF’s are factory tests and field tests by electrical and visual techniques were also given. The problems associated with the electrical Isolation and protection of isolation joints were then outlined.

In summary, electrical isolation in plants can be critical for the integrity of buried structures. Tests are necessary on a routine basis for essential protection and maintenance.

The final paper was given by Derek Savage of ExxonMob, entitled ‘Strategy for Refurbishment of Corrosion Control at Road-Crossings’. The original strategy involved work-guides for partial excavation at interfaces where underground pipe-lines crossed at a road-crossing. Due to signal attenuation from the wrap and bends, Long-Range Ultrasonic (LRUT) was considered unsuitable, being only useful for detecting whether general corrosion is present. Detection of localized corrosion due to individual stone contact is necessary.

Direct current voltage gradient (DCVG), although a good technique for off-site piping, is not considered effective due to lack of electrical isolation of ‘on-site’ piping circuits. Partial excavation at interfaces or sections under roads had potential to damage pipe/ wrap/backfill on either site.
A new practice was developed to help set an appropriate risk for each line in a road-crossing. To help assess risk at road-crossings, an 'iso-risk' tool was used. Risk points were defined per interface and underground section risk. The risk reductions in 2009 were: Overall SHE risk by 48%; Overall Fire risk by 69%; Environmental risk by 54%. Further refurbishments are planned for 2010 and information shared with HSE at a routine surveillance visit.

The probability of failure of both the interface and main underground section of a pipe may be determined by using a series of tables. These tables use visual inspection of interfaces to infer a probability of failure at the interface and main pipe, e.g. no wrap at interface and stone-contact gravel/good wrap and ‘no-stone’ contact. The table is used for consequence assessment for environmental, fire and toxic-release based on fluid and pressure.

D. Nuttall

#### SUMMARY OF THE ICORR CED WORKING DAY AND SYMPOSIUM ON CORROSION MONITORING

**WARRINGTON CED DAY - AN APPRECIATION AND REVIEW BY DAVID NUTTALL**

In the last edition of CM in his Technical Topics column Douglas Mills gave a brief summary of the CED day in Warrington on 26th April. Below are some comments and a longer review of the talks from an appreciative delegate. Note that the talks are now available on the website.

The event was well-attended by a wide cross-section of the corrosion community and included a visit to the prestigious Serco facilities nearby.

The first lecture was given by Dr Colin Britton, entitled "Corrosion Monitoring - Fact or Fiction?" He started by defining corrosion monitoring as 'The systematic measurement of corrosion or degradation of an item of equipment with the objective of assessing and understanding the corrosion process and/or obtaining information for use in controlling corrosion and its consequences'. He then went on to outline the various methods used: coupons, hydrogen probes, electrical resistance probes, electrochemical probes (LPR) and the various NDT/NDE methods available. Lists of suppliers, process chemicals and users were then given together with areas of expertise and important sources of literature, useful NACE Standards and the Achilles Club database. There followed some ‘negative’ case histories in which corrosion had played a part in engineering failures, together with a more ‘positive’ scenario where lessons had been learnt, including development in computer systems, on-going monitoring and analysis of flow dynamics. Dr Gareth Hinds then addressed the meeting on "Corrosion Monitoring in the Oil & Gas Industry", beginning with the scope and scale of the problem, e.g. oil and gas infrastructure is ageing leading to adverse publicity as a result of environmental damage. He showed that these problems might be overcome by monitoring, which brought the following benefits: improved safety, reduced environmental impact, lower operating costs, lower maintenance/inspection costs, minimising unscheduled shutdowns, optimization processing efforts and inhibition of corrosion rates.

However, each monitoring method had its own inherent random error and it was pointed out that, amongst other things: inappropriate selection of location or technique is worse than no selection, quality of data should be questioned and that review of historical experience should influence decisions. He then outlined the corrosion mechanism as being generally very localized, targeting areas with enhanced water drop and areas where the process stream changes, e.g. water-traps which often act as corrosion sites.

Two basic types of monitoring were discussed: inspection data/structural integrity and Process Safety Management, ZRA, LPR and wall thickness. The pros and cons of using coupons were then discussed, followed by a similar treatment of electrical resistance (ER), including its high sensitivity, linear polarization resistance (LPR), zero resistance ammeter (ZRA), chemical analysis, ultrasonic thickness (UT) and electrochemical noise (EN). Factors affecting the choice of technique selection were included as: at least two methods should be used, speed of response and media conductivity. Finally, future trends and techniques for inaccessible locations were outlined.

The next talk was given by Dr Douglas Mills of the University of Northampton on "Monitoring of Anti-corrosive Coatings using Electrochemical Techniques". He began by dealing with traditional methods, viz: visual inspection thermal imaging (which could possibly detect corrosion under a coating), salt spray and immersion panels. The challenge is to transfer an electrochemical method that works in the laboratory and make it work in the field. The technique used needs to be non-intrusive, fast, accurate, simple to interpret and leave no indication that any measurement has been made.

There then followed descriptions, limitations and situations where electrochemical methods for monitoring coatings in the laboratory might prove useful. These include: DC resistance, Electrochemical impedance spectrometry (EIS), scanning techniques (SVET, SRET and SKP), and the DC Transient/Current Interrupter Technique which was developed for on-site use. A 50 mV perturbation is applied to the sample, turned off and the decay curve plotted and analysed to obtain the resistance of the coating. An in-depth background, requirements and data-gathering for Electrochemical Noise techniques (ECN) - which may be potential and/or current noise in nature was then given.

Test solutions, salt bridges and single substrate arrangements were described, together with a discussion on the time to equilibrium (typically 30 mins). The possibility of reducing measurement time and laboratory work on the effect of frequency appeared promising in that we can use higher frequencies of measurement than 2 Hz, e.g. 10 Hz and still obtain accurate results.

Dr Mills concluded that further work might involve: trying the system on further structures (bridges etc), developing a dedicated small portable coatings testing instrument and programming the computer to decide what length of time electrodes need to be left in place.

D. Nuttall
I am writing this at the start of the holiday season and although I have not yet had a vacation, I have recently taken a few corrosion related pictures at holiday locations. So I thought I’d include a few in this TT as such pictures tend to stimulate more response than some of the other things I cover!

Before I do that I thought I’d touch on politics. You may remember that the Institute is a relatively long standing of the Parliamentary and Scientific Committee (certainly more long standing than almost all the MPs!) Yours truly is the rep. Our current President Paul Lambert has been along to a couple of their annual lunches and also you will recall that we had a big advert and wrote an article in the Science in Parliament magazine relating to our 50th anniversary last year. Back in Dec 2006 during Stuart Lyon’s presidency, we contributed a talk to one of the evening debates and this was also reported in S in P. Despite the looming shadow of cuts, the new coalition government seems as keen if not keener on putting science at the heart of things than its predecessor. I have gone to a couple of events recently at the Houses of Parliament. One on 6th June was the AGM of the P and S where I met Andrew Miller MP, Chair-elect of the committee (he plays guitar so must be a good chap!). This was combined with a meeting on Volcanic eruptions, catastrophic earthquakes and tsunamis – how can we reduce the tolls on humanity? (The first speaker was Steve Sparks from University of Bristol and, yes, he talked about volcanoes!) Prediction is a real challenge. Forecasting corrosion and, in my own area of interest predicting lifetime of a coatings system, is hard enough. But in most cases the processes themselves are gradual, measurement of relevant variables is at least theoretically possible and extrapolation can be employed. With earthquakes and volcanic eruptions, catastrophe theory comes into play (I remember that that was applied in corrosion studies about twenty years ago. But I have not seen any papers on it recently). A corrosion area where there is sometimes sudden catastrophic failure is stress corrosion cracking – but if one could get in there and measure the crack length it would probably be, in theory anyway, predictable. What can you measure to forecast an earthquake? Food for thought!

The other meeting I attended (on 22nd June) was the Parliamentary-Links day organised by the RSC. This had people like Jocelyn Bell (President of Institute of Physics and discoverer, along with Anthony Hewish, of pulsars), David Willetts and Ed Miliband talking as well as Professor John Beddington, the Chief Scientific advisor to HM government (apparently EVERY government department will soon have a scientific advisor). This was a popular meeting (320 delegates with about 70 people standing). It ran close on three hours and the tone was upbeat. If anybody wants more detail I have a pack full of info.

Another thing I’d like to say is a few words about is a book which will shortly be published entitled ‘Towards Zero Failures in Swinging Moorings’ which I have in a minor way contributed to (I think the author found out about me through this column). Who would have thought that the topic was large enough to write a book about. But it is! And a very good book it will be when it is published (contact Jim Izzard (jimgill06@onetel.com) if you would like to get a copy).

Finally to my corrosion snaps: Ai, Aii, B and C. I will make this a bit of a quiz. The locations are: A is Sopot, B is Gdynia (these two towns are close to Gdansk in Poland which I was visiting) and C is near the Snake Inn in the Peak District. What you need to do is identify what we are looking at and suggest a cause. Answers on a postcard please to: Douglas@harrbridge.freeserve.co.uk. I will give you my responses -not necessarily correct- in the next TT. Have a good holiday season!
ABERDEEN BRANCH EVENTS

The March / April 2010 issue of this journal gave an account of a very successful year 2009/2010 session. This issue gives a brief report on our last 2 presentations for the year and extends a hand of gratitude to our generous sponsors, old and new.

Typically, we have a joint meeting with the Marine and Corrosion Forum in April and another joint meeting with NACE in May. This year was not an exception.

In April, We had Mark Richardson of Apache North Sea Ltd and James Dulewiche of Deepwater Corrosion Services Inc. Their presentation was titled The Design, Fabrication and Installation of a Multi Platform Impressed Current Cathodic Protection System. The presentation was given from an operators point of view with focus on project management, best practices and transferable lessons learnt. With 53 people in attendance, Mark clearly outlined the project philosophy deployed in taking a realistic current capacity CP system based on an assessment of the existing CP system performance as opposed to treating the retrofit CP system as a new build. This option was driven by the fact that the Forties (asset name) structures and pipelines were originally designed to offer cathodic protection by sacrificial anodes for a 25 year field life. This has now been exceeded. As one would imagine, the most critical components of concern with intervention requirements were pipelines and risers. Deepwater Corrosion Services supplied the materials and executed the project.

The presentation for the month of May 2010 was given also from an operator’s perspective. It was titled ‘The Contribution of Corrosion Engineering in Identifying and Reducing Loss of Containment in Oil & Gas Facilities. This was delivered by Thierry Chevrot of the Technology Division of TOTAL.

Thierry highlighted corrosion challenges of a global operator and presented the results of a worldwide analysis of loss of containment data taken from reports made by TOTAL operating subsidiaries.

Discussions were tailored around best practices deployed in managing corrosion issues on surface facilities, both onshore and offshore. Other subjects discussed were the corrosion assessment methodology of a worldwide pipeline network and lastly, a worldwide data analysis of losses of containment with suggested solutions for improvement.

A world of thanks to all our sponsors;
Aberdeen Branch, Gold & Ordinary Sustaining Sponsors.

The Aberdeen branch, on behalf of all committee and professional members will like to say a word of thanks to all our valued sponsors for their continued support in sponsoring our programs.

EVENTS

Technical program for ICORR Aberdeen for 2010/2011 year as below:

30 September 2010
Joint: WJS - Dr. Chris Fowler, Director, Corrosion
Exova Group, Exova; “Materials & testing for sour environments.”

26 October 2010
ICorr: Dr. Zainab Marsh, TAQA/WGIM; Operating limits set by ISO 15156/NACE MR0175 versus recent testing advances performed in accordance with NACE TM0177/ECF 17 for the susceptibility of 316 stainless steel to pitting and stress corrosion cracking.

23 November 2010
ICorr: John Middleton; “Validation Testing of Composite Repairs for Pipes and Pipelines”

25 January 2010
ICorr: Rob Howard, Principal Engineer, Lloyds Register sharing on “Materials Engineering - Issues in Oil & Gas”

22 February 2010
ICorr: Dr. Dan Kirkwood, Senior Consultant, Oceanerineering International Services (OIS); presenting “Interactive threats arising from hydrogen in ferrous alloys”

We trust that you will continue to find value in our service to you and to the industry now and in years ahead.

The chart below shows a trend of attendance in the recently concluded ICORR year and boasts an average attendance of 53 people per session with credits to the generous sponsors who make each meeting session comfortable.

Finally, we would like to inform members and others interested in our presentations that moving forward, our monthly presentations will in the Palm Court Hotel, Aberdeen and no more Pittodrie Stadium in Aberdeen.

Contact Details

If you would like any further information on the Aberdeen Branch’s events and activities please contact:
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Qatar Gas Transport Co QGTS.QA (Nakilat) awarded a $610.6 million contract to Daewoo Engineering & Construction Co to build a shipyard in Qatar. The Nakilat Ship Repair Yard is located in Ras Laffan Industrial Complex which is situated at the end of a 10km causeway and spread over 43 hectares, it contains an assortment of workshops and buildings as well as a total of approx 2km of quays and piers. The quays and piers are being constructed from 54 reinforced concrete caissons. The caissons are cellular in design with overall dimensions 36m x 16m x 11m and weigh around 4,000 tonnes each.

Due to the extreme environment in the Arabian Gulf the reinforcing steel within the caissons is protected from corrosion using cathodic protection. Sacrificial anodes provide temporary protection to submerged steel and impressed current systems are used to protect the structures for the next 50 years.

The Cathodic protection systems for these structures are designed and supplied by Corrosion Technology Services, CTS who have utilized the top names in component supply to meet the demanding specification for this prestigious project.

In order to determine the performance of the cathodic protection systems the steel reinforcement needs to be monitored effectively by the measurement of structure to electrolyte potentials. Embeddable reference electrodes are installed at representative locations over the entire structure to provide permanent monitoring facilities by burying the electrodes in the concrete so that they are very close to the actual reinforcement steel.

The nature of the project means that once embedded in the concrete the monitoring devices will be almost impossible to replace so selection was very important.

CTS investigated the performance of different reference electrodes with some manufacturer’s electrodes giving a wide and variable potential range to a standard portable reference electrode.

Silvion WE100 Ag/AgCl reference electrodes were selected due to their accuracy, stability, superior performance and unmatched track record. These reference electrodes are installed as part of a cluster containing a reference electrode, a current pick up probe and an instrument negative connection. In all there will be almost 700 Ag/AgCl Silvion reference electrodes installed on the project.

The ICCP systems consist of Telpro MMO coated tubular Ti anodes to protect submerged steel and De Nora Lida MMO coated titanium ribbon mesh anodes to protect the splash zone and atmospherically exposed concrete.

Power to the impressed current CP zones will be by state of the art remotely monitored and controlled multi-channel transformer rectifiers by Aegis Technical Systems. Air cooled power supplies will be housed in substations within the piers and quays and units within a substation will be connected via RS485. From substation to substation an optic fibre network will be used to monitor and control all TR’s from anywhere on the network.

Silvion are delighted that our reference electrodes have been chosen to monitor the performance of the above cathodic protection systems and we are very pleased to have been involved in such a prestigious project.

For information on Silvion Electrodes visit: www.silvion.co.uk
FOCUS ON SUSTAINING MEMBERS: RECTIFIER TECHNOLOGIES (UK) LTD

Rectifier Technologies Ltd (RTUK) is a Design and Manufacturing Company based in Haverhill, Suffolk, UK, specializing in providing Secure power Solutions for a variety of applications.

We specialise in Switch Mode technology for Impressed Current Cathodic Protection Power Supplies which is the next Generation of CP equipment. It has many advantages over traditional Transformer/Rectifier technology, including very high efficiency, greatly improved power to volume ratio, reduced physical weight/size, ultra low output ripple, modular design can be expanded over time as loads increase, ideal for remote control and monitoring and web enabled.

Another advantage of this design is no large amounts of iron and copper utilized, therefore making the equipment less attractive to thieves and vandalism.

This technology is relatively new in the Cathodic Protection environment, but it has been well proven over many years in other DC power conversion areas, specifically Telecommunications and more recently the Offshore Oil and Gas markets.

Perhaps one of RTUK’s greatest strengths is our in-house design and engineering capabilities. We look for Customer bespoke equipment requirements. A recent example of this is battery and charger systems supplied to the Greater Gabbard Wind Farm, off the Suffolk coast. This consisted of a switch mode, microprocessor based rectifier system, rated at 24 volt, 60 amps, which incorporated 100Ah capacity SLA batteries supplied in 316 Stainless Steel Enclosures to protection level IP65.

Thermal testing was carried out measuring the way in which air circulated within the enclosure, thus determining the best component location to maximise the cooling effect of the metal skin. Matt black paint finish was utilised, internally and externally, again to maximize heat transfer.

This was achievable due to the Strategic Partnership we have with our sheet metal Fabricator allowing us to provide prototypes and custom cabinet design.

As a relatively small Organisation our flexibility allowed us to deliver these equipments in just 6 weeks from order placement, this included drawings for Approval and Witnessed Works Inspection.

RTUK is currently developing a range of 500 Watt Rectifiers at various voltages specifically for Impressed Current Cathodic Protection applications to join our family of Rectifier modules.

This is being developed in house by our design team which has been strengthened by the addition of the Group Senior Applications Engineer who is a leading expert in cathodic protection power supply design. He has been transferred to RTUK having worked for the Parent Company in Australia for many years. This makes RTUK the Group ‘Centre of Excellence’ for CP Power Supply design and manufacture.

RTUK also has the ability to manufacture in volume, we supply Network Rail PADS approved products, we are registered with LINK-UP and have UVDB and UVDB Verify Accreditation. The Company has ISO9001 and major customers include – Network Rail, Highways Agency, Virgin Media, Schneider Electronics, Telefonica (Spain), Shell E&P, Cable & Wireless, KCom (Kingston Communications) and Nokia.

In addition to the above, an ever increasing number of Cathodic Protection Contractors.

In May 2010 the Company obtained ISO 14001:2004 Certification.

RTUK is a Corporate Sustaining Member of the Institute of Corrosion (ICorr)

Please visit our website: www.rectifiertechnologies.co.uk
**Abstract**

A preliminary study was conducted to assess whether an alternating magnetic field (AMF) water treatment system could be used to remove nodules on pipe samples that were previously in service at a secondary cooling water system at Three Mile Island (TMI) Nuclear Power Station. Secondary service water also obtained from TMI was treated in one closed-loop system containing a pipe sample while it was left unaltered in another (control) otherwise identical system and pipe sample. A substantial increase in water clarity was observed within 48 hours of commencing the AMF treatment. Also within that timeframe, all but one of the nodules on the pipe sample housed in the closed-loop with treated service water were removed while the nodules on the pipe sample in the control system remained unchanged. After eight months of exposure, the pipe samples were sectioned and examined using optical microscopy to measure corrosion pit depth in each using quantitative image analysis techniques. The results revealed that the mean pit depth was approx. 50% greater in the control pipe sample compared to that for the sample exposed to AMF treated water.

**1. Introduction**

Mineral deposits in service water systems not only reduce flow through the pipes but also provide a protective environment for corrosion inducing bacteria such as sulfate-reducing bacteria (SRB) [1]. Mineralization can occur abiotically and also result from the activity of a number of organisms including bacteria, yeast and fungi [2]. Consortia of bacteria can produce orange-red nodules, or tubercles, of iron oxy-hydroxides with a relatively hard shell containing calcium carbonate as illustrated schematically in Figure 1. The cells and metal ions in a tubercle can create an oxygen concentration gradient that effectively goes to zero close to the metal substrate. Under these circumstances, pitting of steel at the base of the tubercle can result from differential aeration, a large cathode to anode surface area ratio, and the development of acidity and metallic chlorides. The region near the substrate often becomes colonized with anaerobic SRB resulting in the accumulation of corrosion inducing sulfide at the steel surface. The presence of this dark sulfide can lead to the rapid formation of a corrosion pit that can propagate through the entire wall thickness of the pipe in a relatively short period of time. Such a through wall failure resulting from SRB activity in a mild steel pipe from a water cooling supply line at Three Mile Island (TMI) Nuclear Power Station (Middletown, PA, USA) is shown in Figure 2. Corrosion failures due to tuberculation have been reported for piping and equipment in marine and soil environments, as well as in oil refining, process industries, and fossil fuel and nuclear power plants [1, 2]. The presence

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Figure 1 - Mineralized nodule formed by iron oxidizing bacteria providing a protective anaerobic environment for corrosion inducing sulfate-reducing bacteria (SRB).

Figure 2 - Through wall failure resulting from SRB activity in a mineralized deposit on a mild steel pipe in the water cooling supply line to the main and auxiliary vacuum pumps at TMI Nuclear Power Station (photograph provided by Russ Green, TMI Nuclear Power Station).
of mineralized tubercles can be highly deleterious in service water systems where adequate flow and uninterrupted service life are critical. The bacteria are protected by a hard shell containing calcite, an adhesive phase of CaCO₃, as illustrated in Figure 1. In waters where HCO₃⁻ and CO₃²⁻ anions are predominant, calcite is also the principal scale former in condensers, heat exchangers, water heaters, etc. [3].

Several attempts have been made to prevent the formation of mineralized nodules and scales. Some approaches have been aimed at killing the organisms that colonize the surface. For example, antifouling paints containing tributyltin were once used on as much as 70-80% of the world fleet of ocean going ships yielding almost $6 billion in total annual savings [4]. Despite this earlier popularity, the use of tributyltin has been all but abandoned in favor of less effective but tin-free alternative coatings [5]. Paints and coatings can be helpful if applied before pipes are placed in service [6], but extensive cleaning is generally required once uncoated pipes have been exposed to natural waters. Cleaning processes have been developed using biocides [7] and/or acid solutions [8]. However, these treatments are typically very expensive and hazardous to plant personnel as well as the environment. Also, biocides are often ineffective against bacteria within thick nodules due to the inherent diffusion barrier that only allows a gradual exposure of the bacteria to the biocide. In particular, adhesive calcite particles can fill in pores within the nodule structure and severely limit the rates in which biocides reach the bacteria. By the time the bacteria are exposed to significant concentrations, they can have already built up a resistance to the biocide [1].

Another approach for cleaning mineralized deposits in service water systems is to flush abrasive spheres through the lines during routine maintenance shut downs. The inside of a circulating condenser line at TMI that was cleaned in this manner is shown in Figure 3. As can be seen in this figure along the upper region of the pipe, this abrasive treatment generally does not remove all mineralized deposits. Consequently, the growth of numerous pits is often left unimpeded under the tubercles that are not removed by this treatment. This abrasive treatment, as well as others, requires uniform flow of water everywhere in the system to clean the pipes completely. However, non-uniform flow conditions are common in service water systems, particularly at bends and junctions. Consequently, nodules tend to remain on several areas where the water the flow rate happens to be low or stagnant during cleaning operations.

Aqua-Phyd, Inc. (Newport Beach, CA) have developed a water conditioning treatment that is based on flowing water through a strong (12 to 14 Tesla amplitude) alternating magnetic field (AMF) as illustrated in Figure 4. The alternating magnetic field is produced in the water as it flows from the inlet to the outlet through along the magnetic core [15].

Aqua-Phyd, Inc. developed a water conditioning treatment that is based on flowing water through a strong (12 to 14 Tesla amplitude) alternating magnetic field (AMF) as illustrated in Figure 4. The alternating magnetic field is produced in the water as it flows from the inlet to the outlet through along the magnetic core [15].

The primary application of this water conditioning has been with irrigation systems to dissipate mineral compounds in the soils so that the water is more efficiently distributed for root absorption. Users of this treatment have occasionally reported an unusually large amount of mineral and organic matter that appears to be from the inside wall of the irrigation line. This phenomenon points to the possibility that this AMF treatment may also be useful for removing mineral compounds that hold this matter together and facilitate its adhesion to the inside walls of service water pipes. One of the most prevalent adhesive compounds found in water systems, as well as soils, is the calcite phase of CaCO₃. Others have reported similar findings and have shown that magnetic treatments can favor the precipitation of the aragonite phase of CaCO₃ as opposed to calcite, which would otherwise precipitate in the absence of the magnetic treatment [10 - 12]. The purpose of the present work was to assess the possibility of nodule dissolution using AMF water treatment using service water and a post-service pipe samples from a secondary cooling system at TMI.

2. Procedures

A typical pipe section that had been in service for 30 years in a secondary and contained nodules produced by biofouling was obtained from TMI. The pipe section was kept wet until testing with service water from the same secondary system from which the pipe was removed. Sections of the pipe were mounted in two closed-loop test systems shown in Figure 6 and exposed to service water under quasi-static flow conditions. One of these systems contained the AMF treatment and the other control system did not include an AMF unit but was otherwise identical. After 48 hours of testing, the water and pipe samples were examined by briefly opening
the chambers where the pipe samples were housed. The samples were not allowed to dry before recommencing the experiments. After eight months of testing, the pipe samples were removed and sectioned to reveal the pits that had formed in the inner wall. These sections were then polished to 600 grit and examined using optical microscopy. Quantitative image analysis (ImageJ, NIH) was used to measure the depths of over 100 pits in each pipe sample that was tested. The resulting pit depth distributions were compared on a probability plot where a linear trend in the data corresponds to a log-normal distribution.

3. Results and Discussion

The clarity of the TMI service water increased dramatically within 48 hours with the AMF treatment while the same water in the control system did not change significantly as demonstrated in Figure 6. Photographs of the inside surfaces of the pipe samples tested for 48 hours are shown in Figure 7. It can be seen in this figure that the original scale on the control specimen was unchanged. By contrast, only one of the pre-existing tubercles remained on the surface of the pipe tested in AMF treated water after the 48 hours of testing.

The tests were continued for eight months to determine whether the removal of the nodules on the pipe section in treated water results in less pitting corrosion. The pipe samples were removed from the test loops and sectioned several times to observe pitting corrosion that took place in each. Image analysis techniques were used to measure pit depth in the wall of samples tested under control and AMF treated conditions. The maximum depths of over 100 pits were measured for each pipe section tested. Typical optical micrographs of sample cross-sections are shown in Figure 8 for the control and AMF treated water conditions. Horizontal lines corresponding to the image analysis determination of pit depth for a few of the pits that were measured are shown in these micrographs. The pit depth distributions for each sample are shown on a probability plot in Figure 9. This figure shows that the pit depth was generally about 50% greater for the pipe tested in control service water compared to the that for the pipe exposed to AMF treated service water. This pit depth difference is quite salient considering that the pipe samples were in service for 30 years at TMI prior to their use in the present experiments.

The effectiveness of AMF water treatment likely depends on many key parameters such as the strength of magnetic field, the gradient of the magnetic field and the flow rate of water in the magnetic field. To understand how to optimize the performance of AMF systems so as to benefit broad applications, it will likely be necessary to establish clear physical insights and quantitative theory at the atomic level. While it is believed that the morphology of calcium carbonate micro-crystals is altered in water under the influence of a magnetic field [10–12], the mechanism of crystallization and the exact structure...
of these precipitates are unclear. Another unexplained observation with magnetic water treatments is the persistence of charged species in the water (100 to 400 mV) that can last for many hours [9]. Accordingly, further investigation is needed with carefully controlled model conditions and specimens in order to achieve a better understanding of the phenomena responsible for the promising results presented here.

4. Conclusions

An alternating magnetic field device was used to treat secondary cooling water from TMI nuclear power station in a closed-loop test with a mild steel pipe section that had been in service for 30 years. A substantial increase in water clarity occurred within 48 hours of treatment during this test which was accompanied by the dissolution of all but one nodule on the service of the pipe sample tested in AMF treated water. By contrast, the nodules on the surface of a control pipe sample tested in unaltered service water remained unchanged. After eight months of testing, the mean pit depth for the control pipe sample was about 50% larger than that for the pipe sample tested in treated water. Thus, AMF treatment holds much promise for the dissolution of biofouling nodules in service water system that would in turn lead to a reduction in pitting induced by anaerobic species in the water (100 to 400 mV) that often accompanies it, account for a large portion of the total operating costs of these installations.

Acknowledgement

The authors thank Russ Green, Senior Engineer at Three Mile Island Nuclear Power Station, for providing the pipe sample and service water used in the present work. Support from Aqua-PhyD, Inc. in setting up the experimental closed loop flow systems used in the present research is also gratefully acknowledged.

References

Cookson has announced a new leader for its Enthone High Performance Specialty Chemicals business in Europe. David Crimp, currently Executive Vice President of Cookson’s Alpha Materials Group Europe will extend his role by assuming additional responsibility for Enthone Europe with immediate effect.

David has been with the Cookson Group for over 20 years and brings to Enthone Europe an inclusive, engaging and visionary leadership style together with a wealth of business and commercial experience.

David’s key achievements at Cookson have included the successful transition of the AMG business from autonomous country business units to a single Pan-European entity. His primary task, in his new role will be to work in partnership with Enthone Europe to shape the organisation for the future.

“David will look for opportunities to integrate our Enthone Europe and AMG Europe businesses, creating synergies wherever feasible,” said Steve Corbett, CEO Cookson Electronics. “He will utilise his experience and knowledge, together with his style and preference for improved employee engagement, to blend the best from both organizations and develop a new high performing culture by empowering employees to make choices for themselves. I see David’s appointment as an innovative approach to our European Market that will allow us to deliver great customer service and fulfill the potential of our excellent businesses.”

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Cape House, 3 Red Hall Avenue, Paragon Business Village, Wakefield, WF1 2UL
T: 01224 215800

Cleveland Bridge UK Ltd
Cleveland House, Yarm Road, Darlington, DL1 4DE
T: 01325 502345

Coating Services Ltd
Partington Street, Mumps Bridge, Oldham, OL1 3RU, UK
T: 0161 665 1998

Collis Engineering Railway Contracts
Salcombe Road, Meadow Lane Industrial Estate, Alfreton, Derbyshire, DE55 7RG
T: 01773 833255

Concrete TS Ltd
Unit B2 (2), Moss Industrial Estate, Leigh, Lancs, WN7 3PT, UK
T: 01942 261909

Corrocoat
Forster Street, Leeds, LS10 1PW
T: 01132760760

Denholm Industrial
21 Boden Street, Glasgow, G40 3PU
T: 0141 445 3939

Dyer & Butler Ltd (Rail)
Mead House, Station Road, Nursling, Southampton, SO16 0AH, UK
T: 02380 667549

F A Clover & Son Ltd
Bardolph Road, Richmond, Surrey, TW9 2LH
T: 0208 948 6321

F & H Hyman Ltd
40-42 Middle Street, Wakefield, WF1 1DF
T: 01924 272606

Forth Estuary Transport Authority
Forth Road Bridge, Administration Office, South Queensferry, EH30 9SF
T: 0131 319 1699

H & H Painting Contractors Ltd
4 Hamilton Gardens, Mutley, Plymouth, PL4 6PJ
T: 07837 382619

Harrisons Engineering Lancashire Ltd
Judge Wilmey Mill, Longworth Road, Billington, Clitheroe, Lancashire, BB7 9TP
T: 01254 823993

Hyspec Services Ltd
Unit 3 Meadowfield Industrial Estate, Cowdenbeath Road, Burntisland, Fife, KY3 0LH
T: 01592 874661

Industrial Coating Services
5 Danesbury Crescent, Kingstanding, Birmingham, B44 0QP
T: 0121 384 2266

Industrial Painting
48-49 RCM Business Centres, Sandbeds Trading Estate, Dewsbury Road, Ossett, WF5 9ND
T: 01924 272606

Interserve Industrial
Unit 2, Olympic Park, Poole Hall Road, Ellesmere Port, Cheshire, CH66 1ST
T: 0151 3737660

Jack Tighe Coatings
Sandall Lane, Kirk Sandall, Doncaster, DN3 1QR
T: 01302 880360

Jack Tighe Ltd
Redbourne Mere, Kirton Lindsey, Gainsborough, Lincs, DN21 4NW, UK
T: 01652 640003

Lanarkshire Welding Co.
82 John Street, Wishaw, Lanarkshire, ML2 7TQ
T: 01698 264271

Mabey Bridge Ltd
Station Road, Chepstow, Monmouthshire, NP16 6YL
T: 01291 623801
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address</th>
<th>Phone Number</th>
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<tbody>
<tr>
<td>Maclean and Speirs</td>
<td>Unit D, East Fulton Farm, Darluit Road, Linwood, PA3 3TP</td>
<td>01505 324777</td>
</tr>
<tr>
<td>Merseyside Coatings Ltd</td>
<td>Pickering Road, Halebank Industrial Estate, Widnes, Cheshire, WA8 8XW</td>
<td>0151 423 6166</td>
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<tr>
<td>Northern Protective</td>
<td>16 High Reach, Fairfield Industrial Estate, Bill Quay, Gateshead, Tyne &amp; Wear, NE10 0UR</td>
<td>0191 438 5555</td>
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<tr>
<td>Nusteel Structures</td>
<td>Lympne Industrial Estate, Lympne, Hythe, Kent, CT21 4LR</td>
<td>01303 268112</td>
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<tr>
<td>Paintel Ltd</td>
<td>26 St George's Road, Saltash, Cornwall, PL12 6EH</td>
<td>07730 691227</td>
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<tr>
<td>Palms Ltd</td>
<td>1120 Elliott Court, Herald Avenue, Coventry Business Park, Coventry, CV5 6UB</td>
<td>02476 710294</td>
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<tr>
<td>Port Painters Limited</td>
<td>Unit 3, Ringside Business, Hoel-Y-Rhosog Cardiff, CF3 2EWx</td>
<td>02920 777070</td>
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<tr>
<td>Pyeroy Limited</td>
<td>Kirkstone House, St Omers Road, Western Riverside Route, Gateshead, Wear, NE11 9E</td>
<td>0191 4932600</td>
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<tr>
<td>Roy Hankinson Limited</td>
<td>Alexander House, Monks Ferry, Birkenhead Wirral, CH41 5LH</td>
<td>0870 7892020</td>
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<tr>
<td>Rowecord Engineering</td>
<td>Neptune Works, Usk Way, Newport, South Wales, NP20 2SS</td>
<td>01633 250511</td>
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<tr>
<td>Shutdown Maintenance Services Ltd</td>
<td>Kingsnorth Industrial, Hoo, Rochester, Kent, ME3 9ND</td>
<td>01634 256969</td>
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<tr>
<td>Site Coat Services Ltd</td>
<td>Unit 11 Old Wharf, Grantham Lincs, NG31 7AA</td>
<td>01476 577473</td>
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<tr>
<td>South Staffs Protective Coatings Ltd</td>
<td>Bloomfield Road, Tipton, West Midlands, DY4 9EE</td>
<td>0121 522 2373</td>
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<tr>
<td>Strada Contractors Ltd</td>
<td>Unit 9, Portsmouth Enterprise, Quartermaine Road, Portsmouth, PO3 5QT</td>
<td>02392 666109</td>
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<tr>
<td>Supablast Nationwide</td>
<td>Jubilee Estate, Gorsey Lane, Coleshill, Bolton, Lancs, BL6 SHY</td>
<td>01675 464446</td>
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<td>T I Protective Coatings</td>
<td>Unit 6, Lodge Bank, Crown Lane, Horwich, Bolton, Lancs, BL6 SHY</td>
<td>01204 468080</td>
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<tr>
<td>Walker Construction</td>
<td>Park Farm Road, Folkstone, DA9 9RR</td>
<td>01322 387000</td>
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<tr>
<td>Wardle Painters Ltd</td>
<td>Unit 5, Wimborne Building, Atlantic Way, Barry Docks, Glamorgan, CF63 3RA, UK</td>
<td>01446 748620</td>
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<tr>
<td>William Hare Ltd</td>
<td>Brandleholme House, Brandleholme Road, Bury, Lancs, BLB 1J, UK</td>
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</table>

**ICATS REGISTERED COMPANIES WITH APPLICATORS IN TRAINING**

<table>
<thead>
<tr>
<th>Company Name</th>
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<tbody>
<tr>
<td>Abrasion Ltd</td>
<td>Unit 1 B, OJ Industrial Park, Claybank Road, Portsmouth, PO3 5SX, UK</td>
<td>02392 661023</td>
</tr>
<tr>
<td>Community Clean</td>
<td>11 Old Forge Road, Ferndown Industrial Estate, Ferndown, Wimborne, Dorset, BH21 7RR, UK</td>
<td>0845 6850133</td>
</tr>
<tr>
<td>ENC (Yorkshire) Ltd</td>
<td>Unit 3B Rotherham Road, Dinnington Sheffield, S25 3RF</td>
<td>01909 567860</td>
</tr>
<tr>
<td>Fairhurst Ward Abbotts</td>
<td>225 London Road, Greenhithe, Kent, DA9 9RR</td>
<td>01322 387000</td>
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<tr>
<td>Gemini Corrosion</td>
<td>Broomhill Road, Spurryhillock Industrial, Stonehaven, Aberdeenshire, AB39 2NH</td>
<td>01569 765488</td>
</tr>
<tr>
<td>JPV (Painters) Ltd</td>
<td>Unit 8 Prospect Way, Hutton Industrial Estate, Brentwood, Essex, CM13 1XA, UK</td>
<td>01277 201515</td>
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<tr>
<td>Matatec Ship Repairers</td>
<td>MacGregor House, Seaton Delaval Tyne &amp; Wear, NE25 0PT</td>
<td>0191 2379900</td>
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<tr>
<td>P C Richardson &amp; Co</td>
<td>Courville House, Ellerbeck Court, Stokesley Business Park, Stokesley, TS9 5PT, UK</td>
<td>01642 714791</td>
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<tr>
<td>Standish Metal</td>
<td>Potter Place, West Pimbo, Skelmersdale, Lancs, WN8 9PW, UK</td>
<td>01695 455977</td>
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<tr>
<td>T&amp;T Coatings Ltd</td>
<td>Snowdon House, Snowdon Road, Middlesborough, T32 1DY, UK</td>
<td>01642 247972</td>
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<tr>
<td>W G Beaumont &amp; Son</td>
<td>Unit L1, Chadwell Heath Industrial, Kemp Road, Dagenham, RM8 1SL</td>
<td>0208 590 8523</td>
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<tr>
<td>Company Name</td>
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<tr>
<td>Abbey Gritblasting Services</td>
<td>Unit 13, Clopton Commercial Park, Clopton, Woodbridge, Suffolk, IP12 3TP</td>
<td>0191 262 0510</td>
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<tr>
<td>Barrier Ltd</td>
<td>Stephenson Street, Wallsend, Tyne &amp; Wear, NE28 6UE, UK</td>
<td>0191 262 0510</td>
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<tr>
<td>Carrodus Contractors Limited</td>
<td>Unit 134, Medway Enterprise Centre, Enterprise Close, Strood, Kent, ME6 4SY</td>
<td>01634 271786</td>
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<tr>
<td>Celtic Painting Consultancy Ltd</td>
<td>Rosedale, Carelliken Lane, Langstone Newport, Gwent, NP18 2JZ</td>
<td>01633 40019</td>
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<tr>
<td>Coastline Preservation Ltd</td>
<td>Tredgar Wharf, Marine Parade Southamptom, Hants, SO14 5JF</td>
<td>02380 221480</td>
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<tr>
<td>E &amp; P Painting Contractors</td>
<td>Rossfield Road, Rossmore Trading Estate, Ellesmere Port, Cheshire, CH63 3AW</td>
<td>0151 9558141</td>
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<tr>
<td>Forward Protective</td>
<td>Vernon Street, Shirebrook, Mansfield Notts, NG20 8SS</td>
<td>01623 748323</td>
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<tr>
<td>GABRE (UK) Ltd</td>
<td>9 Holme Road, Dromore, Omagh Co Tyrone, BT78 3BX</td>
<td>02882 897950</td>
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<tr>
<td>G W Burton Ltd</td>
<td>New Court, Wooddalling, Norwich, Norfolk, NR11 6SA</td>
<td>01263 584203</td>
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<tr>
<td>GPS Services &amp; Distribution Ltd</td>
<td>Alexandra Business Park, Riverside South, Pallion, Sunderland, Tyne &amp; Wear, SR4 6UG</td>
<td>01753 654123</td>
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<tr>
<td>GCS Painting Contractors Ltd</td>
<td>61 Portland Road, Selston, Nottingham, NG16 6AS</td>
<td>01773 860983</td>
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<tr>
<td>H &amp; S Decorating</td>
<td>Administration Building, Forth Road bridge, South Queensferry, Edinburgh, EH30 9SF</td>
<td>01753 654123</td>
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<tr>
<td>Hempel UK Ltd</td>
<td>Llantarnam Park, Cwmbran, Gwent, NP44 3XF</td>
<td>01633 874024</td>
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<tr>
<td>Hill Price Associates Ltd</td>
<td>Hill Price Associates Ltd, 3 Prospect Place The Maritime Quarter, Swansea, SA1 1QP</td>
<td>01792 544255</td>
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<tr>
<td>Leighs Paints</td>
<td>Tower Works, Kestor Street, Bolton, Lancs, BL2 2AZ</td>
<td>01698 264271</td>
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<tr>
<td>Malakoff Limited</td>
<td>North Ness, Lerwick, Shetland, ZE1 0LZ, UK</td>
<td>01595 695544</td>
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<tr>
<td>Matthew James Services</td>
<td>Unit 4, Shibdon Business, Cowen Road Blaydon, Newcastle-Upon-Tyne, NE21 5TX</td>
<td>0191 414 5700</td>
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<tr>
<td>Metal Cleaning UK Ltd</td>
<td>Randles Road, Knowsley Business Park, Knowsley, Merseyside, L34 9HX</td>
<td>0151 5492449</td>
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<tr>
<td>MIS Services Ltd</td>
<td>Unit 12 Laurence Industrial, Eastwoodbury Lane, Southend-On-Sea, Essex, SS2 6RH</td>
<td>01702 520400</td>
</tr>
<tr>
<td>Offshore Marine Services Ltd</td>
<td>Brumby House, Jalan Bahasa, PO Box 80148, 87011 Lubuan F.T. Malaysia</td>
<td>+603 621424410</td>
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<tr>
<td>Opus Industrial Services</td>
<td>Ethan House, Royce Avenue, Cowpen Industrial, Estate, Billingham, TS23 4BX, UK</td>
<td>01642 371850</td>
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<tr>
<td>Orromac Coatings Ltd</td>
<td>Newton Chambers Road, Thorcliff Park Estate, Chapeltown, Sheffield, S35 2PH</td>
<td>0114 246 1237</td>
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<tr>
<td>Prize Spraying</td>
<td>Easdale, Carlton Colville, Lowestoft Suffolk, NR33 8WL</td>
<td>01502 564437</td>
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<tr>
<td>R A Materials &amp; Foundries</td>
<td>Unit 19, Heysman Business Park, Middleton Road, Heysham, Lancs, LA3 3PP</td>
<td>01606 723426</td>
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<tr>
<td>R. L. P Painting</td>
<td>Heathfield House, Old Bawtry Road, Finningley, Doncaster, DN9 3DD, UK</td>
<td>01302 772222</td>
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<tr>
<td>Steel Protection Consultancy Ltd</td>
<td>7a High Street Mews, High Street, Leighton Buzzard, Beds, LU7 1EA, UK</td>
<td>01525 852500</td>
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<tr>
<td>Sussex Blast Cleaning</td>
<td>Unit 35-37 Station Road, Hailsham, East Sussex, BN27 2ER</td>
<td>01323 849229</td>
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<tr>
<td>TEMA Engineering Ltd</td>
<td>5-6 Curran Road, Cardiff, CF10 5DF, UK</td>
<td>020920 344556</td>
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<tr>
<td>Tees Valley Coatings</td>
<td>Riverside Park Road, Middlesborough, Cleveland TS2 1UT</td>
<td>01642 228141</td>
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<tr>
<td>The Renovate Services Co.</td>
<td>Amlwch Industrial Estate, Anglesey, LL68 9BQ</td>
<td>01407 831331</td>
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<tr>
<td>Watson Steel Structures</td>
<td>Lostock Lane, Lostock, Bolton, BL6 4BL</td>
<td>01204 699999</td>
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</table>
DIARY DATES 2010/11

1st–3rd September 2010
51st Corrosion Science Symposium
Venue: University of Southampton
CALL FOR PAPERS
One page abstracts should be submitted via email to: J.A.Wahrton@soton.ac.uk
Deadline for receipt of abstracts: Friday 25th June 2010

29th September 2010
Visit to Wedge Group Galvanising Plant
Venue: Sawtry, Cambridgeshire
You are invited to take a guided tour of the new £6m state-of-the-art galvanizing plant. There will also be presentations, lunch and networking opportunities.
To book please contact Tracy Messer
Tel: 01902 600704
Email: corrosion@wedgegalv.co.uk

14th October 2010
London Branch Joint Meeting with LMS
Speaker: Richard Holt of Subspection Ltd on corrosion monitoring in the marine environment.
Venue: Naval Club, 38 Hill Street London W1 17.30 for 18.15 start

11th November 2010
London Branch joint meeting with J&WS
Speaker: Mike Taylor of PPG Protective and Marine Coatings on linings for internal protection of storage tanks including the use of weldable primers
Venue: Naval Club, 38 Hill Street, London W1 17.30 for 18.15 start

2nd December 2010
Annual London Branch Luncheon
Royal Overseas League Club
Co-ordinator - Mike Allen
For further details contact mike.allen9@btinternet.com

27th November – 1st December 2011
Fray International Symposium
Venue: Hilton Cancun, Cancun, Mexico
Honoring the distinguished work and lifetime achievements of Prof. Derek Fray. The symposium will be based in the equally important three topical areas: principles, technologies and industrial practice with special emphasis to a globally sought clean environment of 21 century.
For further details contact Dr. Florian Kongoli
Email: fkongoli@flogen.com
www.flogen.com/FraySymposium

9th December 2010
London Branch visit to the Varsity Match at Twickenham
Details from Mick Ball at mball@denso.net

4th December 2011
Fray International Symposium
Venue: Hilton Cancun, Golf and Spa Resort, Cancun, Mexico
For further details contact Dr. Florian Kongoli
Email: fkongoli@flogen.com
www.flogen.com/FraySymposium

SHORT COURSES

29–30 November 2010
New Energy Institute workshop on Corrosion Management
The workshop will describe the model process of Corrosion Management for the upstream oil and gas sector and is based on the EI publication ‘Guidance for corrosion management in oil and gas production and processing’.
Contact: Will Sadler
Email: wsadler@energyinst.org
Tel: 020 7467 7135

9th-12th November
Corrosion Control in the Oil and Gas Industry
Amsterdam: – Further details contact Colin Britton, Tel: +44 (0)1480-860943 Email: cbrit79727@aol.com or website at www.cfpa.com

London Branch publish a monthly Newsletter
Details of all Branch activities, dates and venues can be found at www.icorr.org