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CORROSION & MATERIALS

Vol 41 No 2, May 2016
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WATER & WASTE WATER FEATURE

Inside this Issue:

Corrosion & Prevention 2016: *Plenary Speakers*

Project Pofile: *Cathodic Protection of a Sewage Treatment Dissolved Air Flotation Tank*

Project Pofile: *50 Years of Coatings Testing at SA Water*

Project Pofile: *Tie in Channel Lining Works - Retrofitting 'Off the Shelf' Products for a Better Outcome*

Tech Note: *Down the Drain: CCTV Changing Sewer Asset Management*

University Profile: *Curtin Corrosion Engineering Industry Centre*

Research Paper: *Corrosion of Stainless Steel Elements in Water Pumps*

CORROSION & PREVENTION 2016

13–16 November
SKYCITY Convention Centre
Auckland, New Zealand

PROUDLY PRESENTED BY:

MAJOR SPONSOR:

The Destination

Kia Ora – Welcome to New Zealand

Feel the spirit of manaakitanga – the uniquely New Zealand form of hospitality.

As ancient explorers and early settlers discovered, you're never far from something incredible in New Zealand. New Zealand packs a lot of punch. It's a geographical and geological treat, with active and dormant volcanoes, thermal springs, wild rivers and glaciers, fine beaches and fertile plains. There's no better place for adventure, rejuvenation and inspiration. New Zealand is compact and easy to get around, so you can experience a whole lot in one trip.

Auckland

Home to 1.5 million people, the 'City of Sails' offers an opportunity to scale New Zealand's tallest building, the Sky Tower as well as savour fine food and wine in Auckland, New Zealand's largest city. Situated alongside two sparkling harbours and flanked by black sand beaches and native forest, this multicultural hub offers the perfect mix of urban chic and outdoor excitement.

Check it out

www.newzealand.com

Technical Topics

Corrosion & Prevention 2016 invites technical papers on all subjects related to corrosion. The conference will bring together leading researchers and industry practitioners who combat corrosion on a daily basis. Diverse technical streams will showcase the latest developments in corrosion, ranging from fundamental corrosion science to hands-on application. Submissions may include research papers, review papers and case studies related to the technical streams and industry sectors listed below.

Technical Streams

- Advances in sensing & monitoring
- Asset and integrity management
- Cathodic protection
- Concrete corrosion and repair
- Corrosion mechanisms, modelling and prediction
- Corrosion prevention implementation
- Education, training and research
- Materials selection and design
- Protective coatings

Industry Sectors

This conference will have material of value to those working within the following industries:

- Buildings and construction
- Cultural and historical materials preservation
- Defence, aviation, maritime
- Education and research
- Food processing
- Government
- Marine, transportation and infrastructure
- Mining and resources
- Oil & Gas
- Power Generation and energy systems
- Water and wastewater

Conference Convenor

Raed El Sarraf

Technical Chair

Raman Singh

Committee

Brian Hickinbottom
Erwin Gamboa

Sponsorship and Exhibition

Sponsorship will enable your company to make a significant contribution towards the success of Corrosion & Prevention 2016. In return, the conference offers strong branding and exposure in a focussed and professional environment. As with every Conference, the exhibition will be an integral part of the activities. It provides an opportunity for organisations to come face to face with the delegates; providing a marketplace to increase your organisation's visibility and to showcase and demonstrate your products and services.

For further information, please contact the Australasian Corrosion Association on +61 3 9890 4833 or email aca@corrosion.com.au

To Register please visit www.acaconference.com.au

Corrosion & Prevention 2016 Early Bird Registration Competition

Register for Corrosion & Prevention 2016 before *Friday 12 August* to go into the draw to win

- Four night's accommodation in the 4.5 star SkyCity Hotel Auckland
- A SkyWalk Experience for 2 people

Total prize value over $1400

Terms and conditions

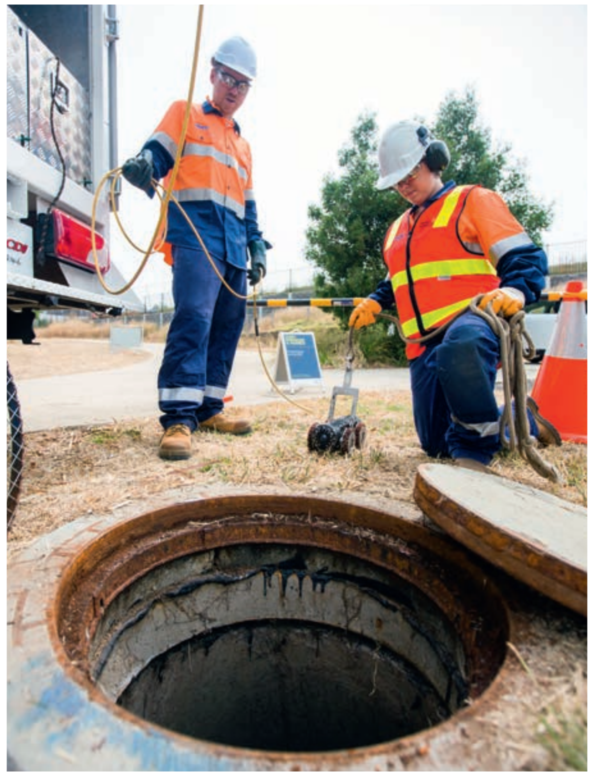
For full competition terms and conditions please refer to www.acaconference.com.au

Corrosion & Materials
Corrosion & Materials is the official publication of The Australasian Corrosion Association Inc (ACA). Published quarterly, _Corrosion & Materials_ has a distribution of 2,500 to ACA members and other interested parties. Each issue features a range of news, information, articles, profiles and peer reviewed technical papers. _Corrosion & Materials_ publishes original, previously unpublished papers under the categories 'Research' and 'Professional Practice'. All papers are peer reviewed by at least two anonymous referees prior to publication and qualify for inclusion in the list which an author and his or her institution can submit for the ARC 'Excellence in Research Australia' list of recognised research publications. Please refer to the Author Guidelines at www.corrosion.com.au before you submit a paper to Tracey Winn at twinn@corrosion.com.au

ACA also welcomes short articles (technical notes, practical pieces, project profiles, etc.) between 500 – 1,500 words with high resolution photos for editorial review. Please refer to the Article Guidelines at www.corrosion.com.au before you submit a short article to Tracey Winn at twinn@corrosion.com.au

The Australasian Corrosion Association Inc
The ACA is a not-for-profit, membership Association which disseminates information on corrosion and its prevention or control by providing training, seminars, conferences, publications and other activities.

Vision Statement
Reducing the impact of Corrosion.



Front Cover Photo:
Select Solutions team lower CCTV camera into sewer.

CORROSION & MATERIALS

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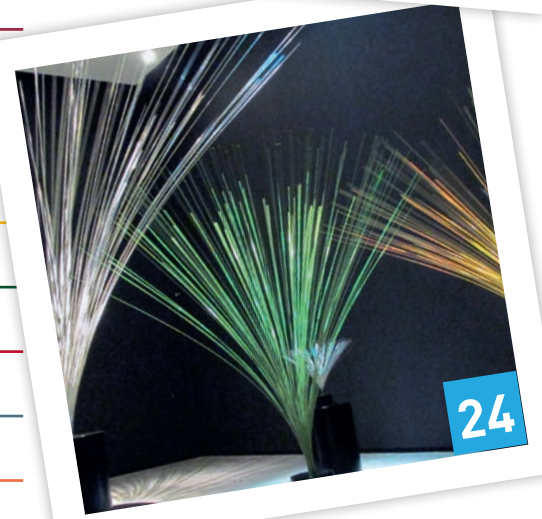
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Dean Wall
Chairman

Greetings everyone, this year is quickly disappearing and as the newly appointed Chairman of the ACA Board I would say that my first term as Chairman has seen some challenging times for our Association. The Industry we all work in continues to be affected by one of the biggest downturns in many a year if, not decades and we have all been challenged to deliver and achieve targets. We too have had to tighten our belts and make decisions to cut costs and ensure we are in a good position to move forward. The ACA Board met in February this year and was joined by our President John Duncan. I can report that the Board is gelling well in collectively making decisions and I am confident we are moving steadfastly in the right direction for our Association's future growth and longevity.

Our EO Wesley Fawaz and his staff are working diligently to deliver our new suite of recently announced training courses including: NACE CP, SSPC Concrete and the Hot Dip Galvanizing Inspection Course; of which we ran our first pilot just recently. It was well attended and we have already received some great industry feedback. We've also recently updated two of our other courses. The ACA Board has prioritised the investment, development and the importance of the ACA offering alternative, up to date training from around the globe to our markets and has supported the hiring of a new training assistant to aid the development of this area.

I recently had the pleasure of attending the VIC Branch's Technical event and can report it was great to see over a hundred corrosionists gathering at the Royal Society in Melbourne to hear some good technical presentations and network with local industry experts. This was a most enjoyable event to meet and greet with our Association's members. Well done to the ACA VIC Branch.

We are also working on bringing Technical Events to all the Branches and have delivered a joint technical seminar with The Maritime Industry Australia Ltd (MIAL) where we discussed the corrosion challenges facing the maritime industry on Thursday 28 April in Melbourne.

Our next Board Meeting will be in June and will precede a very important strategic planning meeting for the ACA. Here we will bring together representatives of our corrosion community and develop our Association's Strategic Plan for 2017-19. The ACA Board sees this planning meeting as a very important step in leading the Association forward, delivering and building on our ACA strategic plan.

As the ACA Board Chairman I wish to acknowledge the fine efforts of ACA Executive Officer Wesley Fawaz and in closing I would like to say thanks firstly to my employer: - Jotun Australia for their ongoing support of my involvement in the ACA. On behalf of the ACA Board I would like to thank all the ACA Staff and volunteers for all their efforts during yet another demanding period for us all. We continue to come out on top and I look forward to yet another wonderful year of training and events for our Members and to your ongoing efforts in supporting the development our future ACA.

Yours in Corrosion and best wishes to all.

Dean Wall
Chairman

ACA 2016 Events

Part of the role of the ACA is to organise events that bring together industry experts to present on new technologies, updates to standards, and share knowledge and experiences via case studies on a variety of projects. Here are the events that are planned so far for 2016.

Month	Event Title	Event Date	Event Location
May	Protecting Infrastructure & Assets against Corrosion	Thursday 19 May	Auckland
	Corrosion in the Oil & Gas Industries	Thursday 26 May	Perth
June	Corrosion in the Power & Energy Industries	Thursday 9 June	Brisbane
	Protective Coatings: Maintaining & Preserving Assets in a Challenged Economy	Thursday 23 June	Melbourne
	Australian Electrolysis Committee Meeting	Friday 24 June	Gold Coast
July	Introduction to Corrosion	Wednesday 13 July	Sydney
		Thursday 14 July	Newcastle
		Thursday 21 July	Hobart
	APGA / ACA Joint Event – Pipeline Corrosion Management	Thursday 21 July	Perth
August	Corrosion in the Oil & Gas Industries	Thursday 4 August	New Plymouth
	Corrosion in the Water & Wastewater Industries	Thursday 18 August	Sydney
September	Concrete Corrosion	Thursday 1 September	Adelaide
November	Corrosion & Prevention 2016	Sunday 13 – Wednesday 16 November	Auckland
	Introduction to Corrosion	Tuesday 15 November	Auckland

ACA members will receive further details on each event as appropriate throughout the year, but for now, please include these in your 2016 diary. For further information on these events for 2016 please don't hesitate to contact Jacquie Martin (jmartin@corrosion.com.au) in the ACA office on +61 3 9890 4833.

Branch Events

Each of the 8 ACA Branches will conduct regular technical events throughout 2016. To enquire, you may contact your local Branch at the following email addresses:

New South Wales: nsw@corrosion.com.au
New Zealand: nz@corrosion.com.au
Newcastle: ncl@corrosion.com.au
Queensland: qld@corrosion.com.au
South Australia: sa@corrosion.com.au
Tasmania: tas@corrosion.com.au
Victoria: vic@corrosion.com.au
Western Australia: wa@corrosion.com.au

YCG Events

Targeting individuals under 35, new to the corrosion industry and/or interested in the corrosion industry, the ACA Young Corrosion Professionals conduct regular events. For further details email ycg@corrosion.com.au or go to www.corrosion.com.au

THE AUSTRALASIAN CORROSION ASSOCIATION INC
YOUNG CORROSION GROUP

Please refer to **www.corrosion.com.au** for up to date details on all ACA activities.

Wesley Fawaz
Executive Officer

The ACA really is a team effort with a countless number of members volunteering their time for the success and sustainability of the organisation.

I always say to members that you will gain more value from your membership the more that you are engaged. There are many opportunities to be involved in the ACA, so if you're interested, please do not hesitate to contact me to discuss further.

I too volunteer for a not for profit organisation and know how difficult it is to find spare time and how precious your own time is and that's why I am always amazed and motivated by our dedicated ACA members.

Volunteers don't often get recognised enough for their input and dedication either (I hope I am not putting you off now), so I am taking this opportunity to acknowledge two members in particular who have been entrenched within the ACA for many years and have had two major events occur recently outside the ACA.

Ian MacLeod has recently retired as Executive Director, Fremantle Museums & Collections after 37.5 years. Although his career comes to an end, his influence and dedication to the ACA continues as he remains in his role as Editor of *Corrosion & Materials*. The ACA team wish you all the best Ian in your next adventure.

In recognition of his long term volunteering dedication to the ACA, Willie Mandeno was recently awarded the 2016 Turner Award at the Annual IPENZ Awards Dinner in New Zealand. Congratulations Willie and I'm glad you were able to accept this great honour while sharing the experience with your engineering daughter who was also attending the dinner.

You may or may not believe me, but the ACA office is always moving and shaking with plenty going on.

I feel we have become a very dynamic organisation in recent years – firstly developing strong foundations and secondly constantly changing, always with something new whilst also looking forward. There is so much going on at the moment that I don't know where to begin, but here goes with some of the recent highlights:

- The Board recently advertised to fill its two independent director role vacancies from outside the membership. This is a first for the ACA and will add great value to the decisions made at Board level. I am very pleased with the amount of interest we received from very skilled and experienced individuals. Once the selection process is complete, these will be announced.
- The ACA Board has scheduled its next facilitated strategic planning day on Saturday 25 June in Melbourne in preparation for the 2017-2019 strategic plan. This plan will be announced during the Corrosion & Prevention 2016 conference in Auckland.
- A membership survey was recently announced. Thank you to those members who completed the survey with the results to be used for strategic planning purposes and results will be summarised in the next issue of *Corrosion & Materials*.
- The NACE Cathodic Protection Program was announced and scheduled for the second half of the year.
- The New Hot Dip Galvanizing Inspector Course has received a lot of early interest and the updated Coating Selection & Specification course was announced with an in-house course being held next month for Hydro Tasmania.
- The ACA (with support from NACE Malaysia) is conducting its Corrosion & Protection of Reinforced Concrete Structures & Buildings course and Hot Dip Galvanizing Inspector course in Kuala Lumpur later this year.
- I recently attended the annual NACE conference in Vancouver, with many positive meetings to further offer ACA courses internationally, to license more international courses in Australasia and to potentially co-develop new courses.
- Solange Brave and Brendan Pejkovic recently left the office and we welcomed Bianca Spetrini as the Training & Events Assistant.
- The 2016 ACA events are now well underway and the Annual General Meeting will be held on the 26 May in Brisbane.
- The 2015 Annual Report is now available on the 'About Us' webpage for those who wish to view the 2015 financial statements.

While all this goes on, so does the planning for the annual conference. Corrosion & Prevention 2016 requires a special mention as registrations are now open and it's critical to the ACA and the sponsors and exhibitors that as many members as possible are able to attend.

I know the New Zealand members are strongly supporting the conference and I hope many outside New Zealand will make the trip to what is such a beautiful country, so why not make a holiday out of it as well.

Wesley Fawaz
Executive Officer
wesley.fawaz@corrosion.com.au

ACA Training Calendar 2016

ACA/ACRA Corrosion & Protection of Concrete Structures

Member $1115 Non-member $1395

Melbourne June 23 – 24
Adelaide October 24 – 25
New Zealand November 10 – 11

ACA Coating Inspection Refresher

Member $605 Non-member $740

Australia December 5
New Zealand October 29

ACA Coating Selection & Specification

Member $1560 Non-member $1900

Melbourne June 6 – 8
Sydney September 5 – 7

NACE Cathodic Protection Program CP 1 – CP 4

Member $3335 Non-member $3670

CP1 Brisbane July 18 – 23
CP1 Melbourne October 17 – 22
CP2 Brisbane July 25 – 30
CP2 Melbourne October 24 – 29

To express interest an in CP 3 & CP 4, please email aca@corrosion.com.au

Hot Dip Galvanizing Inspector Program

Member $1560 Non-member $1900

Melbourne April 27 – 28
Auckland May 17 – 18
Brisbane August 2 – 3
Perth August 30 – 31

Corrosion Technology Certificate
(Also offered as Home Study)

Member $2330 Non-member $2730

New Zealand July 18 – 22
Sydney November 28 – December 2

CTC Home Study

Member $2330 Non-member $2730

Start any time

Corrosion & CP of Concrete Structures

Member $1115 Non-member $1395

Melbourne October 6 – 7

Metallurgy of Steels Introduction

Member $1560 Non-member $1900

Melbourne September 26 – 28

NACE Coating Inspection Program CIP 1

Member $3740 Non-member $4275

Melbourne April 18 – 23
Sydney May 23 – 28
Perth June 27 – July 2
Adelaide August 22 – 27
Brisbane September 12 – 17
Melbourne October 10 – 15
New Zealand October 31 – November 5
Sydney December 5 – 10

All Australian course fees listed are GST inclusive. All NZ and Thailand course fees are exempt from GST.
To calculate the fee pre-GST, divide the fee by 1.1

NACE Coating Inspection Program CIP 2

Member $3740 Non-member $4275

Sydney May 30 – June 4
Perth July 4 – 9
Brisbane September 19 – 24
Melbourne October 17 – 22
New Zealand November 7 – 12

Prerequisites now apply to this course.

NACE Coating Inspection Program CIP 1

Member $2950 Non-member $3180

Thailand June 20 – 25

NACE Coating Inspection Program CIP 2

Member $2950 Non-member $3180

Thailand June 27 – July 2

NACE Coating Inspection Program CIP 3 Peer Review

Member $1470 Non-member $1725

Sydney July 25 – 29

By appointment only. Duration: 2 hour oral exam in front of a 3 member review board. Pre-requisites apply go to Training at www.corrosion.com.au for more details

Protective Coatings Quality Control

Member $1560 Non-member $1900

Sydney April 11 – 13
Brisbane August 29 – 31

SSPC Concrete Coatings Inspection

Level 1 $3000 Level 2 $3500

Perth May 2 – 7
Sydney September 12 – 17

IN-HOUSE TRAINING

Did you know that you can have ACA's suite of courses come to you?

The ACA can present any of its courses exclusively for an organisation; we can also tailor any course to your organisation's specific needs. Please contact the ACA's training department on **+61 3 9890 4833 or aca@corrosion.com.au**

NACE 2016 IMPACT Report

Executive Summary

NACE International initiated the International Measures of Prevention, Application, and Economics of Corrosion Technologies (IMPACT) study to examine the current role of corrosion management in industry and government and to establish best practices.

The most significant outcome of this study is that by reducing what continues to be an astoundingly high cost of corrosion requires a change in how corrosion decisions are made. While important to continue investment in technology for corrosion control, putting this technology into an organisational management system context and justifying corrosion control actions by business impact is required. The community that will require the greatest adaptation to this change is the corrosion profession. This profession must become fluent in the language of management systems and adopt financial and risk tools used by those that make financial decisions. Ultimately, making organisational or industry-wide impact requires commitment to this common way of working by all levels in organisations.

For a copy of the full Report go to http://impact.nace.org/

NACE® INTERNATIONAL

NACE East Asia and Pacific Area Conference 2016

The ACA is officially supporting this conference. The ACA will be hosting a Concrete Stream and Warren Green will be a keynote speaker.

For more information and for ACA members wanting to register go to www.eapaconference.org, using the Promotion Code: **EAPACA2016.**

ACA Exhibits at AOG for the First Time

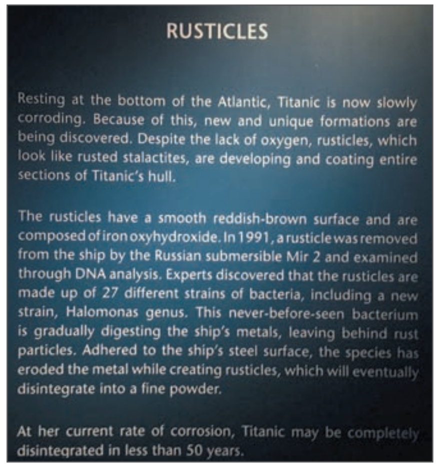
The ACA in conjunction with the Maritime Industry Association Limited (MIAL) co-exhibited at the Annual Australasian Oil & Gas Exhibition & Conference in Perth, during 24-26 February this year. The stands situated side by side were in the Work Boat section of the Exhibition. The stands were 'womanned' by the ACA's Tracey Winn and MIAL's Alison Saunders. Both booths were well attended.

As part of AOG the ACA hosted a morning seminar titled 'Corrosion in the O&G Industry' on Thursday 26 February, chaired by Graham Carlisle and this too was well attended. A Business Card Draw was conducted at the stand, with the first prize being a Bottle Penfolds Bin 128 Shiraz and 3 copies of 'Rust: the longest war'.

1st prize winner (pictured here) went to Dan O'Leary from Evolution Commercial, 2nd prize went to David Simpson of Jotun, 3rd prize went to Peter Whiteley of DMT Marine Equipment (pictured here) and 4th prize went to Carl Riley of AkzoNobel.

Also noted at the Subsea Welcome Drinks on the first night, held at the wonderful Titanic Exhibition also at the Convention Centre, was an interesting fact about CORROSION. 'The Titanic which is resting on the bottom of the Atlantic Ocean is slowly corroding away. As a result of this, new and unique formations are being discovered. RUSTICLES! They look like rusted stalactites and are coating the entire sections of the Titanic's Hull'!! (See image description below from the Exhibition).

Tracey Winn manning the ACA stand.



RUSTICLES

Resting at the bottom of the Atlantic, Titanic is now slowly corroding. Because of this, new and unique formations are being discovered. Despite the lack of oxygen, rusticles, which look like rusted stalactites, are developing and coating entire sections of Titanic's hull.

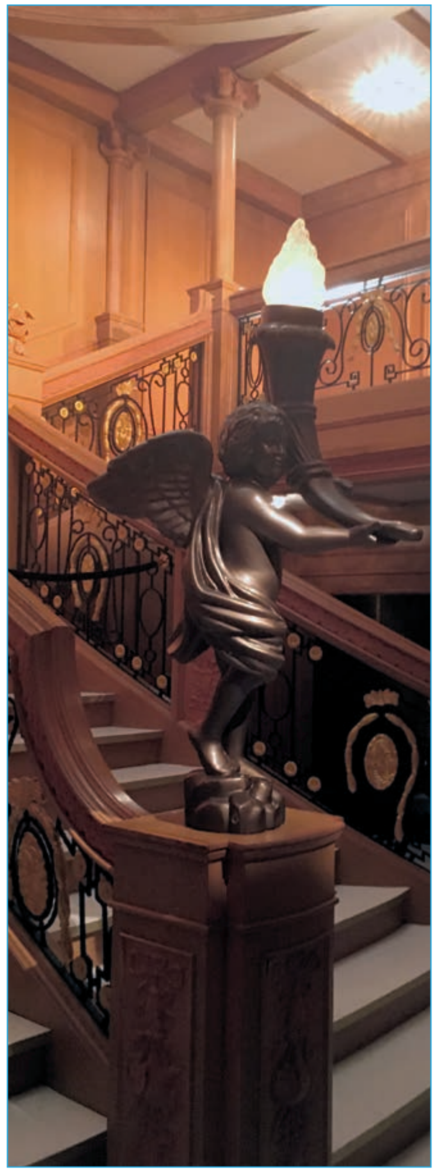
The rusticles have a smooth reddish-brown surface and are composed of iron oxyhydroxide. In 1991, a rusticle was removed from the ship by the Russian submersible Mir 2 and examined through DNA analysis. Experts discovered that the rusticles are made up of 27 different strains of bacteria, including a new strain, Halomonas genus. This never-before-seen bacterium is gradually digesting the ship's metals, leaving behind rust particles. Adhered to the ship's steel surface, the species has eroded the metal while creating rusticles, which will eventually disintegrate into a fine powder.

At her current rate of corrosion, Titanic may be completely disintegrated in less than 50 years.

Rusticle description at the Titanic Exhibition.

Dan O'Leary.

Peter Whiteley.



The entry to the Titanic Exhibition.

Flowcrete and Altex make NZ Distribution Agreement

Flowcrete Australia has entered into a new distribution agreement to make its full range of high-performance resin flooring solutions available across all of New Zealand and the Pacific Islands.

Collaborating with Altex Coatings Ltd (a member of the Resene group of companies) will geographically enhance Flowcrete Australia's presence in the construction market throughout these regions. This advantage is thanks to the extensive network of offices and well-established links to the building industry that the Tauranga based protective coatings specialists has developed.

Altex Coatings has identified a significant demand for flooring materials among its existing client base and this agreement means that its customers can immediately source a wide variety of specialist epoxy, polyurethane and methyl methacrylate (MMA) resin floor and wall coating solutions.

By having access to Flowcrete's full portfolio, Altex Coatings will be able to provide commercial and industrial developments with innovative flooring technology that is not otherwise available in New Zealand and the Pacific Islands.

Overview

The Australasian Corrosion Association will host a one day event aiming to provide a technical platform for the Power and Energy Industries including asset owners, operators, and service providers.

Speakers will share their work experiences, best practices and solutions to the challenges of producing energy and maintaining assets in harsh environments. The program will look at new technologies and methodologies as well as case studies in preventing corrosion and conducting remedial works.

Who should attend?

Presentations will appeal to all industry sectors involved with the Power and Energy Production - including asset owners, project and integrity engineers, operators, inspection and maintenance personnel, contractors and suppliers.

Venue

Champions Rooms 1 & 2
The Gabba
Via Gate 1, Stanley Street
Woolloongabba

Costs

ACA Members - $250 (Inc GST)
Non Members - $295 (Inc GST)

Contact

For further information on this event please contact Jacquie Martin on +61 3 9890 4833 or jmartin@corrosion.com.au

Program

Time	Session	Speaker
8.30 – 8.55	***Registration***	
8:55 – 9:00	**Welcome and Opening**	
9.00 – 9.45	Hot Dip Galvanizing – How to Obtain the Durability You Expected	Peter Golding, *Galvanizers Association of Australia*
9.45 – 10.25	A Question of Access; Overcoming the Problems of Corrosion Remediation at Height	Andy Caddy, *ABSAFE*
10.25 – 10.55	***Morning Tea***	
10.55 – 11.35	Understanding Corroded Substrates for Improved M&R Performance	Steve Pritchard, *International Paint*
11.35 – 12.15	High Temperature Degradation Mechanisms in Stainless Steels - Failure Mechanisms and Case Studies	Richard Clegg, *Bureau Veritas*
12.15 – 12.55	Induced Voltages on Pipelines	Allan Sterling, *ANODE Engineering*
12.55 – 13.50	***Lunch***	
13.50 – 14.30	Corrosion of Queensland's aging Power Transmission Assets	David Wainwright, *Powerlink*
14.30 – 15.10	Material Degradation in Solar Thermal Power	Geoff Will, *QUT*
15.10 – 15.40	***Afternoon Tea***	
15.40 – 16.20	Cooling Tower Concrete Remediation and Protection	Mike Rutherford, *Freyssinet*
16.20 – 16.55	Speakers Forum	
16.55 – 17.00	**Seminar Close**	

To register or for more information go to www.corrosion.com.au

Altex Coatings Ltd Announces New Executive Appointment

Altex Coatings has announced the appointment of Wynand Kruger to its newly created Technical Manager position. According to Managing Director Mike O'Sullivan, the appointment will further streamline and improve the high-end technical services upon which Altex Coatings has built its class-leading reputation.

Wynand will lead the Altex technical team, while also bringing focus and coordination to Altex Coatings' technical services and R&D functions. Through this new position, the company aims to achieve enhanced levels of technical support to meet growing customer demand.

Drawing from its over 60 years of experience, Altex Coatings has several new ventures in the pipeline to compliment their traditional industrial and marine coatings business. Wynand and his technical team will drive these programs, providing key sales team support across all business segments.

Wynand has 25 years of overseas experience in environmental engineering, project management and process engineering within the petrochemical industry, and holds a chemical engineering degree and a B.Com in Marketing and Economics. He brings a wealth of personal experience and knowledge to this new position and to the New Zealand Protective Coatings industry.

Mike O'Sullivan (left) welcomes new Technical Manager, Wynand Kruger (right).

Maintaining & Preserving Assets in a Challenged Economy using Protective Coatings

23 June 2016

Melbourne

SPONSORED BY:
galvanizers ASSOCIATION OF AUSTRALIA
International

PROUDLY PRESENTED BY:
AUSTRALASIAN CORROSION ASSOCIATION INC.

Overview

Protective coatings are used across a multitude of industries including construction, infrastructure, oil and gas and mining. Protective coatings are universal, can be budget sensitive and an extremely effective approach to controlling and preventing corrosion. The longevity of protective coatings varies enormously with modern coatings capable of providing very high levels of corrosion protection, value for money and durability even in the most extreme environments.

This event will bring industry experts together to share their knowledge and investigate ways to better improve the longevity of protective coatings in a variety of applications and environments. The aim is to explore the protective coatings industry by looking at case studies, new technologies, environmental considerations, industry qualifications, standards and training and where possible reflect on how coatings can assist in a challenged economy.

Venue

Bayview on the Park
52 Queens Road
Melbourne VIC 3004

Cost

ACA Members - $250
Non Members - $295

Contact

For further information on this event please contact Jacquie Martin on +61 3 9890 4833 or jmartin@corrosion.com.au

Program

Time	Session	Speaker
8.30 – 8.55	***Registration***	
8:55 – 9:00	**Welcome & Opening**	
9.00 – 9.40	Overview of Protective Coatings	
9.40 – 10.20	Coating Assessment & Field Repairs on Oil Pipelines	Alan Creffield, Viva Energy
10.20 – 10.50	***Morning Tea***	
10.50 – 11.30	Hot Dip Galvanizing – How to Obtain the Durability you Expected	Peter Golding, Galvanizers Association of Australia
11.30 – 12.10	Coatings for Improved Performance following Maintenance & Repair	Jamie O'Brien, International Paint
12.10 – 12.50	Case Studies: Marine Protective Coatings for Steel & Concrete	Dean Ferguson,
12.50 – 13.30	***Lunch***	
13.30 – 14.10	Retrofitting off the Shelf Products for Better Outcomes	Gianni Mattioli, Mattioli
14.10 – 14.50	A Two-Part Waterborne Topcoat for Defence Aircraft	Chris Lyons, DST Group
14.50 – 15.30	12 months on - AS/NZS 2312 from a Coating Manufacturers Perspective	Ted Riding, Jotun
15.30 – 15.50	***Afternoon Tea***	
15.50 – 16.30	Case Study	Nick Riley, Esso Australia
16.30 – 17.10	Replace or Repair: Polymers & Coatings for Repair & Reclamation of Assets	Graham Carlisle, iasgroup
17.10 – 17.30	Open Forum	
17.30 – 17.35	**Seminar Close**	
17.35 – 18.30	Cocktail Function	

To register or for more information go to www.corrosion.com.au

Attracting and Retaining Young Engineers through Technology

The skills shortage in the engineering sector continues to pain organisations in Australia. Medland Metropolis, a future-conscious consulting engineer with 70 per cent of its workforce comprising younger employees, is adopting new technology, Union Square Software, as a means to attract the incoming generation of workers.

Medland Metropolis was established in 1987 by founder Chris Medland with its first office in Brisbane. Providing building services in the private and public sector, the company now also operates from Sydney, Melbourne and London, with 60 staff across these offices.

When selecting a new solution, the three priorities were; flexible working to meet the needs of the next generation of employees, the potential to reduce valuable floor space through alternative working arrangements, and the potential to integrate a number of disparate systems. These three would enable stronger collaboration and increased efficiency.

Investigating alternatives for two years, Medland Metropolis selected Union Square as the one solution that would meet all needs with additional capability.

Angela Williams of Medland Metropolis said, "We understand that we need to adapt our ways of working to meet the needs of generations new and old. This naturally has a flow-on affect directly benefiting our clients. Union Square will enable our people to work from home, on site with clients or from our offices. They thrive on flexibility."

Will Yandell, Director Australasia, Union Square Software said, "It's all about supporting the 'app generation' as they flow into the workforce. The mature construction and engineering sector has entrenched methods of operating. We have introduced software to the sector that bridges the gap with what new generations entering the workforce rely on and are seeking from employers to maintain their engagement and retention."

Union Square Software is an international company headquartered in the UK, with offices in Australia, Canada and Sweden. The company entered the Australian market in 2013 and offers software solutions for the Construction and Architecture/Design industry.

UNION SQUARE

Australian Lecturers Attend NACE CP Train the Trainer

The first step in offering the NACE CP Program was to arrange a Train the Trainer program to accredit Australian lecturers to lecture the NACE CP Program. In February this year in Brisbane, NACE Specialist and CP 4 instructor Marilyn Lewis from the USA trained Kingsley Brown, Wayne Burns, Jim Galanos, John Grapiglia, Ulf Kreher and Allan Sterling. For the first few courses in Australia, this group will co-lecture courses as 'cadets' alongside fully accredited NACE CP lecturers from outside of Australia before being fully qualified to lecture.

Turner Award for Professional Commitment

William (Willie) Lloyd Mandeno was awarded the IPENZ 2016 Turner Award for Professional Commitment in recognition of his extraordinary contribution to and leadership in the field of corrosion prevention technology. The Institution of Professional Engineers New Zealand (IPENZ) award citation reads as follows: "We particularly recognise his national and international reputation as a specialist in corrosion mitigation and protective coatings.

In his role as a Technical Principal for Opus, he's been responsible for the preparation of a range of maintenance and refurbishment contracts including protective coatings specifications for private and public assets including power stations, transmission towers, bridges, oil tanks and pipelines. He has served as the specifier of maintenance coating systems for the Auckland Harbour Bridge for 30 years. He is committed to mentoring young engineers, passing on the specialist knowledge he's built up during 45 years in the profession.

Willie has made a huge contribution to improving engineering and related bodies over many years. He is a Life Member of the Australasian Corrosion Association, and was awarded the Association's prestigious Corrosion Medal in 2008 for Meritorious Contributions to the Mitigation of Corrosion. He has contributed to joint Standards New Zealand and Standards Australia committees and was awarded a Standards New Zealand Meritorious Service Award in 2003. He became a Fellow of IPENZ in 1999 and has been an IPENZ Heritage Committee volunteer, serving on the Wellington Chapter."

VALE

GEOFFREY CHARLES RIPPINGALE
14 February 1945 – 6 January 2016

By John Marden

It is with sadness that we record the passing of Geoff Rippingale, aged 70 years at his home in Patterson Lakes Victoria. Geoff was well known in the cathodic protection industry for over 38 years.

Geoff first started work at The Gas & Fuel Corporation as an apprentice Electrical Mechanic in 1961. Between 1966 - 1968 he served with the Army as a National Serviceman but returned to the Corporation after 2 years. During his service Geoff served a tour of duty in Vietnam between October 1967 -April 1968. In 1971 Geoff joined the Corrosion Mitigation section of The Gas & Fuel Corporation as a Field Technical Officer. In 1975, Geoff was promoted to Planning and Projects Co-Ordinator for the entire North-western areas of Victoria eventually assuming full responsibility for the corrosion mitigation of the area in 1977. During this time he was responsible for the design, planning, supervision, co-ordinating, analysing and reporting on activities relating to corrosion protection on the Corporation's underground assets in the northern and western regions of metropolitan Melbourne and country Victoria.

Between 1997 -1998, Geoff accompanied by his now deceased wife Gillian, went to Bangladesh where acting on secondment to Gascor Consulting International he was a Corrosion Control Consultant. His duties included training staff from Gas Transmission Company Limited of Bangladesh in the design, operation and maintenance of corrosion mitigation services and the production of a Corrosion Control Operations Manual.

After his return from Bangladesh and the privatisation of the Gas & Fuel in 1998, Geoff was promoted to Branch Manager of Cathodic Protection Systems/GSB/AMS where he directed a team of 12 people designing, installing, testing, analysing and reporting on activities relating to corrosion protection of customer's assets. In this role he also acted as an 'Account Manager' for the Westar and Stratus Networks gas distribution business.

In his capacity with Cathodic Protection Systems, Geoff co-presented papers at the Australasian Corrosion Associations conferences in Hobart in November 2006 and Sydney in November 2007 describing both the benefits of Cathodic Protection on coated steel gas pipelines and the assessment of results of DCVG (Direct Current Voltage Gradient) pipeline coating surveys. Additionally he contributed to the production of the VEC (Victorian Electrolysis Committee) Resource Manual in July 2014. Geoff also represented owners of Gas, Oil, Water and telecommunications assets at the Victorian Electrolysis Committee as well as co-ordinating and supervising the routine testing of Cathodic Protection on all Tasmania's gas reticulation and transmission pipeline systems. In 2004 Geoff resigned as Branch Manager of Cathodic Protection Systems and took up a role as a consultant where he assisted others in his usual diligent, professional and competent manner until his retirement in 2009.

Geoff was a highly educated and loyal employee and held an MBA, a Graduate Diploma of Management, a Bachelor of Arts, a certificate of Corrosion Technology and an 'A' Grade Electrical Licence. He had also successfully completed a Pipeline Coating Inspection Course, a Business of Management training course and a Quality Awareness Course and was a member of Australasian Corrosion Association and Australian Pipeline Industry Association.

Geoff is survived by his sister Cheryl and stepchildren. In his own words Geoff's work gave him "the opportunities to work outside and meet many interesting people." He found his work "absorbing" and his dedication and work ethic was evident in all his endeavours.

T J Hull Award

Brenda Little was awarded the T.J. Hull Award at NACE Corrosion 2016 Award's dinner in Vancouver in March earlier this year. The Award is given in recognition of an outstanding contribution to NACE in the field of publications. The contribution must, in some manner, have contributed significantly to furthering the aims and objectives of NACE in the field of publication and dissemination of corrosion information in an effective and timely manner. Congratulations to Brenda!

ACA Welcomes New Members

Corporate Bronze

DH Corrosion-DPC Coatings
www.dhcorrosion-dpccoatings.com
D.H. Corrosion - D.P.C. Coatings are market leaders in steel treatment, surface preparation and coatings application. They cater for needs both on-site and at their factory processing facilities. Their expert team will ensure you get the right advice and service for your particular project and provide you with the best possible back up and support. They have unparallelled expertise in the Industrial, Marine, Offshore and Petro Chemical industries.

IKAD Engineering
www.ikad.com.au
Their mission is to provide Western Australian industry with fully integrated project management and engineering solutions. Their experienced locally based team and world class business management systems allow them to meet the needs of any industrial client with unprecedented flexibility.

Paynter Dixon Qld Pty Ltd
www.paynter.com.au
Australian owned and operated, Paynter Dixon, founded in 1914, is proud to be one of the Country's foremost construction and property development companies. Since bringing their total management concept to Queensland in 1954, they have played a key role in the growth and innovation of this State's commercial and industrial property sectors. They deliver innovative and cost effective built solutions in a variety of markets, including hospitality, aged care, water, education, infrastructure, industrial and commercial construction and interior fit-outs.

Materials & Testing Laboratories
Is a wholly New Zealand owned and operated company with its head office and laboratory facility in Auckland. The company operates as an independent test house in a variety of areas. The main focus is on non-destructive inspection services, ultrasonics, radiography and surface methods inspection. From its inception the laboratory has been dedicated to the provision of a professional, high quality, reliable service. In addition to the tests for which the laboratory is registered, it also carries out a variety of other work, which includes: failure and chemical analysis, metallurgical inspection and a wide variety of tests on products from prototype to standard compliance tests on items such as: cots, ladders and lawn mowers.

AWS Services P/L
www.awsservices.com.au
AWS Services is the trusted name in protective coatings, waterproofing and remedial services. Servicing: Western Australia, New South Wales and Victoria since 2000. They provide services such as concrete repair, corrosion protection, waterproofing, protective coatings and remedial repairs for the commercial, industrial, mining and residential divisions. Their experienced team have the knowledge and resources to help you/your company achieve the best outcome on an existing site or a new construction.

Evolution Commercial
www.evolutioncommercial.com.au
Evolution Commercial's core expertise is in the production of vessels and other large, custom structures manufactured from one or more of the following materials; aluminium, steel, fibreglass (FRP)/composites, which includes the production and installation of associated: electrical and electronic systems, fuel, water and other fluid systems, heating, ventilation and air conditioning (HVAC), hydraulic systems - interior fitout, mechanical and pneumatic systems

Powerlink QLD
www.powerlink.com.au
Powerlink is a State Government Owned Corporation, which owns, develops, operates and maintains the high voltage electricity transmission network that extends 1700km from north of Cairns to the New South Wales border. As a Transmission Network Service Provider (TNSP) in the National Electricity Market, they don't buy or sell electricity. Powerlink's primary role is to provide a safe, cost effective and reliable network to transport high voltage electricity from generators to electricity distribution networks owned by: Energex, Ergon Energy and Essential Energy which then supply to more than two million customers.

Omega Industries
www.omegaind.com.au
Are a privately owned ISO 9001,4801 & 18001 accredited coatings firm. Specialising in manufacturing and contracting services since 1987, Omega Industries have built a prominent position in the industry servicing various sectors for all paint related requirements. They focus their efforts on a cost effective and efficient solution to their clients' requirements. They fund, design, manufacture, service and maintain the built environment; providing customised coatings solutions for asset protection, creating an identity and safety demands.

ACA Auckland Division Meeting

February 2016

The first ACA Auckland Division meeting for 2016 was held at The Landing hotel on February 17 with Raed El Sarraf, Opus Consultants, Auckland, addressing the subject of '*When Should You Maintain Galvanized Structures – Strategies and Solutions*'. Raed described a recent project that is being carried out for the NZ Transport Agency (NZTA) to assist the Agency with maintenance and life extension of galvanized steel structures installed on road bridges and motorways.

Raed commenced by describing the process of hot-dip galvanizing (HDG), the metallurgy of galvanizing, and the relevant AS/NZS/ISO Standards that are in use for HDG. Galvanizing is a commonly used method of corrosion protection on steel highway structures such as gantries, culverts and crash barriers. While hot-dip galvanizing protection is well established, guidance is still being sought to determine the optimum time to repair the galvanizing by coating the zinc and also selecting the most cost effective maintenance procedure. To assist asset owners and maintenance engineers to manage the maintenance of critical galvanized structures, a maintenance strategy has been developed. The strategy is dependent upon the existing condition of the galvanized structure and the remaining zinc thickness (microns) on the steel. A number of maintenance options can be considered from information gathered and then a net present value (NPV) cost analysis is undertaken to determine the best maintenance option over the remaining life of the galvanized structure.

Raed's presentation outlined the background to the maintenance options, maintenance strategies and the development of a zinc deterioration model for different atmospheric corrosivity categories. The model is based on site inspection criteria. From the model it is possible to carry out a cost analysis to determine the most cost-effective maintenance solution for a galvanized structure.

After a lively Q&A session Raed was thanked for his thought-provoking presentation. The AGM for the ACA Auckland Division was then held and the following members were elected onto the Committee for 2016: Raed El Sarraf, John Duncan, Les Boulton, Jeffrey Robinson, Aaron Davey, Ash Arya, Bruce Fordyce, Sean Ryder and Grant Chamberlain.

Raed El Sarraf discussing his presentation with Jeffrey Robinson (l) and Ash Arya (r).

Raed El Sarraf presenting on the life extension of galvanized steel.

Attendees at the meeting during the Q&A session.

VIC YCG Event Lawn Bowls

Friday 26 February

SA Branch Raffle

Quality Maritime Surveyors won the Clipsal 500 Racing Jacket in the SA Branch Sids & Kids Raffle.

sids and kids SOUTH AUSTRALIA

BRANCH AND YCG EVENTS

ACA NZ Branch

NZ Branch AGM, New Plymouth, 23 March 2016

A meeting of the NZ Branch Committee was held on 23 March at the Vector premises in Bell Block, New Plymouth. New Plymouth has recently welcomed the opening of the amazing Len Lye Centre, a new art gallery that has attracted global attention for its 6-metre high gleaming stainless steel façade.

The Branch Committee Meeting was presided over by the NZ President Mark Sigley and there were representatives present from all three NZ Divisions: Auckland, Taranaki and Wellington. During the half-day meeting there was much discussion on current corrosion issues in NZ including a progress report on the annual ACA Conference to be held in Auckland from 13-16 November 2016.

The AGM of the NZ Branch followed at the New Plymouth Sport Fishing & Underwater Club. In his report to the AGM the President made the point that although membership had dropped a little the NZ Branch was very active and in good shape. The President then announced the appointments to the NZ Branch Committee for 2016.

Following the AGM and refreshments, Jaco Herling, Taranaki Committee, introduced the two speakers for the technical part of the evening.

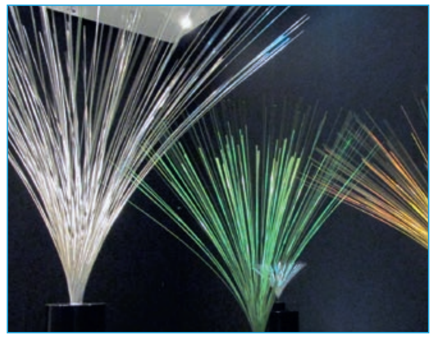
The first speaker was Neil Adamson, Altex Coatings, Tauranga, who gave an interesting presentation on various aspects of predicting the coating life on steel pipework situated in aggressive environments both above ground and buried underground.

The second speaker was Matthew Vercoe, Metal Spray Suppliers (NZ) Ltd, Auckland, who addressed the subject of metal spray coatings for the protection of steel in some extreme environments and also in hazardous applications.

Both speakers adeptly fielded many questions after their presentations and the speakers were thanked for their excellent efforts by Chairman Jaco Herling. The combined Branch AGM and technical presentations made it a very pleasant evening with lots of networking and bonhomie.

The Len Lye Centre (LLC) clad in 6-metre high stainless steel sheet next to the Govett-Brewster Gallery in New Plymouth.

Len Lye (1901-1980) internationally renowned artist-sculptor with much of his work housed at the LLC.



Kinetic sculptures in stainless steel by Len Lye housed at the LLC.

Queensland Brewery Visit

February 24, 2016

The ACA Queensland Branch ventured out to Ipswich on the 24 February for an event with a difference. With the numbers limited, the visit to the Pump Yard Brewery filled up fast. The Brewery was commissioned four years ago and is unique in that a special licence allows the brewing equipment to be not screened off from the patrons. After some tenacious lobbying with various regulatory bodies including the council, ATO (yes, they administer the alcohol excise rules) and Queensland heritage buildings. The evening began, as it should, with some tasting of a light beer. Wade Curtis, the master brewer took the group through an interesting discussion of how the heritage listed building was refurbished. The mountains of dust and dirt, 100 year old graffiti and one cadaver label told the story of the building's purpose.

It began as a water pumping facility for the Ipswich township. A well in the yard provided the early residents with their two pails of fresh water a day (the third had to be paid for). From the 1920s, the building housed a trade school, the remnants of this use such as a flywheel installed above the bar and an overhead crane rail in the function room, have been incorporated into the décor. Wade and his business partner extensively refurbished the building digging up floors and laying pipework and services into the new floor for the craft brewery. Importantly Wade took the group through the brewing process from how the barley is prepared prior to malting, the wort is prepared with hops and ultimately the yeast is added.

Keys to a good brew according to Wade are: the quality of water, yeast and temperature control. The beers that left an impression included the pale ale and the Coal Miner's Stout. The group entered into a lively debate about whether bottles or cans were better for beer taste. Cans seemed to win. The group of corrosionists went away a lot more wiser about beer and learnt about the history of the Pump Yard and the building restoration. Oh yes, the vats were built from 316L Stainless steel!

ACA VIC Branch Technical Event

On Wednesday 13 April the ACA VIC Branch held their first technical event for the year. Delegates ranging from asset owners, contractors and consultants in gas, water and oil were drawn together for the event 'Pipelines: Transmission and Corrosion' at the Royal Society of Victoria. The event was sold out, with 80 of the 110 registered attendees turning out for the evening! The evening was centred around three presentations:

1. Justin Rigby - 'Inspection Test Plans: Your Onsite Quality Document'
2. Alireza Kouklan - 'Stray Current and Cathodic Protection Challenges for Urban Pipelines'
3. Alan Bryson - 'Exploring Options for Non-Destructive In-Line Inspection'

As well as these great presentations, the evening consisted of drinks and nibbles networking before and after the speeches. The event was proudly sponsored by Select Solutions and Universal Corrosion Coatings (UCC).

Due to the success of the event and a strong theme in the questions asked during the night, the VIC Branch plan to host a similar event next year 'Pipelines: Transmission and Corrosion 2.0' with at least one presentation on cathodic shielding/coating disbondment on pipelines. See you there next year!

Proudly Sponsored by:

Newcastle Branch Event

On March 16, the Newcastle Branch hosted a technical event on 'Data recovery from Historic Shipwrecks'. A total of 37 people attended to listen to Dr Ian MacLeod, the current Executive Director of Fremantle Museums and Collections, present this unique and interesting topic.

Ian has been involved in conservation of historic shipwrecks for the past 38 years, and has presented more than 200 papers on decay mechanisms and the development of new treatment methods to preserve cultural material.

Ian's presentation outlined the analysis and treatment methods of a variety of culturally significant artefacts, most notably the "de Vlamingh Plate", and the fascinating insights that could be gained through analysis of the corrosion features. The presentation also explored the retrieval methods utilised to recover important artefacts from shipwrecks, such as the cannon and anchor from HMS *Sirius*, which was wrecked off the coast of Norfolk Island.

The information that Ian gathers from his analysis of the decay of shipwrecks also provides insight into the historical weather patterns and ocean movements that would otherwise be unknown to marine researchers.

The presentation was held at the Beach Hotel in Merewether. The 'Beaches' as it is known, is a regular venue for the Branch technical events as the location and food is remarkable.

Simon Krismer, Callan Herron, Ian MacLeod, Igor Chaves, Dylan Pearce.

CORROSION & PREVENTION 2016

PROUDLY PRESENTED BY:

MAJOR SPONSOR:

13–16 November
SKYCITY Convention Centre
Auckland, New Zealand

PLENARY SPEAKERS

P F THOMPSON MEMORIAL LECTURE

Percival Faraday Thompson (1885-1951) is recognised as Australasia's pioneer in the science and technology of metallic corrosion and its mitigation. In recognition of this singular distinction the Australasian Corrosion Association inaugurated the P F Thompson Memorial Lecture in 1951. The Lecture is the Association's premier dedicated Lecture and the Lecturer is encouraged to mark P F Thompson's distinction by referring to or emulating the academic and technical qualities for which Thompson became known, particularly his prowess with practical demonstration.

Patricia Shaw has been selected to give the 2016 P F Thompson Memorial Lecture.

Patricia Shaw
Research Team Leader, BRANZ, New Zealand

Patricia Shaw is the Better Buildings Research Team Leader at BRANZ, leading a team of material scientists, fire and structural engineers. The team are currently working on over 20 research projects into improved techniques and materials for use in the building industry. Patricia obtained a PhD in Chemistry from the University of Auckland and has over 20 years' experience as a Materials Scientist. She previously worked for the NZ Defence Force, specialising in protective coatings and managing their corrosion program. Since joining BRANZ her research focus has been on the resilience and durability of building materials, with a particular interest in the degradation of polymeric materials.

Howard Combs
General Manager- Global Sales, Carboline, USA

Howard Combs has spent the past 38 years in the protective coatings field. He has held senior positions in global companies, being responsible for Sales, Marketing, R&D and Manufacturing. He is a specialist in elastomeric coating technology. Howard graduated with a business degree from Brigham Young University in 1975. Today he is based in the headquarters of Carboline, St Louis USA and heads up the Carboline global sales group.

Nick Laycock
Senior Materials & Corrosion Engineer, Shell, Qatar

Nick is currently the Senior Materials & Corrosion Engineer for the Pearl GTL facilities and the Corrosion R&D Lead for Shell in Qatar. He joined Shell in New Zealand in 2006 and before that he was a researcher and consultant, specialising in localised corrosion. He has authored about 100 peer-reviewed papers and is an Associate Editor of *Corrosion Science*. Nick has an MSc and PhD from the Corrosion & Protection Centre at UMIST, and has received the Shreir Award (1994) and Hoar Award (1997 and 2011) from ICorr, and the Guy Bengough Award (2013) from the Institute of Materials, Minerals & Mining.

Digby Macdonald
Professor in Residence, Departments of Nuclear Engineering & Materials Science and Engineering, University of California, USA

Professor Digby Macdonald is currently the Professor in Residence for the Department of Materials Science and Engineering at the University of California at Berkeley. His work involves electrochemistry, thermodynamics, and corrosion science, with emphasis on the growth and breakdown of passive films, chemistry of high temperature aqueous solutions, electro-catalysis, advanced batteries and fuel cells, stress corrosion cracking and corrosion fatigue, materials for nuclear power reactors and the deterministic prediction of localised corrosion damage. His current research involves studying Simulating Coolant and Corrosion Processes in Water-Cooled Nuclear Reactors and the Development of Deterministic Corrosion Damage Models. He has published over 900 papers, has 11 patents to his name and still consults with industry on a variety of corrosion related issues.

Kamachi Mudali
Senior Professor, Homi Bhabha National Institute (HBNI) University, DAE

Dr U. Kamachi Mudali a holds a M.Sc. (Materials Science), M.Tech (Corrosion Sci. & Eng.) and Ph.D in Metallurgical Engineering and has been at IGCAR, Kalpakkam since 1984. Kamachi is the Associate Director of the Corrosion Science and Technology Group & Materials, the Process and Equipment Development Group, & Convener of IGCAR Patents and Technology Transfer Cell. He is a Fellow of NACE International, USA; ASM International, USA; Asia Pacific Academy of Materials; Indian National Academy of Engineering; Indian Institute of Metals; Tamil Nadu Academy of Sciences; Institution of Engineers (India) and a Honorary Fellow of Electrochemical Society of India. Dr. Mudali has made excellent contributions in localised corrosion, advanced materials and coatings for aggressive environments, corrosion testing and monitoring, surface modification and analysis and FBR reprocessing materials, processes and equipments. He has published 370 papers in journals, co-edited 14 books/proceedings and holds an h-index of 28.

He is a Senior Professor at Homi Bhabha National Institute (HBNI) University, and is an adjunct Professor at PSG Institute of Advanced Studies, Coimbatore.

David Williams
Professor in Electrochemistry, University of Auckland

Professor David E Williams is a graduate of the University of Auckland (PhD, electrochemistry, 1974). After post-doctoral work at Oxford University and Imperial College London and industry experience at IMI Titanium, he developed his research career in electrochemistry and chemical sensors at the UK Atomic Energy Research Establishment, Harwell, in the 1980s. He became the Thomas Graham Professor of Chemistry at University College London in 1991 and co-founded Capteur Sensors Ltd. He was Head of the Chemistry Dept. at UCL from 1999-2002 and co-founded Aeroqual Ltd. He was Chief Scientist of Inverness Medical Innovations, based at Unipath Ltd, Bedford, UK, from 2002-2005. He joined the faculty of the Chemistry Dept. at Auckland University in February 2006 and co-founded Air Quality Ltd in 2013.

He is a Principal Investigator in the MacDiarmid Institute for Advanced Materials and Nanotechnology. He has published 250 papers in international journals – on electrochemistry, surface science of biomedical devices, semiconducting oxides as gas sensors, air quality instruments and corrosion science – and is inventor of around 40 patents. He is a Fellow of the Royal Society of New Zealand. He has been awarded the John Jeyes medal (chemistry in relation to the environment) and Geoffrey Barker medal (electrochemistry) of the Royal Society of Chemistry, the Pickering medal (technology) of the Royal Society of NZ, the Maurice Wilkins award of the NZ Institute of Chemistry, the U R Evans award of the UK Institute of Corrosion and the Castner medal of the Society for Chemical Industry.

ACA Training Survey Results 2015

The 2015 ACA Training and Course Pathway Survey was conducted in order to understand the industry requirements and what role the ACA can play to facilitate in meeting those needs. Since obtaining these results, the ACA has developed an action plan (with some announcements made recently) and will continue to diversify its training offerings in the future in response to industry desires.

The Survey was designed to obtain member and non-member opinions on possible training pathways; reactions to recent past training and likely intentions on key aspects of future training. This report summarises the key findings and highlights subsequent aspects of priority for the ACA in relation to its training offering.

Demographic

In total, 857 members and non-members completed the Survey. These respondents spanned geographically across all Australian states as well as New Zealand and were sufficiently representative of the greater ACA membership profile. In relation to the ACA segment they were affiliated with, Contractors formed the largest group (28.9%), followed by Consultants (22.1%), Suppliers (21%) and Asset Owners (20.5%). The exception was academics/researchers who made up a smaller proportion than any other segment (7.5%).

The Survey also identified the respondents' area of specialisation and nearly 2/3 indicated coatings as a key area of interest.

When asked to nominate their age bracket, respondents were most commonly older than 45 years (55.9%), 23.8% were aged between 36 - 45 years and 19.6% were 35 years or younger.

Current Courses

Respondents were asked to indicate which ACA delivered courses they were aware of prior to completing the Survey. Of the 20 courses presented, 11 of those had less than a 50% awareness rate. This indicates an opportunity for improvement in promoting the ACA's breadth of courses to members and industry. Not surprising, under 50% of the respondents had not attended a course in the past 5 years. This clearly indicates that the ACA has not diversified its training to offer new opportunities and is a key objective of the ACA's current strategic plan. Survey results indicated very clearly that whilst decisions about training were mostly a joint decision between employers and employees, the employer most often funds the professional development.

Value for Money

Employers who indicated they had paid for training were subsequently asked to rate a course in terms of value for money. Of all ACA's course offerings, the NACE CIP programs have the highest awareness however they scored the lowest value for money ratings from employers with comments particularly regarding the pricing of NACE CIP courses.

In response to this feedback, and although these courses are priced higher than other courses offered by ACA, there are many more elements to running these 6 day training courses compared to other courses. These include; requirement to provide two lecturers (experts in the industry), lecturer flights, lecturer accommodation and other expenses, venue hire and student catering, blast yard hire, transport, equipment and replacement of, royalties payable to NACE, books, printing, couriers (international and national), steel panels and more.

Draft Course Pathways

The framework of the draft course pathways was only presented to respondents who indicated a specialisation and then only the relevant pathways to that specific specialisation were provided. This assisted with achieving relevant and calculated responses.

Whilst the notion of pathways was embraced (however this may change from course pathways to skills pathways based on feedback) there were commonly concerns and suggestions expressed relating to:

the need to incorporate greater levels of practical experience/fieldwork components in order to impart knowledge and better assess competency.

incorporate e-learning resulting in greater flexibility for students and hence a broader catchment and increased enrolment numbers.

Future Attendance

Respondents were asked what their likelihood of attending courses within the pathways would be and from those results it is clear to see that some courses (and pathways) have much greater interest than others. The top 10 of these are listed below in order of indicated demand:

Course Name
Coatings Selection & Specification
Protective Coatings Specialist
NACE CIP 2
Corrosion Pipeline Integrity
Pipeline Assessment
Condition Assessment of Coatings & Steel
Cathodic Protection 2
Concrete Repair Advanced
Corrosion Engineering
Protective Coatings Quality Control

Action Plan

The ACA Education & Training Committee has used the results of this survey to develop an action plan to diversify the ACA training offerings to meet industry training needs.

Since the results of the survey were analysed, the ACA has:

1. Introduced the comprehensive four level NACE International Cathodic Protection Program
2. Scheduled the SSPC Concrete Coating Inspection Program
3. Developed and scheduled a new Hot Dip Galvanizing Inspector Program (in association with the Galvanizers Associations of Australia and New Zealand)
4. Updated the Coatings Selection & Specification Course
5. Signed an agreement with NACE to introduce their Pipeline Program
6. Reviewed, updated and modified the Protective Coatings Quality Control course to a more succinct two day course
7. Drafted a Protective Coating Specialist concept

Further plans are in the pipeline and ACA has discussed the possibility of co-developing future courses with other Associations.

Thank you to everyone who participated and provided their valuable feedback in this Survey.

- Approved for review
- Development options being investigated
- Currently Offered
- NACE agreement '16 – '17

ACA Now Offering NACE Cathodic Protection Program – An Introduction

CP 1: Brisbane 18–23 July, Melbourne 17–22 October 2016

CP 2: Brisbane 25–30 July, Melbourne 24–29 October 2016

Expressions of interest are welcome for CP 3 & CP 4

The decision to adopt the NACE CP Program was taken for a number of reasons which we (the ACA) believe will benefit our members and industry in the long term. The reasons for adopting these include:

- There is an increased demand for NACE accreditation by companies in Australasia undertaking CP works. This is not across all industries, but it is becoming more difficult to currently verify or show that engineers and technicians have the required depth of CP training to undertake certain tasks.
- The ACA courses needed detailed revision to bring them up to date. Whilst this could be undertaken, it would be difficult to rank them in comparison to the detail that NACE courses go to enable them to be recognised as suitable or equivalent courses.

There are a number of key differences between the NACE and the previous ACA courses. The ACA offered two courses, the CP Monitoring course and Advanced CP Course.

The CP Monitoring course was structured as a three day course covering the basics of cathodic protection. The course contained a field component although this was limited.

The Advanced CP Course was a five day course which included a revision of the Monitoring course, plus additional theory on the design and testing of CP system. This also included a limited field component.

The NACE CP courses however are structured into four separate courses aimed at different levels of attendees are all a 5 ½ and 6 day duration which includes assessments.

What is very important to note is that as per the ACA courses, there is no requirement for the NACE courses to be attended consecutively, and attendees can undertake the course level that they feel is best suited to their knowledge and experience. However, it is strongly recommended that attendees progress from CP1 to CP 4 attending each full course, in order to have a greater chance of passing the practical and written exams and to gain Certification.

The four NACE Cathodic Protection Program courses are as follows:

CP 1-Cathodic Protection Tester
CP 2-Cathodic Protection Technician
CP 3-Cathodic Protection Technologist
CP 4-Cathodic Protection Specialist

Other courses are available within the groups that specialise on Maritime, Interference and Coatings in Conjunction with Cathodic Protection, but the courses listed above are the primary courses and the basis for the others. In years to come, the ACA may however also offer these other courses.

Practical Components to NACE CP

Practical testing on simulated tubs is a large component of the CP 1 and CP 2 courses and the assessment comprises written and practical assessment of the capabilities of the student. A pass in both is required to successfully complete (pass) the courses.

The practical components are intended to ensure students are competent in the use of test equipment, taking the necessary readings as well as practical fault finding in CP installations, TR units and assessing interference are amongst the skills learnt and examined. The practical aspects are fundamentally different to the courses offered by the ACA previously.

What if I have attended an ACA CP Course?

The following provides guidance for ACA members that have undertaken ACA CP courses and what courses are most likely suited to you if you wish to migrate to the NACE courses.

CP Monitoring to NACE CP 1 and CP 2

It should be noted that all NACE courses are aimed at attendees involved in CP and it is recommended that you have spent 6 months minimum in the field. The courses are not intended to convert a complete novice into someone that is fully experienced in the monitoring of CP systems.

CP 1-Cathodic Protection Tester

This course is the basic introductory course for CP. The contents cover many areas currently covered by the ACA CP Monitoring course. Basic electrical theory is also covered in greater detail and is also aimed at familiarisation with instruments used in CP. This course is targetted at people working in the field and having some knowledge of CP.

It also includes some other topics such as AC voltages (induced onto pipelines), the use of cable locators, and operation of various other test equipment. as well as the installation of CP equipment.

CP 2-Cathodic Protection Technician

This course assumes that the attendee has the basic electrical knowledge / theory covered in NACE CP 1 as this is not included or revised at this level. It also assumes that participants are familiar with the use of CP instrumentation and their limitations.

The initial chapters go into a high level of detail on corrosion and corrosion cells, and looks at the theory and covers other areas such as Faraday's Law. The course examines some of the other testing and criteria expected to be understood by technicians such as E log I, effects of pH, anodic passivation etc.

Other topics covered include; testing and mitigation of AC, practical bench testing (which is also examined) on interference testing as well as fault finding on TR units. The latter, whilst not able to be performed in the field unless the student is a licensed electrician, is a requirement to pass the course and the TR units for the Australian courses have been specially modified to allow the testing whilst still complying with Australian regulations whilst identifying faults and testing.

So – Which course am I best suited to?

For ACA members having completed the CP Monitoring and looking at transferring to the NACE courses, the question you need to ask is how comfortable are you with taking measurements and interpreting results. How well do you know the instruments and their limitations? If you feel that you have a good grasp of CP and are comfortable with the theory of corrosion covered in the CP Monitoring notes and feel comfortable with soil resistivity measurements and testing for interference, then NACE CP 2 might be a good entry point. If on the other hand this is not familiar to you, then it may be worth considering starting with the NACE CP 1.

Advanced CP to NACE CP 1 and CP 4

Before comparing these courses, it is important to note that whilst the ACA Advanced CP course does revise the CP Monitoring content, the NACE course assumes that you have a good working knowledge of the learnings gained in NACE CP 1 and CP 2 as this is only very briefly reviewed.

CP 3-Cathodic Protection Technologist

This course contains no practical component but rather expands on the theory. The content of this course is in many aspects similar to the Advanced CP course, but does include a number of additional chapters including AC corrosion, High Voltage DC transmission, advanced measurement techniques and advanced CP design, with many components not covered in the previous Advanced CP course.

CP 4-Cathodic Protection Specialist

This course entitles successful participants to be classed as NACE CP Specialists.

The course contains some new content not completely covered in the lower classes, whilst the bulk of the course is based on looking at working through advanced formulae and techniques for designing a variety of CP systems. These include concrete, tank internal and tank bottoms and other systems not commonly encountered but expected to be designed by a CP 'specialist'.

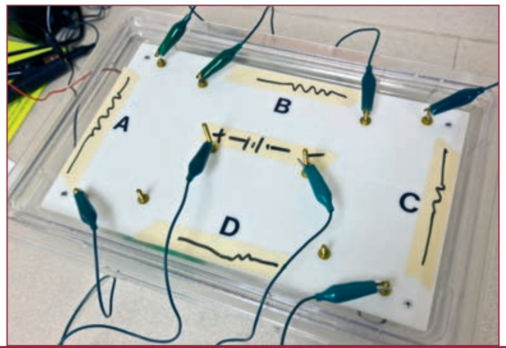
In fact, as a 'specialist' (NACE CP 4) you should be able to guide people with problem solving in a wide range of CP systems, including onshore, offshore, concrete, internal of tanks etc. – not just design these systems.

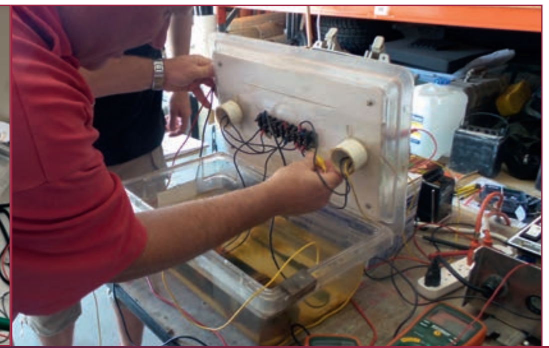
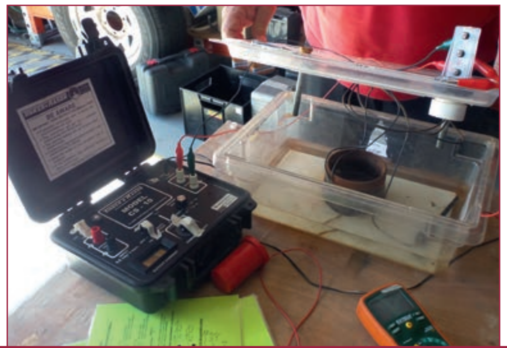
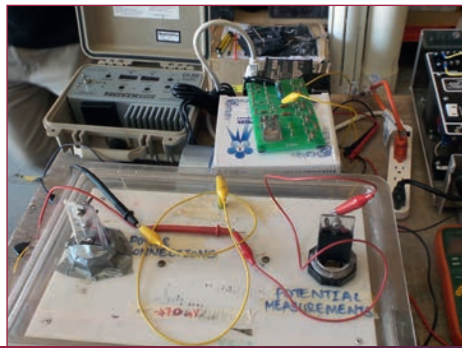
The assessment for this course assumes that you are familiar and can answer questions on all courses from CP 1 through to CP 4. The assessment comprises two parts, one being a multiple choice covering all courses. The second part is also split into two with one being specific to the learning in CP 4 and the other part being an essay working through a problem and identifying the steps involved in solving a problem.

The latter is intended to test the practical aspect of the participant's knowledge. The intention of the assessment is that it will be very difficult for an attendee to pass the course if they haven't actually had the practical experience and exposure to various CP systems to make them a true 'specialist'.

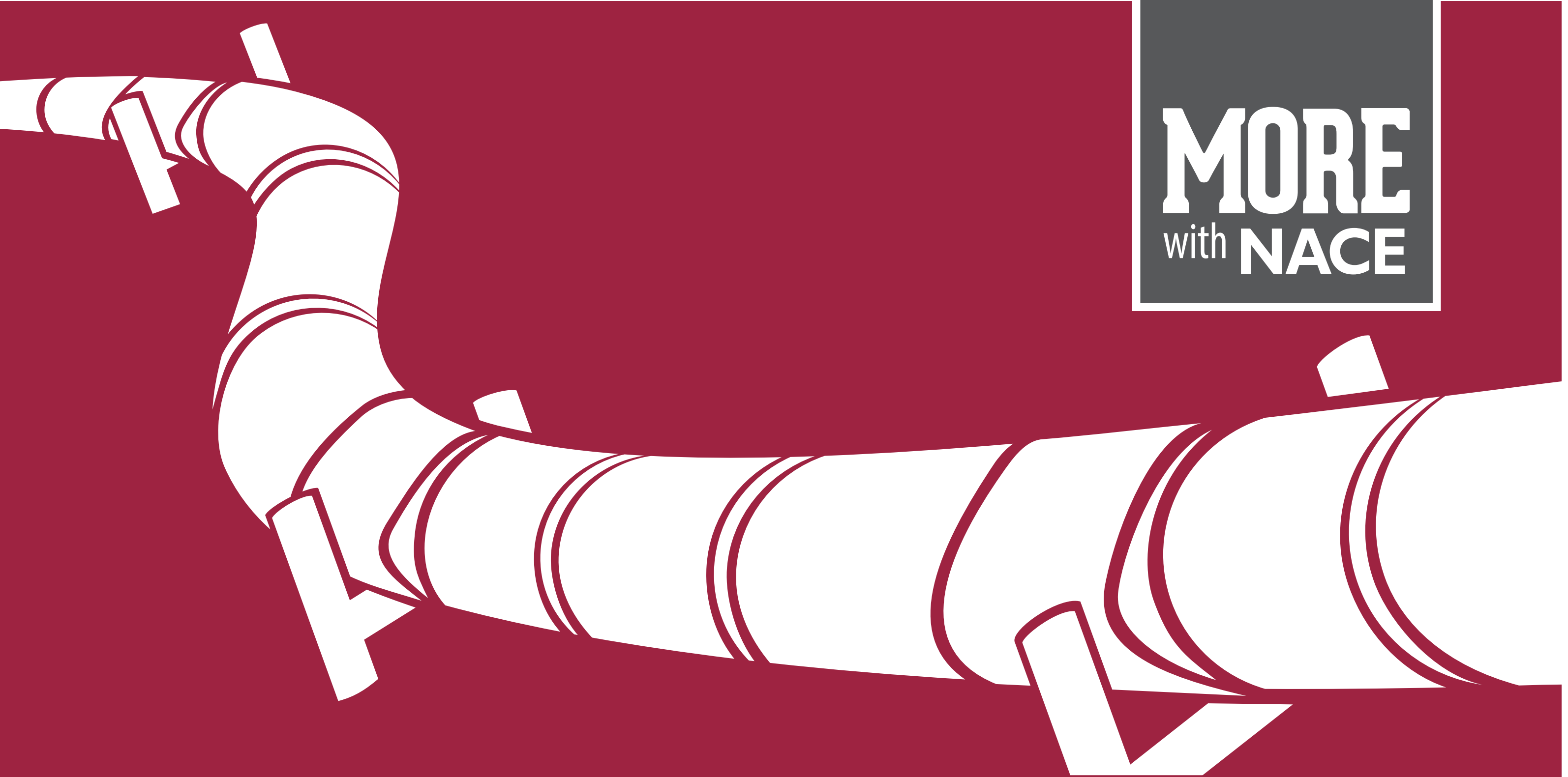
In an effort to increase my general understanding of CP, I attended the course in the NACE building in Houston, Texas. The course went from corrosion theory all the way to site techniques, tips and tricks that CP engineers or technicians will find vital. I learned about a variety of techniques used across the CP industry that I wouldn't otherwise have any exposure to. The group study on the course offered a great insight across other jobs, the vastness of the industry and really helped me pass the course. The experience broadened my professional skill base and I have used the course notes on several occasions to implement the knowledge gained on the course.

Luke Thompson, *Infracorr*

To register or for more information on the NACE CP Courses to be offered by the ACA go to www.corrosion.com.au or www.NACE.org/cp



The ACA now offers NACE International's Cathodic Protection Program 1–4

Please note, the ACA no longer offers its own CP monitoring and advanced courses.

The NACE Cathodic Protection (CP) Program is a comprehensive program for professionals in any industry including pipelines and bridges, tanks and well casings, the maritime and offshore industries, coated steel and concrete, water and wastewater systems.

LEVEL	DESCRIPTION
CP 1—Cathodic Protection Tester	Provides theoretical knowledge and practical fundamentals for testing on both galvanic and impressed current CP systems. Classroom instruction is comprised of lectures and hands-on training, using equipment and instruments for CP testing.
CP 2—Cathodic Protection Technician	Provides both theoretical knowledge and practical techniques for testing and evaluating data to determine the effectiveness of both galvanic and impressed current CP systems and to gather design data. Classroom instruction is comprised of lectures and hands-on training, using equipment and instruments for CP testing.
CP 3—Cathodic Protection Technologist	The CP3 course builds on the technology presented in the CP2 course with a strong focus on interpretation of CP Data, trouble shooting and mitigation of problems that arise in both galvanic and impressed current systems, including design calculations for these systems.
CP 4—Cathodic Protection Specialist	This course focuses on the principles and procedures for CP design on a variety of structures for both galvanic and impressed current systems. The course discusses theoretical design concepts, considerations that influence the design (environment, structure type/materials of construction, coatings), design factors, and calculations (including attenuation).

How to Become CERTIFIED

CP 1—Cathodic Protection Tester

COURSE / EXAM:
CP 1—Cathodic Protection Tester **-OR-** Exam only

CP 2—Cathodic Protection Technician‡

Path 1

CERTIFICATION:
CP 1—Cathodic Protection Tester **-OR-** equivalent training

COURSE / EXAM:
CP 2—Cathodic Protection Technician **-OR-** Exam only

WORK EXPERIENCE:
3 years in Cathodic Protection

Path 2

CERTIFICATION:
CP 1—Cathodic Protection Tester **-OR-** equivalent training

COURSE / EXAM:
CP 2—Cathodic Protection Technician **-OR-** Exam only

WORK EXPERIENCE:
1 year in Cathodic Protection

EDUCATION:
4-year Physical Science or Engineering Degree

Path 3

CERTIFICATION:
CP 1—Cathodic Protection Tester **-OR-** equivalent training

COURSE / EXAM:
CP 2—Cathodic Protection Technician **-OR-** Exam only

WORK EXPERIENCE:
2 years in Cathodic Protection

EDUCATION:
2 years post-high school training from approved Math or Science Technical/Trade School

CP 3—Cathodic Protection Technologist‡

Path 1

CERTIFICATION:
CP 2—Cathodic Protection Technician **-OR-** equivalent training

COURSE / EXAM:
CP 3—Cathodic Protection Technologist **-OR-** Exam only

WORK EXPERIENCE:
8 years in Cathodic Protection

EDUCATION:
Algebra and Logarithm training

Path 2

CERTIFICATION:
CP 2—Cathodic Protection Technician **-OR-** equivalent training

COURSE / EXAM:
CP 3—Cathodic Protection Technologist **-OR-** Exam only

WORK EXPERIENCE:
3 years in Cathodic Protection

EDUCATION:
4-year Physical Science or Engineering Degree

Path 3

CERTIFICATION:
CP 2—Cathodic Protection Technician **-OR-** equivalent training

COURSE / EXAM:
CP 3—Cathodic Protection Technologist **-OR-** Exam only

WORK EXPERIENCE:
6 years in Cathodic Protection

EDUCATION:
2 years post-high school training from approved Math or Science Technical/Trade School Algebra and Logarithm training

CP 4—Cathodic Protection Specialist‡

Path 1

CERTIFICATION:
CP 3—Cathodic Protection Technologist **-OR-** equivalent training

COURSE / EXAM:
CP 4—Cathodic Protection Specialist **-OR-** Exam only

WORK EXPERIENCE:
12 years ADVANCED Cathodic Protection including 4 years in responsible charge

EDUCATION:
2 years post-high school training from approved Math or Science Technical/Trade School

Path 2

CERTIFICATION:
CP 3—Cathodic Protection Technologist **-OR-** equivalent training

COURSE / EXAM:
CP 4—Cathodic Protection Specialist **-OR-** Exam only

WORK EXPERIENCE:
6 years ADVANCED Cathodic Protection including 4 years in responsible charge

EDUCATION:
4-year Physical Science or Engineering Degree

Path 3

CERTIFICATION:
CP 3—Cathodic Protection Technologist **-OR-** equivalent training

COURSE / EXAM:
CP 4—Cathodic Protection Specialist **-OR-** Exam only

WORK EXPERIENCE:
4 years ADVANCED Cathodic Protection in responsible charge

EDUCATION:
4-year Physical Science or Engineering Degree & an ADVANCED Physical Science or Engineering Degree that required a qualification exam

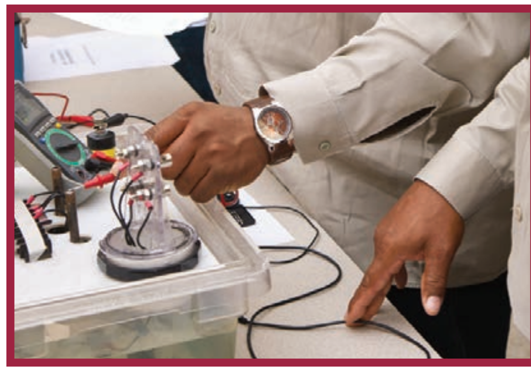
Path 4

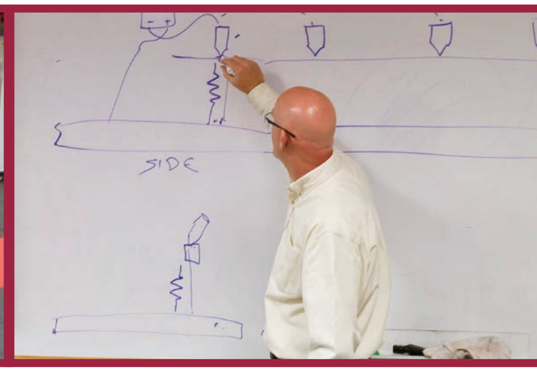
CERTIFICATION:
CP 3—Cathodic Protection Technologist **-OR-** equivalent training

COURSE / EXAM:
CP 4—Cathodic Protection Specialist **-OR-** Exam only

WORK EXPERIENCE:
4 years ADVANCED Cathodic Protection in responsible charge

LICENSE:
PE, P Eng., or equivalent **-OR-** EIT registration or equivalent



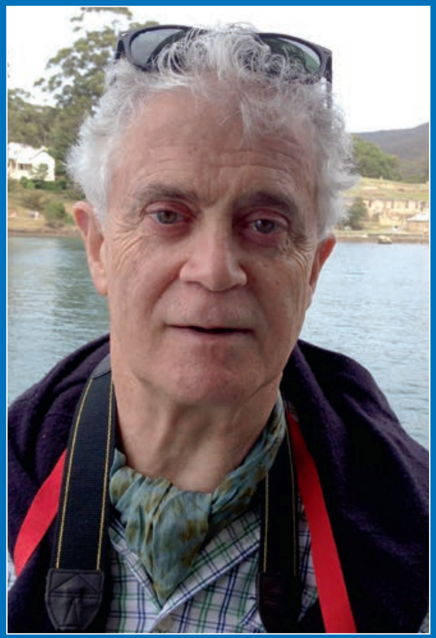


For questions please contact Skye Russell at the ACA on +61 3 98904833 or aca@corrosion.com.au

To register or for more information on the NACE CP Courses to be offered by the ACA go to www.corrosion.com.au or www.NACE.org/cp

IMAC RETIRES

IMAC Retires!



Dr Ian D MacLeod, (IMAC - as he is affectionately known to those of us that love, admire and respect him at the ACA) retired after 37.5 years from the WA Museum on Friday 29 April this year. Ian started on his 30th birthday - 16 October 1978, as an ARC research funded electrochemist, looking at copper corrosion on shipwrecks sites.

Retiring as Executive Director, Fremantle Museums & Collections (he was in his current position for five years, before that as the Executive Director, at the Collection and Research facility in Welshpool for 8 years and Relocation Director for 2 years before that) and so his story goes on.

"We now have 15 million items stored in ideal museum storage conditions of dust and debris filtered out to one micron and with temperature controlled at 22C and RH at 50%. This is what I spent a huge amount of time and energy achieving as I knew I could never treat millions of objects so; by placing them in an ideal environment we have prevented accelerated decay on the same."

The IMAC & ACA story so far...

Ian Donald MacLeod was Ballarat born and educated at the local high school before a seven year stint at the University of Melbourne from 1967-1974 which saw him with an Honours degree and a Ph D in chemistry. In 2007 he was awarded a Doctor of Science from his almer mater for his published works on '*Chemistry and Conservation of Shipwrecks and Rock Art*'.

His first conference with the ACA was in 1984 in Rotorua, New Zealand where he spoke on '*The effects of concretion on the corrosion of non-ferrous metals*' then inspected the decaying wreck of the Edwin Fox in Picton. His report led the local teams into action that ended up saving this iconic vessel for the people of New Zealand. In 1986 he featured in the ABC Science national television program *Quantum* on the use of oxygen isotope ratios in barnacles to determination of the seawater temperatures and to track the voyage of a ship in 1811. In the Bicentennial year he conducted in-situ corrosion research on the wreck of HMS *Sirius* (1790) off Norfolk Island and delivered the P.F. Thomson Memorial Lecture on '*Marine corrosion on historic shipwrecks and its application to modern materials*' at the ACA Conference in Perth, Western Australia. The following year he featured on the ABC Radio Science Show talking on iron corrosion, phosphorus impurities and their effects on concretion formation. In 1990 he became coordinator of the metal working group of the International Council of Museums' Committee for Conservation.

In 1991 he jumped into the murky water of Port Philip Bay and demonstrated the applicability of corrosion measurements to the management of iron shipwrecks in cool seawater and talked on the corrosion and conservation of ships' fastenings at the Getty Museum in Los Angeles. Not being content with these challenges he worked with colleague Bill Jeffery from SA Heritage on an in-situ corrosion study of wrecked barges and paddle steamers in the zero-visibility fresh water environment of the River Murray in South Australia. He established a model for prediction of desalination rates for corroded iron cannon and determined how the shipwrecks can be dated from the chloride extraction kinetics. Corrosion on shipwrecks in Lake Huron called him in 1993 to chilly waters to look at decay of metals in alkaline fresh water lakes. This was rewarded with warm salty water dives on the wreck of the USS *Arizona* in Pearl Harbour, Hawaii. He was a consultant on the conservation of materials recently recovered from the wreck of the RMS *Titanic*. His penchant for in-situ studies took him to the Cromwellian shipwreck *Swan* off the Isle of Mull, Scotland and he determined that the corrosion profiles provide data on how the site conditions have changed over the centuries.

1996 saw David Whitby introduce the Governor of Victoria and open the 13th International Corrosion Congress. MacLeod delivered a plenary regarding corrosion of the wreck of HMVS *Cerberus* (1926). The journey to Western Australia was punctuated by some South Australian shipwreck studies on the *Clan Ranald* (1909) wreck and the *Willyama* (1907) in Investigator Strait, South Australia. The following year this work was extended to other wrecks in Gulf St Vincent and Spencer Gulf. He provided expert defence witness for the Malaysian Government regarding the conservation of materials from the wreck of the *Diana* (1817) and conducted desalination experiments in court. In 1998 he conducted a corrosion assessment of a PBY5A Catalina in Texas which saw the Western Australian Government and WA Museum make a commitment to buy and restore the historic flying boat. His assessment of the impact of pH and stress on copper alloy corrosion opened up new understanding of why corrosion patterns can be so different on the same object. He dived in the wild waters of the Atlantic coast of Portugal to study the decay of silver coins on the 1786 wreck of the *San Pedro del Alcantara*. Back in Australia he attended as an expert witness during a murder trial in the Supreme Court of NSW and at a case in the Perth Magistrates court. The following year saw him prepare the guided missile destroyer HMAS *Perth* for corrosion monitoring over the next 100 years.

International travel saw him give lectures in Rome, in Athens and Amsterdam to specialist conservation courses before he was given concrete boots to project manage the relocation of staff and collections from the CBD of Perth to a fitted out warehouse and laboratory complex. This involved moving more than 5 million objects and the $11 million project was completed on time and on budget. This was rewarded by a return to field work in Victoria and workshops on metal conservation in Hong Kong and at the University of Melbourne. He addressed the 50th Anniversary conference of the ACA on the Gold Coast and conducted a review of the conservation of the turret, engine and condenser recovered from the USS *Monitor* (1862).

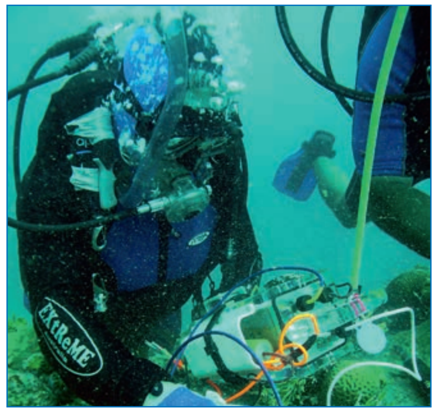
Work on the planning for AE2 submarine expeditions in conjunction with the Submarine Institute of Australia commenced in 2004. He conducted a detailed survey of wrecked aircraft and ships in Chuuk Lagoon, Micronesia. As a member of the WA Fulbright Fellowship Fund Raising committee he helped them raise $1 million within a year. In 2008 he was involved in making movies on corrosion themes in Turkey and in Chuuk Lagoon. The following year he was presented with award for Outstanding Contribution to Research in Materials Conservation by the materials conservation profession.

The 2010 highlight was being President of the ACA and hosting the 18th International Corrosion Conference in Perth in 2011 and giving his third PF Thompson lecture. The Victorian shipwreck Clarence (1850) off St Leonard's, Port Phillip Bay became the focus of his energies for three years with funding from an ARC Cooperative Research Centre on Historic Shipwrecks. A grant from the Australian Synchrotron facilitated a study of the de Vlaming plate (1697) which identified some unique corrosion patterns that showed up the English origins of the tin and lead ores used in making the pewter plate. More recently Ian MacLeod appeared on the ABC TV *Catalyst* show regarding treating the WWI submarine AE2 in the Sea of Marmara, Turkey with sacrificial anodes. Earlier this year he discovered the direct relationship between sweat in Thai textiles and the microbiological derived acidity and so quantified the impact of high temperature and relative humidity on biological decay.

Ian has been a member of the ACA for over 36 years. Ian was awarded Life Membership for his outstanding service to the ACA at C&P2014. He has been the Editor of '*Corrosion & Materials*' since October 2013 and currently serves as the Chair of the ACA Foundation Scholarship Program. Ian will continue with both these roles.

Spreading NaOH pellets on the Xantho engine in 1990.

Recording corrosion parameters on the wreck of an 'Emily' bomber, Chuuk Lagoon, Federated States of Micronesia in 2006.



Above the wreck of the San Pedro de Alcantara (1786) near Peniche in Portugal in 1996.

CHANGES TO AS/NZS 2312

R A Francis, Consultant, Ashburton, VIC, Australia

In Australia and New Zealand, AS/NZS 2312 *(Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings)* and its predecessors have covered the factors to be considered in selection and specification of protective coatings since 1967. The latest version of the Standard has been released with the main change to the Standard being being the removal of the section on galvanized coatings to a new Part 2, with thermal spray to become a proposed Part 3. This article looks at some key new topics and changes in the paint coatings section of importance to the specifying engineer.

Nuts, bolts and washers can cause major corrosion problems. If they are painted before assembly, then the coating will be damaged during installation and tightening. If they are painted on-site after assembly, surface preparation will usually be compromised and the coating system will have reduced durability. Section 3 of the Standard recommends the use of hot dip galvanized bolts, stainless steel bolts in more severe environment (if galvanic corrosion can be controlled) or the use of PVC caps. The Standard also points out that damage to painted surfaces under the fastener is likely and recommends that only a thin coat of primer, ideally inorganic zinc, be used under fastener heads and nuts to minimise damage.

Fabrication problems such as sharp edges, including the requirements for rounding or chamfering, and dealing with gouges, shelling and laminations are also covered. Of great importance is the comment that responsibility for repair of these defects must be made clear in the specification and other documentation. Ideally, defects should be detected and repaired by the fabricator before shipping to the coating applicator.

Some paint systems are no longer recommended. These include some rarely specified alkyd systems, and chlorinated rubber systems which are no longer used because of availability and concerns over VOC levels. Ultra high build epoxy and vinyl ester systems have been deleted as they are rarely used for atmospheric exposure and would not be economic for such exposures. They are listed in the non-atmospheric exposure coating systems in Appendix C.

A new single coat solvent-borne inorganic zinc silicate applied to a film thickness of 125 microns has been added. This will provide a high durability system to complement the 125 micron water-borne system, but is easier to apply and can be used in humid environments. While this system is controversial and solvent-borne products are rarely specified to this thickness, there are now suppliers who will allow their products to be applied to this higher thickness. In fact, to meet the requirements of AS 3750.15 Type 4, solvent-borne products must be able to be applied to this thickness without defects. The durability of both the water-borne and solvent borne systems applied to 75 microns are now identical, as are the two 125 micron systems.

The popular zinc rich primer/ epoxy mid coat and polyurethane top coat systems dominate coating specifications around the world, and are probably the most important paint coating system where colour is required. Similar polysiloxane top coat systems are increasingly being specified. Two new polysiloxane three-coat systems have been added to the existing two-coat system; PSL2 with a zinc-rich primer and PSL3 with a zinc-free primer. These are the equivalents of the popular PUR5 and PUR3 systems, with similar durability.

In the section on inspection, two levels of inspection are suggested:

- Level 1 inspection for C1 and less critical C2 environments which would rely only on the contractor's quality control, other than a final inspection by the principal.
- Level 2 inspection for all other work and work where abrasive blasting or water jetting are carried out. An inspector engaged directly by the Principal should carry out all necessary tests and checks.

The Standard points out that, regardless of the extent of inspection, all defects are unlikely to be identified and some minor maintenance must be expected.

AS/NZS 2312 Part 1 has updated paint systems, more information on selection, and should make coating selection easier and result in better paint coating specifications.

NEW PRODUCT SHOWCASE

The ACA does not officially endorse any of the products advertised in *Corrosion & Materials.*

Smart Sinks™

Disposal of liquid waste from a range of industries—especially waste containing solid residues—is difficult, costly and can sometimes cause unexpected damage. Craig Hanson, the inventor of the Smart Sinks™ filtration system, noticed that when he was working as a carpenter/builder, he was often called on to repair or replace cupboards around sinks, particularly those used with filters such as plaster traps in dental laboratories.

Hanson developed a patented solution to remove particulate waste from cleaning water so that the solids can be disposed of in a bin or skip, leaving clean, potable water that can be released to the drainage system.

The Smart Sinks™ system is a versatile and flexible system designed and manufactured in Australia. The latest version is the Smart Sinks Filtration Bin, a fully mobile system suitable for both indoor and outdoor applications. This unit is ideal for tradespeople needing to clean equipment when working in high-rise construction sites or remote locations. Based on a standard 'wheelie bin', it comes with its own water supply that is recirculated back through the unit making it very environmentally friendly. They can also be used in conjunction with a 'wet vac' when cutting concrete or using a hole saw; the wet vac is emptied into the Smart Sinks Filtration Bin and solid waste is separated from the waste water.

In order for the Smart Sinks™ sediment filtration system to be patented, the design incorporates three disposable bags, a valve and visual indicators that simplify the use of the system. The filtration bags concentrate the solid material so that the bags from each of the three stages of filtrations can be simply lifted out and disposed of as standard rubbish. The primary filter collects up to 92 per cent of waste material, with subsequent filters ensuring that all waste is removed.

Smart Sinks™ can be used to dispose of trade waste from professions such as plastering, tiling, concreting and rendering, and other industries that potentially release pipe blocking solid waste into the environment through our waterways, sewerage and drainage systems.

In addition to helping protect the environment, Smart Sinks™ can also save money. Blocked pipes are expensive to maintain and can cause lost productivity and costly repairs when associated cabinetry is damaged. Failure to comply with local government waste disposal laws and water authority guidelines can lead to large fines being imposed.

Other models available range from a standard 450 mm built-in bench top unit through to various stand alone modules for use in laboratory applications and workplace situations.

For more information contact
Leslie Hanson
Phone: +61 (0)7 5488 4154
Email: Leslie@smartsinks.com.au
www.smartsinks.com.au

In-House Ultrasonic Thickness Gauges

Russell Fraser Sales (RFS) has expanded their range of in-house ultrasonic thickness gauges. Due to the popular reception from their customers for their first in-house entry-level RFG-1000 gauge, RFS has increased their range to now include the more advanced RFG-2000, RFG-4000 and RFG-4000DL models.

The new RFG-2000 is designed to be used for measuring steel only and is so easy to use: simply turn the unit on, zero it and start taking measurements. The display is easy to read, even in poor lighting conditions with a bar graph giving an indication of the stability of the reading. Featuring lightweight metal housing the RFG-2000 can save you time and money by providing fast, repeatable and accurate results, even in harsh operating conditions. Typical applications include: Corrosion & Pitting, Tube & Pipe, Tanks, Boilers and Disc Brakes on mining trucks.

The new RFG-4000 is a rugged and fully-featured gauge, built to satisfy the harshest operating conditions. Manufactured in the USA and featuring a 5 year limited warranty this high quality instrument features a backlit LCD display, 'Scan Mode' to capture minimum thickness and much more. A dual element transducer is included as standard with the kit but additional transducers are also available for cast iron, plastics, fibreglass, steel and glass applications. The RFG-4000DL also has data-logging capabilities for up to 1000 readings. RFG-2000 and RFG-4000 gauges have a 5 year warranty on the gauge.

For more information contact
Russell Fraser Sales today:
T: +612 9545 4433 F: +612 9545 4218
E: rfs@rfsales.com.au
Web: www.rfsales.com.au

The Pipecheck Solution

Russell Fraser Sales Pty Ltd (RFS) has recently supplied Sonatest Veo Phased Array Flaw detectors into Queensland for pipeline inspection applications. With 2 x 400V pulsers for conventional inspection, as well as the ability to utilise phased array and ToFD, the Veo is a powerful tool for ultrasonic inspection.

Veo has the ability to record all data for later analysis on a PC, which is ideal for inspection of Oil and Gas infrastructure. Veo's rugged and reliable design and large screen makes it perfect for harsh on-site operating conditions. Veo and new generation Sonatest WP2 WheelProbe, makes it easier than ever to scan large areas of pipeline for analysis. Veo's software is also very intuitive.

Along with the Sonatest investment being made by the Oil and Gas industry in Queensland, RFS has also recently supplied Creaform 3D Laser Scanning equipment to both inspection companies and asset owners.

The Pipecheck solution is being rapidly adopted by the Oil and Gas industry due to its ease of use, repeatable, reliable and recordable results. Burst calculations are made to the ASME B31G, B31Gmod and Effective Area codes with results being made available immediately and reports available at the push of a button.

Other features that have made this solution attractive to the Oil and Gas industry include the ability to include UT data from wheel probes or manual thickness gauges and the ability to correlate ILI data.

For more information contact
Russell Fraser Sales today:
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Web: www.rfsales.com.au

Flexible Coatings Help Protect Marine Structures

Both abrasive and corrosive, the marine environment is unforgiving of maritime structures such as offshore platforms and rigs, and ocean-going vessels—all of which are major investments for the companies operating them.

One way to minimise and mitigate the effect of some types of corrosion is through the use of flexible surface coatings that are resistant to chemical attack from petroleum products and salts. According to Denis Baker, Special Projects Engineer at Gold Coast-based Rhino Linings Australasia (RLA) "A corrosion barrier has to have durability and flexibility in addition to being impermeable to the wide range of agents that affect maritime structures."

An offshore structure is also harsh on surface coatings, both in terms of how they wear and also how they are applied. Some of the areas most affected are the decks, superstructure, ballast tanks and anchor or chain wells. To prepare these working areas for treatment, the platform deck has to be abrasive blasted to clean off any existing coatings. Rhino Pure Polyurea (Extreme or PP1195) is then applied over the primed area to a nominal thickness of 3000 microns on the deck surface providing resistance to weather extremes, excellent flexibility and high impact strength. To minimise downtime, spray coating enables quicker application and less disruption to a client's operations. "The beauty of our coatings is that they are rapid setting," said Baker

Where pipes and other equipment penetrate the deck areas on offshore structures, it is important that liquids do not run down the pipes to the ocean below. Most offshore rigs cover these penetrations with a butyl rubber 'boot' that is taped to the pipe and the deck. One suitable coating material to use with the boots is Rhino Pure Polyurea (PP1195), creating a liquid tight, weather resistant, flexible interface on all deck penetrations. The Rhino Pure Polyurea comes as a two-part solution that is mixed under high temperature and pressure (3000 psi at 65ºC) in a specially designed spray apparatus. Pure Polyurea coatings 'snap cure' to form a solid surface in a few seconds and can be sprayed up to 6000 microns thick (and greater) on a sloping or vertical surface without sagging or running.

Whereas epoxies and paints form a solid, rigid shell, the flexibility of Pure Polyurea coatings allows them to move with the expansion and contraction of the underlying structure as temperatures change.

For more information contact:
Rhino Linings Australasia Pty Ltd
501-505 Olsen Avenue
Molendinar Qld 4214

Local call Australia-wide:
1300 88 77 80
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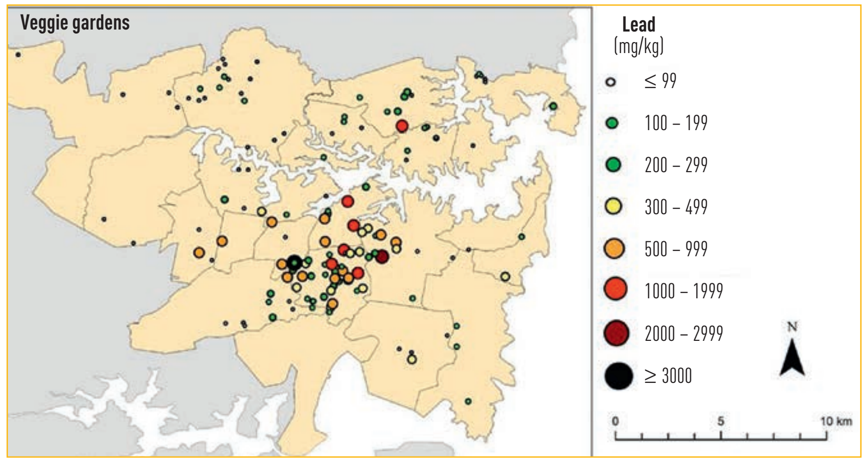
Olympus Instruments Support Environmental Safeguards

Industrialisation has left much of the urban environment contaminated with a variety of heavy metals, chemicals and pesticide residues. Research by a team from Macquarie University has produced a series of maps that plot the concentrations of metal pollutants such as lead. Led by Professor Mark Taylor and senior researcher, Marek Rouillon, the group investigates environmental pollution and risks to human health from aerosols, dusts, sediments, soil and water. According to Professor Taylor, it would be expected that there would be contamination in a major city. "We live in an industrial environment," he said. "We have used lead-based petrol and paint for most of the 20th Century."

The compact, lightweight Delta Element hand-held XRF analyser from Olympus.



Soil lead concentrations in 141 vegetable gardens in Sydney, Australia (© Macquarie University, 2015).

A technician analysing soil samples in a public park.

One technique that is key to the work is X-ray fluorescence spectrometry (XRF) analysis. Andrew Saliba, Regional Sales Specialist with Olympus, said the latest portable X-ray fluorescence (pXRF) analysers, such as the Delta Premium, have been developed specifically for complete environmental investigations. "The technology has been refined and is now often used by environmental consultancies specialising in contaminated land remediation and recycling companies needing to determine what materials are in waste products," Saliba said.

Rouillon has been working to evaluate the reliability and repeatability of XRF analysis on environmental samples. The Macquarie team's results indicate Sydney residences have a mean soil lead concentration of 220 mg/kg which is approximately 10 times the typical natural background for Sydney's soils and rocks.

In conjunction with the contamination mapping, Macquarie researchers also run the community orientated VegeSafe program. This scheme seeks to inform people about metals and metalloids in their garden soils and provides a free sampling program for domestic and community garden soils. "Typically, undisturbed soil in urban areas accumulates contaminants over long periods of time and should be avoided when growing home produce" Rouillon stated.

Olympus IBD is a business division of Olympus Corporation that develops and markets advanced, non-destructive testing systems, and a large selection of industrial scanners, probes, software programs, and instrument accessories.

Heatstrip® Elegance

After three years of product development, Thermofilm in May will introduce Heatstrip® Elegance, the world's first true outdoor-rated strip heater that is off-white rather than the traditional black.

Thermofilm, a world leader in electric heaters, worked with coating technology experts to develop a unique composition that has driven a new generation of outdoor heater.

Heatstrip Elegance radiant heaters blend in seamlessly with most white ceilings in any al fresco, verandah and patio areas for both residential and commercial premises. They are corrosion protected so suitable for seaside locations.

The Heatstrip makeover has extended to its effectiveness with a new heating element design that produces a more even temperature distribution and allows the energy efficient heater to operate at higher temperatures.

Greg Trezise, Thermofilm's national sales manager, said it has taken years to get the right formula for the new coating to ensure it withstands constantly high surface temperatures.

"There's no other off-white outdoor heater in the world that does not discolour through the constant heat it produces as white is the hardest colour to operate at a high temperature," he said.

Thermofilm's R&D has extended to making the new off-white coating flexible so that it doesn't crack unlike other strip heaters that use traditional paint coating technology.

All three new models are IP55 rated meaning they are protected from water ingress from all directions. They are available from trade outlets, Bunnings and specialty outdoor living, electrical and heating stores. The RRPs are: 1800W-$699 (974mm length); 2400W-$799 (1204mm length) and 3600W-$899 (1804mm length). They come with a two year residential warranty and a one year commercial warranty.

The 3600 watt model is the first true 3600W heater offered in the world in the electric radiant strip heater category.

For more information visit: www.heatstrip.com.au and www.thermofilm.com.au

ACA Foundation Ltd.

Advancing corrosion mitigation through education

Note from the Chairman

Dean Wall has moved on to more wide-ranging ACA responsibilities and challenges as ACA Operations Board Chairman and as a result I have the honour of assuming the ACA Foundation Chair role. The Deputy Chair of the ACA Foundation is Sarah Furman, the Secretary is Jacquie Martin and Foundation Board Members include Kingsley Brown, Roman Dankiw, Ian Godson, Ian MacLeod and Dean Wall. We are also pleased to have a permanent part-time Foundation Project Officer, Simone Di Nucci, 1 day per week (Tuesdays) at ACA Head Office in Melbourne. This team together with Foundation Donors and ACA member volunteers various are charged with the progression, development and growth of the ACA Foundation.

The ACA Foundation Ltd exists for the purposes of advancing corrosion mitigation through education by providing scholarships, bursaries and awards for academic excellence.

As part of this educational focus, we are delighted to announce an extensive Scholarship Program for 2016 **(see the ad on this page)**:

The ACA Foundation Board has recently passed a decision to amend the Scholarship Application Criteria for the 2016 Scholarship Program and beyond. Under the new guidelines submissions will be accepted from university (tertiary institution) employed post graduate applicants in corrosion related fields. The broadened criteria will not however extend to include applicants from general academia of tertiary institutions. In this context, 'Post Graduate' refers to University Research Fellows, University Research Engineers, University Research Scientists and the like.

The Foundation also seeks to invest in future leader development as well as special projects targeting corrosion education in secondary education and the broader community. To this end, the **Secondary School Resource Working Group** are currently reviewing and tailoring several science experiments for Year 9/10 students from the NACE C-Kit and the Corrosion Education Site, all of which address the key principles of corrosion. Both the Science Teachers Association of Victoria (STAV) and the Australian Science Teachers Association (ASTA) have been briefed on this initiative.

The **Project Working Group** is currently addressing two corrosion related initiatives impacting the broader community:

1. Updating of the 'Boat Owner's Guide to Corrosion' Booklet (last published 1982). Once the document is finalised an effective marketing strategy will be considered and may involve Guest Speaker/s at Yacht Club membership meetings with the Booklet being offered as corroborative material to support the information discussed.
2. Reworking of the ACA Foundation website to include a prominent section dedicated to 'Corrosion Basics'. This will include an overview of key corrosion principles and Questions and Answers regarding common corrosion issues experienced in the home and in other environments.

In order to enable us to provide the above exciting programs and projects, we remain indebted to the generosity of our Foundation Donors and we would also like to remind you of the Centurion Program as a modest way to contribute to the ACA Foundation Ltd Scholarship Fund by the pledging of at least AUD$100 annually for as long as you are able.

Warren Green, *Chair, ACA Foundation*

ACA Foundation 2016 Scholarship Program

After the outstanding success of the ACA Foundation Scholarship Program in 2015, the ACA Foundation is delighted to release the following Scholarships in 2016

- 5 x ACA Corrosion Training Course Registration Scholarships, valued at $2,000 each
- 1 x Post Graduate Conference Attendance Scholarship, valued at $1,345
- 4 x First Time Conference Attendance Scholarships, valued at $2,000 each
- 1 x Brian Cherry International Travel Scholarship, valued at $8,500
- 1 x International Conference Scholarship, valued at $3,500

For more information on the ACA Foundation Ltd 2016 Scholarship Program including criteria, deadlines and application process and application form, please refer to the Foundation page on the ACA website www.corrosion.com.au or contact Jacquie Martin at foundation@corrosion.com.au

ACA Standards Update

Welcome to the second corrosion related standards report for 2016.
The standards reporting for 2016 is scheduled against Technical Groups (TG) as indicated below:

Issue	2016 Standards search for TG interests
Feb	Concrete Structures & Buildings; Asset Management
May	Water/Wastewater
Aug	Coatings
Nov	Concrete

This Standards report focuses on the **Water/Waste Water** (inter-alia) Material in relating to corrosion.

As previously this is in two stages, namely:

Stage 1

1. A global standards and publication focus at 4 April 2016, searching through SAIGLOBAL Publications at https://infostore.saiglobal.com/store, for all current publications and standards relating to corrosion of materials in the water and waste water industry. This is in 2 searches for corrosion with water and corrosion with 'waste water'.

These results are shown under Stage 1, Search 1 and Search 2.

Stage 2

2. A SAI Global search, as previously, at http://www.saiglobal.com/online/ for new standards, amendments or drafts for AS, AS/NZS, EN, ANSI, ASTM, BSI, DIN, ETSI, JSA, NSAI and standards and amendments for ISO & IEC published from 13 January - 4 April 2016, using the key words and key word groups:

- 'durability.'
- 'corrosion' or 'corrosivity' or 'corrosive'; but not 'anodizing' or 'anodize(d)'.
- 'paint' or 'coating'; but not 'anodizing' or 'anodize(d)'.
- 'galvanize' or 'galvanized' or galvanizing'.
- 'electrochemical' or 'electrolysis' or 'electroplated'.
- 'cathode' or 'cathodic'.
- 'anode' or 'anodic'.
- 'corrosion' and 'concrete' or 'concrete' and 'coatings'.

These results are shown under Stage 2.

Summary

Stage 1

Through SAIGLOBAL Publications at https://infostore.saiglobal.com/store there were for a search on 'Water and Corrosion', there were 292 publications with no Australian standards with;

- 2 from American Water Works Association (AWWA);
- 8 from NACE;
- 8 from ISO;
- 8 from ASTM; and
- 15 from BSI (10 from ISO; 5 non ISO)

Stage 2

Across SAIGLOBAL online Standards Publications there was a total of 56 listings of post 13 January 2016 new standards, Drafts and Amendments found; 1 Draft from AS/NZS being;

DR AS/NZS 2311:2016	Guide to the painting of buildings

Regards,

Arthur Austin
(Arthur.Austin@alsglobal.com)

Stage 1 Report

Stage 1 Report on SAIGLOBAL Publications at https://infostore.saiglobal.com/store, for all current publications and Standards relating to 'Water and Waste Water Corrosion'.

Table 1

For Titles search on https://infostore.saiglobal.com/store on 4 April 2016 for 'Water and Corrosion' there were 292 citations including:

- None from AS or AS/NZS;
- 2 from American Water Works Association (AWWA);
- 8 from NACE;
- 8 from ISO;
- 8 from ASTM; and
- 15 from BSI (10 from ISO; 5 non ISO tabulated below) as shown following:

AWWA	NACE	ISO
AWWA M58:2011 Internal Corrosion Control in Water Distribution Systems	NACE 11114:2014 A State-of-the-Art Report on the Internal Corrosion of Residential Water Heating Systems	ISO 15106-7:2015 Plastics - Film and sheeting - Determination of water vapour transmission rate - Part 7: Calcium corrosion method
AWWA D104:2011 Automatically Controlled, Impressed-Current Cathodic Protection for the Interior Submerged Surfaces of Steel Water Storage Tanks	NACE TM 01 12:2012 Test to Determine the Potential Corrosion Effects of Ballast Water Treatment Systems on Ballast Tanks	ISO 16784-1:2006 Corrosion of metals and alloys - Corrosion and Fouling in Industrial Cooling Water Systems - Part 1: Guidelines for Conducting Pilot-Scale Evaluation of Corrosion and Fouling Control Additives for Open Recirculating Cooling Water Systems
ASTM	NACE 34108:2008 Review and Survey of Alkaline Carbonate Stress Corrosion Cracking in Refinery Sour Waters	ISO 16784-2:2006 Corrosion of Metals and Alloys - Corrosion and Fouling in Industrial Cooling Water Systems - Part 2: Evaluation of the Performance of Cooling Water Treatment Programmes using a Pilot-Scale Test Rig
ASTM STP179-56 Symposium on High-purity Water Corrosion	NACE 46107:2007 Control of Corrosion, Deposition, and Microbiological Growth in Recirculating Water Systems in Buildings	ISO 16539:2013 Corrosion of Metals and Alloys - Accelerated Cyclic Corrosion Tests with Exposure to Synthetic Ocean Water Salt-Deposition Process - 'Dry' and 'wet' Conditions at Constant Absolute Humidity
ASTM D4627-12 Standard Test Method for Iron Chip Corrosion for Water–Miscible Metalworking Fluids	NACE RP 03 00:2003 Pilot-Scale Evaluation of Corrosion and Fouling Control Additives for Open Recirculating Cooling Water Systems	ISO/TR 10217:1989 Solar Energy - Water Heating Systems - Guide to Material Selection with Regard to Internal Corrosion
ASTM STP1086-90 Corrosion in Natural Waters	NACE RP0300/ISO 16784-1:2006 Corrosion of Metals and Alloys - Corrosion and Fouling in Industrial Cooling Water Systems - Part 1: Guidelines for Conducting Pilot-Scale Evaluation of Corrosion and Fouling Control Additives for Open Recirculating Cooling Water Systems	ISO 11306:1998 Corrosion of Metals and Alloys - Guidelines for Exposing and Evaluating Metals and Alloys in Surface Sea Water
ASTM STP1300-97 Corrosion Testing in Natural Waters: 2nd Volume	NACE SP 01 00:2014 Cathodic Protection to Control External Corrosion of Concrete Pressure Pipelines and Mortar-Coated Steel Pipelines for Water or Waste Water Service	ISO 4404-1:2012 Petroleum and Related Products - Determination of the Corrosion Resistance of Fire-Resistant Hydraulic Fluids - Part 1: Water-Containing Fluids
ASTM D4778-15 Standard Test Method for Determination of Corrosion and Fouling Tendency of Cooling Water Under Heat Transfer Conditions	NACE 11106:2006 Monitoring and Adjustment of Cooling Water Treatment Operating Parameters	ISO 1005-1:1994 Railway Rolling Stock Material - Part 1: Rough-Rolled Tyres for Tractive and Trailing Stock - Technical Delivery Conditions
ASTM D5969-11e1 Standard Test Method for Corrosion-Preventive Properties of Lubricating Greases in Presence of Dilute Synthetic Sea Water Environments	**BSI**	
ASTM D6294/D6294M-13 Standard Test Method for Corrosion Resistance of Ferrous Metal Fastener Assemblies Used in Roofing and Waterproofing	BS EN 12502-1:2004 Protection of Metallic Materials Against Corrosion. Guidance on the Assessment of Corrosion Likelihood in Water Distribution and Storage Systems. General	BS EN 12502-2:2004 Protection of Metallic Materials against Corrosion. Guidance on the Assessment of Corrosion Likelihood in Water Distribution and Storage Systems. Influencing Factors for Copper and Copper Alloys
ASTM G2/G2M-06(2011)e1 Standard Test Method for Corrosion Testing of Products of Zirconium, Hafnium, and Their Alloys in Water at 680°F (360°C) or in Steam at 750°F (400°C)	BS EN 14868:2005 Protection of Metallic Materials against Corrosion. Guidance on the Assessment of Corrosion Likelihood in Closed Water Circulation Systems	BS 5117-1.5:1992 Testing Corrosion Inhibiting, Engine Coolant Concentrate ('Antifreeze'). Methods of Test for Determination of Physical and Chemical Properties. Coolant Hard Water Stability Test
ASTM A264-12 Standard Specification for Stainless Chromium-Nickel Steel-Clad Plate	92/52015 DC Specification For The Performance Of Corrosion And Scale Inhibitors For Use In Domestic Hot Water Central Heating Systems	ASTM A409/A409M-15 Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service

ACA STANDARDS UPDATE

Stage 2 Report
For Titles search on https://infostore.saiglobal.com/store on 4 April 2016 for 'Waste Water' and Corrosion, there were 8 citations with:

- 1 from NACE (listed above as well);
- 2 from AS
- 5 from Osterreichisches Normungsinstitut (ON) as shown below

Table 2

NACE	AS	ON
NACE SP 01 00:2014 Cathodic Protection to Control External Corrosion of Concrete Pressure Pipelines and Mortar-Coated Steel Pipelines for Water or Waste Water Service	HB 50-2004 Glossary of Building Terms	ONORM B 5013-1:2013 Corrosion Protection by Organic Coatings for Water and Wastewater Engineering in Residential Areas - Part 1: Assessment of Corrosion Probability and Protection of Unalloyed and Low - Alloyed Ferrous Materials
	AS 2610 Set-2007 Spa Safety Standards Set	ONORM B 5013-2:2013 Corrosion Protection by Organic Coatings for Water and Waste Water Engineering in Residential Areas - Part 2: Assessment of Corrosion Probability and Protection of Cement-Bound Materials
		ONORM B 5013-3:1994 (Superseded) Corrosion Protection by Organic Coatings for Water and Waste Engineering in Residential Areas - Testing of Protective Materials and Requirements
		ONORM B 5013-4:1997 (Superseded) Corrosion Protection by Organic Coatings for Water and Waste Water Engineering in Residential Areas - Testing of Corrosion Protection and Requirements
		ONORM B 5013-4:2015 Surface Protection by Organic Coatings for Water and Waste Water Engineering in Residential Areas - Part 4: Requirements and Testing of Corrosion Protection

Stage 2 Report
Table 3 - Search for AS, AS/NZS, EN, ANSI, ASTM, BSI, DIN, ETSI, JSA, NSAI and Standards and Amendments for ISO & IEC PUBLISHED from 13 January - 4 April 2016 for:

New standards, amendments or drafts for AS, AS/NZS, EN, ANSI, ASTM, BSI, DIN, ETSI, JSA, NSAI and Standards or Amendments for ISO & IEC PUBLISHED between 13 January - 4 April 2016	
Key word search on 'durability'- 0 citations found;	
Key word search on 'corrosion' or 'corrosivity' or 'corrosive'; but not 'anodizing' or 'anodize(d)'- 19 citations found; 0 from AS/NZS	
ISO 12289:2016	Aerospace - Rivets, solid, in Corrosion-Resisting Steel - Procurement Specification
ISO/DIS 12944-1	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 1: General Introduction
ISO/DIS 12944-2	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 2: Classification of environments
ISO/DIS 12944-3	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 3: Design Considerations
ISO/DIS 12944-7	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 7: Execution and Supervision of Paint Work
ISO/DIS 3651-3	Determination of Resistance to Intergranular Corrosion of Stainless Steels - Part 3: Low-Cr Ferritic Stainless Steels - Corrosion Test in Media Containing Sulfuric Acid
ISO/FDIS 4623-2	Paints and Varnishes - Determination of Resistance to Filiform Corrosion - Part 2: Aluminium Substrates
I.S. EN ISO 28706-4:2016	Vitreous and Porcelain Enamels - Determination of Resistance to Chemical Corrosion - Part 4: Determination of Resistance to Chemical Corrosion by Alkaline Liquids Using a Cylindrical Vessel (ISO 28706-4:2016)
I.S. EN 62321-7-1:2015	Determination of Certain Substances in Electrochemical Products - Part 7-1: Determination of the Presence of Hexavalent Chromium (Cr(6)) in Colorless and Colored Corrosion-protected Coatings on Metals by the Colorimetric Method
DIN EN ISO 12944-1 (2016-02) (Draft)	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 1: General introduction (ISO/DIS 12944-1:2016); German and English Version prEN ISO 12944-1:2016
DIN EN ISO 12944-2 (2016-02) (Draft)	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coatings Systems - Part 2: Classification of Environments (ISO/DIS 12944-2:2016); German and English Version prEN ISO 12944-2:2016
DIN EN ISO 12944-3 (2016-02) (Draft)	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 3: Design considerations (ISO/DIS 12944-3:2016); German and English version prEN ISO 12944-3:2016
DIN EN ISO 12944-7 (2016-02) (Draft)	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 7: Execution and Supervision of Paint Work (ISO/DIS 12944-7:2016); German and English Version prEN ISO 12944-7:2016
DIN EN ISO 28706-2 (2016-04) (Draft)	Vitreous and Porcelain Enamels - Determination of Resistance to Chemical Corrosion - Part 2: Determination of Resistance to Chemical Corrosion by Boiling Acids, Boiling Neutral Liquids, Alkaline Liquids and/or their Vapours (ISO/DIS 28706-2:2016); German and English Version prEN ISO 28706-2:2016
DIN EN 2879 (2016-04) (Draft)	Aerospace Series - Nuts, Anchor, Self-Locking, Air Resistant, Sealing, Floating, Two Lug, with Counterbore, in Corrosion Resisting Steel, Passivated, MoS<(Index)2> Lubricated - Classification: 900 MPa (at Ambient Temperature) / 235°C; German and English Version FprEN 2879:2015
DIN EN 3908 (2016-05) (Draft)	Aerospace Series - Nipples, Lubricating, Axial Type, in Corrosion Resisting Steel, Passivated; German and English Version FprEN 3908:2015
DIN EN 4297 (2016-04) (Draft)	Aerospace Series - Nuts, Hexagon, Self-Locking by Plastic Ring, Normal Height, Normal Across Flats, in Corrosion Resisting Steel, Passivated - Classification: 900 MPa (at Ambient Temperature) / 120 °C; German and English Version FprEN 4297:2015
DIN 65480 (2016-04) (Draft)	Aerospace Series - Hexagon Nuts with Flange and MJ Thread, Self-Locking, Corrosion-Resisting Steel - Class: 1100 MPa/315 °C; Text in German and English
DIN 65508 (2016-04) (Draft)	Aerospace - Nuts, Hexagon with MJ Thread, Captive Washer and Counterbore, Self-Locking, Corrosion-Resistant Steel - Class: 1100 MPa/315 °C/425 °C; Text in German and English
Key word search on 'paint' and or 'coating'; but not 'anodizing' or 'anodize(d)' or corrosion– 31 Publications found; 1 DRAFT AS AS/NZS	
DR AS/NZS 2311:2016	Guide to the Painting of Buildings
ISO 2811-1:2016	Paints and Varnishes - Determination of Density - Part 1: Pycnometer Method
ISO 4624:2016	Paints and Varnishes - Pull-Off Test for Adhesion
ISO 7784-1:2016	Paints and Varnishes - Determination of Resistance to Abrasion - Part 1: Method with Abrasive-Paper Covered Wheels and Rotating Test Specimen
ISO 7784-2:2016	Paints and Varnishes - Determination of Resistance to Abrasion - Part 2: Method with Abrasive Rubber Wheels and Rotating Test Specimen
ISO 7784-3:2016	Paints and Varnishes - Determination of Resistance to Abrasion - Part 3: Method with Abrasive-Paper Covered Wheel and Linearly Reciprocating Test Specimen
ISO/DIS 12944-1	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating systems - Part 1: General Introduction
ISO/DIS 12944-2	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 2: Classification of Environments
ISO/DIS 12944-3	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 3: Design Considerations
ISO/DIS 12944-7	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 7: Execution and Supervision of Paint Work
ISO/FDIS 1514	Paints and Varnishes - Standard Panels for Testing
ISO/FDIS 3248	Paints and Varnishes - Determination of the Effect of Heat
ISO/FDIS 4623-2	Paints and Varnishes - Determination of Resistance to Filiform Corrosion - Part 2: Aluminium Substrates
JIS A 1902-3:2015	Determination of the Emission of Volatile Organic Compounds and Aldehydes by Building Products - Sampling, Preparation of Test Specimens and Testing Condition - Part 3: Paints and Coating Materials
DIN EN ISO 12944-1 (2016-02) (Draft)	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 1: General Introduction (ISO/DIS 12944-1:2016); German and English Version prEN ISO 12944-1:2016

DIN EN ISO 12944-2 (2016-02) (Draft)	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coatings Systems - Part 2: Classification of Environments (ISO/DIS 12944-2:2016); German and English version prEN ISO 12944-2:2016
DIN EN ISO 12944-3 (2016-02) (Draft)	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 3: Design Considerations (ISO/DIS 12944-3:2016); German and English Version prEN ISO 12944-3:2016
DIN EN ISO 12944-7 (2016-02) (Draft)	Paints and varnishes - Corrosion Protection of Steel Structures by Protective Coating Systems - Part 7: Execution and Supervision of Paint Work (ISO/DIS 12944-7:2016); German and English Version prEN ISO 12944-7: 2016
ISO 17668:2016	Zinc Diffusion Coatings on Ferrous Products - Sherardizing - Specification
ISO 18555:2016	Metallic and Other Inorganic Coatings - Determination of Thermal Conductivity of Thermal Barrier Coatings
ISO 2178:2016	Non-Magnetic Coatings on Magnetic Substrates - Measurement of Coating Thickness - Magnetic Method
ISO 21809-3:2016	Petroleum and NaturalGas Industries - External Coatings for Buried or Submerged Pipelines used in Pipeline Transportation Systems - Part 3: Field Joint Coatings
ISO/DIS 16773-4.2	Electrochemical Impedance Spectroscopy (EIS) on Coated and Uncoated Metallic Specimens - Part 4: Examples of Spectra of Polymer-Coated and Uncoated Specimens
ISO/DIS 16962	Surface Chemical Analysis - Analysis of Zinc- and/or Aluminium-Based Metallic Coatings by Glow-Discharge Optical-Emission Spectrometry
DIN EN 16985 (2016-05) (Draft)	Spray Booths for Organic Coating Material - Safety Requirements; German and English Version prEN 16985:2016
DIN EN ISO 2081 (2016-04) (Draft)	Metallic and Other Inorganic Coatings - Electroplated Coatings of Zinc with Supplementary Treatments on Iron or Steel (ISO/DIS 2081:2016); German and English Version prEN ISO 2081:2016
DIN EN ISO 2082 (2016-04) (Draft)	Metallic and Other Inorganic Coatings - Electroplated Coatings of Cadmium with Supplementary Treatments on Iron or Steel (ISO/DIS 2082:2016); German and English Version prEN ISO 2082:2016
DIN EN ISO 27830 (2016-04) (Draft)	Metallic and Other Inorganic Coatings - Guidelines for Specifying Metallic and Inorganic Coatings (ISO/DIS 27830:2016); German and English Version prEN ISO 27830:2016
DIN EN 4474 (2016-04) (Draft)	Aerospace Series - Aluminium Pigmented Coatings - Coating Methods; German and English Version FprEN 4474:2015
DIN EN ISO 6179 (2016-04) (Draft)	Rubber, Vulcanized or Thermoplastic - Rubber Sheets and Rubber-Coated Fabrics - Determination of Transmission Rate of Volatile Liquids (Gravimetric Technique) (ISO/DIS 6179:2016); German and English Version prEN ISO 6179:2016
Key word search on 'galvanize' or 'galvanized' or galvanizing' – 0 citations found.	
Key word search on 'corrosion' and 'concrete' or 'concrete' and 'coatings' – 0 Standard Publications found.	
Key word search on 'cathode' or 'cathodic' – no corrosion related standards found	
Key word search on 'anode' or 'anodes' or 'anodic' – 0 Standard Publications found	
Keyword Search on 'electrochemical' or 'electrolysis' or 'electroplated' – 4 corrosion related Standard Publications found, none from AA or AS/NZS.	
DIN EN ISO 16773-4 (2016-02) (Draft)	Electrochemical Impedance Spectroscopy (EIS) on Coated and Uncoated Metallic Specimens - Part 4: Examples of Spectra of Polymer-Coated and Uncoated Specimens (ISO/DIS 16773-4.2:2016); German and English Version prEN ISO 16773-4.2:2016
DIN EN ISO 2081 (2016-04) (Draft)	Metallic and Other Inorganic Coatings - Electroplated Coatings of Zinc with Supplementary Treatments on Iron or Steel (ISO/DIS 2081:2016); German and English Version prEN ISO 2081:2016
DIN EN ISO 2082 (2016-04) (Draft)	Metallic and Other Inorganic Coatings - Electroplated Coatings of Cadmium with Supplementary Treatments on Iron or Steel (ISO/DIS 2082:2016); German and English Version prEN ISO 2082:2016
Keyword Search on 'anodize' or 'anodized' - 2 Publications found	
DIN EN 3902 (2016-04) (Draft)	Aerospace Series - Washers for Rivet Assemblies, in Aluminium Alloy, Anodized, Metric Series; German and English Version FprEN 3902:2015
DIN EN 4178 (2016-04) (Draft)	Aerospace Series - Screws, Pan Head, Six Lobe Recess, Coarse Tolerance Normal Shank, Medium Length Thread, in Titanium Alloy, Anodized, MoS<(Index)2> Lubricated - Classification: 1100 MPa (at Ambient Temperature)/315 °C; German and English Version FprEN 4178:2015

A Quick Guide to Intellectual Property Rights by Dr Marianne Seter

To begin with an introduction, Marianne is a registered Patent Attorney in the Melbourne Chemistry group at FB Rice. She has extensive experience in Australian and New Zealand patent prosecution and patent portfolio management. Her skills include oppositions, drafting patent specifications, freedom to operate advice, searching and monitoring third party patent applications globally.

Before entering the Intellectual Property space in 2013, Marianne worked as a Postdoctoral Research Fellow within the ARC Centre of Excellence for Electromaterials Science, specialising in corrosion mitigation of metal infrastructure using rare earth-organic complexes. During this time she developed new and improved "green" corrosion inhibitors, analysing their speciation in aqueous solutions at varying pH and concentrations while also in coatings via filiform analysis.

She has also conducted extensive research in respect of microbiologically influenced corrosion (MIC), specifically, the control and prevention of biofilm formation on metal substrates. In particular, she realised the potential for commercial application of her research in industrial and medical fields.

Below is a quick guide to how your Intellectual Property rights can be protected.

Intellectual property rights are broadly those rights stemming from the inventive or creative efforts of a person, or a group of individuals. The vast majority of countries provide legal protection for the result of these efforts, typically giving the owner a period of time in which to profit from their efforts. During the period of protection, the owner of the right is able to prevent a third party from exploiting the intellectual property. This is often achieved by simply sending a letter of demand to the alleged infringer. Where this approach does not yield the desired result, the owner of the intellectual property right is able to seek remedy from a competent court (in this country, typically the Federal Court of Australia).

Some intellectual property rights are granted automatically by law (such as copyright), while others must be actively pursued in some formal manner (patents, registered trademarks, and registered designs).

Intellectual property rights are strictly territorial in nature, meaning that the right must be obtained and enforced on a country-by-country basis. For example, where a company has only pursued patent protection in Australia for a new type of cathodic protection, they are not able to prevent a person from manufacturing and selling that product in the United States.

Intellectual rights can be sold, licensed (exclusively or nonexclusively) and even willed to a third party.

FB Rice emphasizes the importance of preparing a patent specification that is consistent not only with Australian law, but also the laws of economically important jurisdictions such as Europe, the United States, China and India. FB Rice's trademark practice provides advice and representation regarding protection for your brand both in Australia and overseas.

Your intellectual property rights may fall into one or more of these categories, and FB Rice can provide further advice as to which category is most advantageous to your specific situation.

Patents
A patent is a form of intellectual property protection that is suited mainly to the protection of new and useful products (such as a new type of protective coating) or to a new method of doing things (such as monitoring methods used in cathodic protection). To be patentable, an invention must be at least novel (new) and inventive (not just a routine manipulation of an existing product or process). In order to preserve the novelty of your patent it is important to NOT disclose your invention to any third party before filing a patent application.

The term of patent protection is typically 20 years, however Australia also has an "innovation patent" that is easier to obtain and has a term of only 8 years.

Registered Trademarks
Trademark protection is generally used for the protection of a brand name or logo. Trademarks such as "Freyssinet" and "Jotun" are clearly valuable intellectual property assets for their respective owners.

Registered Designs
This form of intellectual property protection is directed to the distinctive visual appearance of articles.

Design protection is generally easier to obtain than a patent; however the term of protection is relatively short at 10 years. It is also important to remember that design protection does not cover how a product actually works, but just its appearance. So, a competitor could alter the appearance of an article to escape infringing of your rights under design law.

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FB RICE
The IP Navigators

COATINGS GROUP MEMBER PROFILE

Favcote

Q: In what year was your company established?

A: Favcote was originally established in 1984 focussing on commercial painting and repainting services and in 1995 commenced applying these services to Naval and commercial vessels at Garden Island Naval base, Sydney. We then steadily moved into the application of Industrial and protective coatings and also into providing the application of rubber epoxy and anti-static flooring finishes on board Marine Vessels.

Having rebranded as Favcote in January 2008 and with the introduction of a certified quality management system, PCCP accreditation followed, with a fully integrated and certified management system. This has enabled us to offer a very specialised and quality service resulting in considerable growth year on year since.

Q: How many employees did you employ when you first started the business?

A: We originally started with a small team of 6.

Q: How many do you currently employ?

A: Favcote currently employ 8 core members of staff in management, supervision and administration roles and 20 skilled and competent applicators. We have the resources to up-size should the demands of our clients require that.

Q: Do you operate from a number of locations in Australia?

A: We are predominately based at Garden Island Naval base in Sydney where we apply abrasive blasting and the application of protective coatings and specialised application services.

We have also conducted services for major Prime contractors in Adelaide; and HMAS Stirling and Henderson facilities in Western Australia.

Our facility, located in Western Sydney, also provides abrasive blasting and the application of protective coatings for Naval and Army Componentry, and specialised coatings for industry in general.

Q: What is your core business? (e.g. blasting and painting, rubber lining, waterjetting, laminating, insulation, flooring etc.)

A: Our core business is abrasive blasting, in particular the use of Sponge-Jet media and technology of which we are an approved contractor for NSW, and the application of protective coatings. We also specialise in the application of Epoxy based flooring compounds and anti-static rubber finishes on board Naval vessels.

Q: What markets do you cover with your products or services? eg: oil & gas, marine, chemical process, general fabrication, tank lining, offshore etc.

A: The majority of our market is Defence orientated, predominantly Naval and also, indirectly, Army componentry. We are also engaged in substantial restoration and refurbishment work on heritage projects requiring specialised coatings.

Q: Is the business yard based, site based or both?

A: The business is predominantly site based given our commitments at Garden Island and our workshop facility in Western Sydney. However, together with our certified management systems and competently trained staff and applicators, we engage in onsite projects throughout NSW and Australia.

Q: What is your monthly capacity or tonnage that you can blast and prime?

A: Both sites accommodate the fluctuating needs of our clients on a five to six day basis.

Belfry tower restoration, Redfern.

Hammerhead crane Garden Island.

Q: Do you offer any specialty services outside your core business? (eg. primary yard based but will do site touch up etc.)

A: All of the services that Favcote provide are very specialised and require specialist internal and external training and verification. Some of the speciality services that Favcote provide are; Application of flooring products (Chemclad, Epirez, SynDeck); abrasive blasting and application of coatings to APAS standards; abrasive blasting utilising sponge-jet media and technology and Heritage conservation, preservation and restoration.

Q: What is the most satisfying project that you have completed in the past two years and why?

A: We recently completed the restoration of the Belfry Tower and Bell from the Old Eveleigh Railway workshops in Redfern, Sydney where we were engaged and project managed the removal, restoration and re-installation of the Tower and Bell at the Australian Technology Park. We also completed the refurbishment of major sections of the Hammerhead crane (ex Garden Island) and the abrasive blasting of the underwater paint systems from the Jarrah timber Hull of the HM *Bark Endeavour.*

Q: What positive advice can you pass on to the Coatings Group from that satisfying project or job?

A: Understanding both your clients' needs and specification requirements are of the utmost importance before commencing any project and once determined, ensure that you monitor progress in detail and ultimately deliver a quality service. This approach combined with utilising good quality, safety and environmental management systems/practices will ensure that any project will be delivered to the complete satisfaction of the client.

Q: Do you have an internal training scheme or do you outsource training for your employees?

A: We have both internal training plans, which we utilise to hone in on specific skills required to deliver marine and industrial projects and outsource training for high risk tasks such as: confined space entry and rescue, working safely at heights etc., training organisations with which we have a long and successful relationships. Favcote prides itself on internally training staff and employee development. As a PCCP accredited contractor we have 3 members of staff NACE CIP Level 2 trained as well as a number of certified applicators and 8 applicators who are halfway through completing a Certificate III in surface preparation and coatings application run by the Illawarra Institute of TAFE NSW. Also as approved contractors for a number of specialist products, our suppliers conduct 'in-house' competency based training sessions to ensure that their products are applied correctly.

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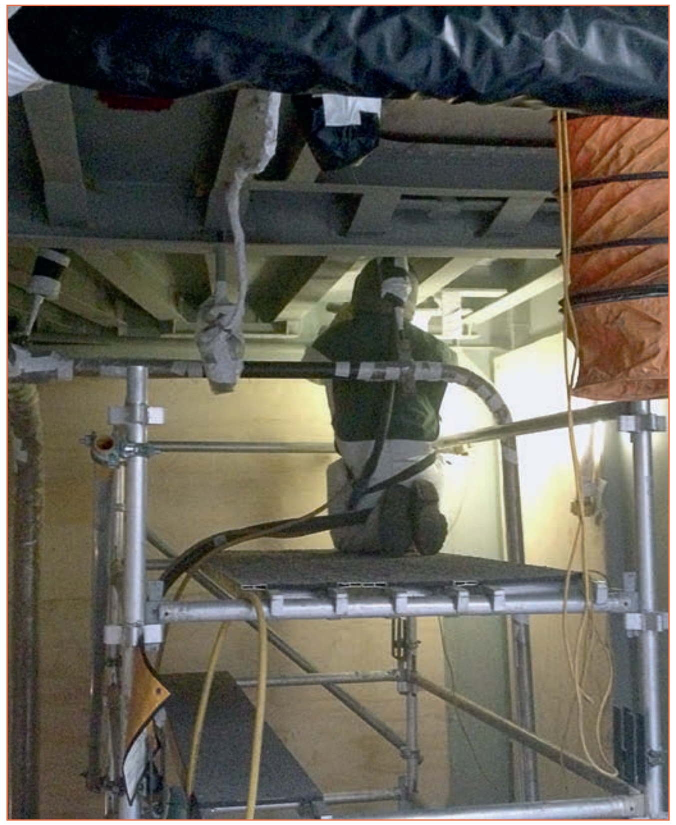
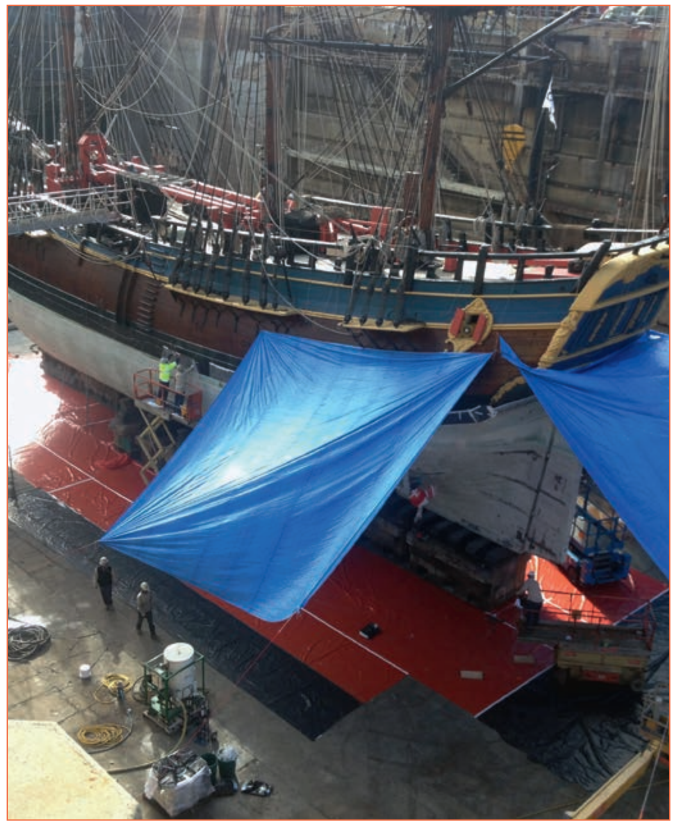
FAVCOTE



Sponge-jet blasting inside Plenum chamber.



Thales-National maritime museum - HMB Endeavour replica.

Curtin University

Curtin Corrosion Engineering Industry Centre

The Curtin Corrosion Engineering Industry Centre (CCEIC) has been conducting high quality research and providing expert consultancy services to oil and gas industry for over 30 years. The centre's services are diverse and catch the attention of many local and foreign companies. It is well known that industry will focus on practical problems and continue to encourage top quality researchers to find the optimal solutions. With this broader perspective in mind, CCEIC has jointly developed industrial projects in collaboration with some of the leading companies like Chevron Australia Pty Ltd and Woodside Energy Ltd under the banner of the Western Australian Energy Research Alliance (WA:ERA). The centre's research laboratory is well equipped with modern equipment facilities and is dedicated to maintain a high standard of customer service. The laboratory conducts research and testing as per ASTM, ISO, Australian and NACE standards.

Thanks to the generous and continuing sponsorship of Chevron and Woodside, which established the Chevron-Woodside Chair in Corrosion Engineering at Curtin University, the centre has steadily grown and developed towards more corrosion engineering focused projects, as the centre is providing technical services and in-house training to sponsors. To mark this development, the centre is currently in the process of adding two senior academics to its team, establishing a unique resource in Corrosion Engineering in Australia for the oil & gas industry.

The Centre is also active in corrosion education. The Graduate Certificate and Diploma in Corrosion Engineering is the first in a series of post-graduate courses Curtin University will offer to meet growing industry demand for qualified corrosion engineers and quality research in this field. The fully on-line delivered courses are tailored to industry needs – specifically in the energy and resource industries – and can be undertaken while working as there are no requirements to attend classes at the university. It is available to Australian and internationally based students and is the only one of its kind in the southern hemisphere.

The centre has close ties with leading corrosion associations. For example, we are member of the ACA Technical Group Steering Committee: petroleum & chemical process industries, and are proud to be corporate members of the ACA and NACE International.

Core Competencies

CCEIC is actively involved in R&D activities related to oil & gas field corrosion. Some major thrust areas of research are as follows:

Corrosion Inhibitor Research

The CCEIC has developed special expertise to validate specific Corrosion Inhibitor (CI) test procedures and protocols and also performs standard analytical tests for investigating and evaluating their performance, not only for the oil and gas industry, but also for cooling systems (automotive and industrial).

Top-of the-line Corrosion (TLC)

TLC occurs when water vapour within the gas mixture condenses on the upper portion of the internal pipe wall. It is recognised as the critical obstacle associated during the transportation of wet gas operating in a stratified flow regime because of the ineffectiveness of available mitigation techniques.

An increasing demand of monoethylene glycol (MEG) as a hydrate inhibitor in Australia through various gas development projects has triggered an interest in different areas of corrosion research. CCEIC currently focuses on 2 aspects associated with TLC; i.e. the influence of MEG on the condensation and corrosion process at the top of the line, and the inhibition of TLC by volatile corrosion inhibitors (VCIs). In-house development TLC setup for high temperature/high pressure conditions enables TLC study in an extreme environment and VCI quantification. We are also working to incorporate electrochemical measurements into TLC study.

Under Deposit Corrosion (UDC)

The oil and gas industry is often faced with under deposit corrosion when solid particles accumulate in the pipeline and result in severe localised corrosion.

CCEIC has developed a methodology for electrochemical investigating of UDC and its inhibition in the presence of mineral deposits and bacteria, and is conducting research to understand the UDC mechanisms. These activities aim to develop corrosion inhibitor formulations specific to deposited surfaces.

Sour Service Research (SSR)

The presence of hydrogen sulphide (H_2S) in oil and gas reserves creates severe problems to control corrosion. CCEIC has a sour gas laboratory that enables the centre to study the unique problems induced by hydrogen sulphide. The laboratory has been designed for conducting experiments at high pressure H_2S, but is presently setup for low levels of H_2S.

Microbiologically Influenced Corrosion (MIC)

CCEIC has in the recent years developed significant capabilities in studying Microbiologically Influenced Corrosion (MIC) phenomena. Through technology and knowledge transfer, the centre is able to put a new spin on the MIC mechanism. By cooperation with the CHIRI Biosciences Research Precinct and other research centres at Curtin University, CCEIC has expanded its research capabilities to provide high-end technology and cutting-edge methods to study microbes and their effects on infrastructure and processes in the energy industry. Core areas of research include marine corrosion, preservation of subsea equipment, bacteria-deposit corrosion and oilfield reservoir souring.

Deep-Water Corrosion (DWC)

The CCEIC is currently leading cross-disciplinary research into the corrosion and microbial degradation processes in the wrecks of the historical HMAS *Sydney II* and HSK *Kormoran* in deep ocean waters. Studying the properties of the rusticles will provide insights into the mechanisms of deterioration for the two ships. Deep-water microorganisms recovered from the rusticles are being cultured and applied to study corrosion under laboratory conditions simulating the deep-sea environment. This knowledge can be applied for the preservation of underwater cultural artefacts and to predicting the life and integrity of other metal deep sea structures, such as subsea oil and gas production lines.

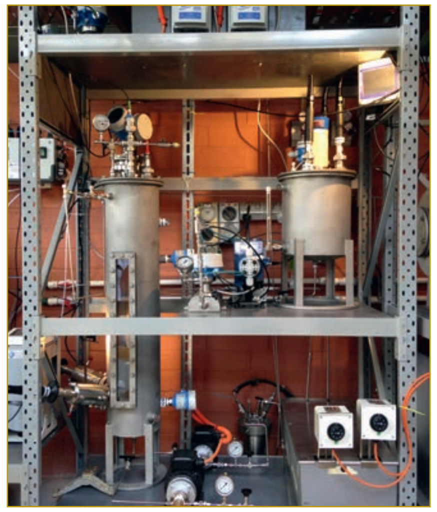
Coatings Research

The centre has significant capabilities in coatings research and testing. Recent projects included the evaluation of internal flow-coatings for dry-gas flow lines.

Monoethylene Glycol (MEG) Regeneration and Reclamation facility

The centre has built the only MEG regeneration and reclamation laboratory scale research facility in Australia with a capacity of 4 litre per hour of lean-MEG production. The facility can operate in slip stream mode or full reclamation mode. It is possible to simulate virtually any rich MEG composition (water and dissolved salt) and condensate blend to enter the MEG pre-treatment vessel, simulating condensate carry over from the high pressure 3 phase separator. The facility is designed to study and improve plant operation (salt removal, minimising MEG losses, in-situ cleaning), influence of MEG production chemical additives on the MEG regeneration/reclamation processes, validation of production chemical qualification results, etc.).

In addition, corrosion studies can be performed at any section of the facility, including simulating TLC and BLC using different feed compositions have been initiated. Current research activties include clean-up to host studies (the fate of drilling mud entering the MEG facility), changeovers studies between different corrosion mitigation strategies and the effectiveness of oxygen scavengers in MEG systems. Last but not least, MEG and the production chemical additives are subjected to thermal cycles in the regeneration and reclamation process, which may result in degradation. CCEIC has developed analytical methods to study MEG degradation products, corrosion inhibitor concentrations, as well as organic acid concentrations and the dissolved salts in the fluids.



Feed blending and Monoethylene Glycol (MEG) pretreatment section of the MEG regeneration and reclamation facility.

Corrosion under Insulation (CUI)

Corrosion under insulation (CUI) is caused by water entrapped within thermal insulation. The presence of insulation, and in particular jacketing, slows down water evaporation, prolongs wetting period of a steel substrate, and allows corrosion to proceed undetected. Through collaboration with Santos, the CUI test rig was designed and constructed for a hot service up to 80 °C. The rig is housed in the chamber in which the relative humidity and environmental temperature are controlled.

CCEIC has developed procedures which are a combination of weight loss, 3D profilometry, an in-situ insulation dry-out monitoring, and corrosion product characterisation has provided valuable information with respect to CUI behaviour. Examples of CUI research areas are listed below.

- Investigation of localised corrosion under thermal insulation. Understanding of birth and death of pitting sites and identify conditions where pits propagate or stabilise.
- Evaluation of insulation prior to its installation.
- Study of wet/dry cycles and quantification of its effect on CUI.

In-House Facilities

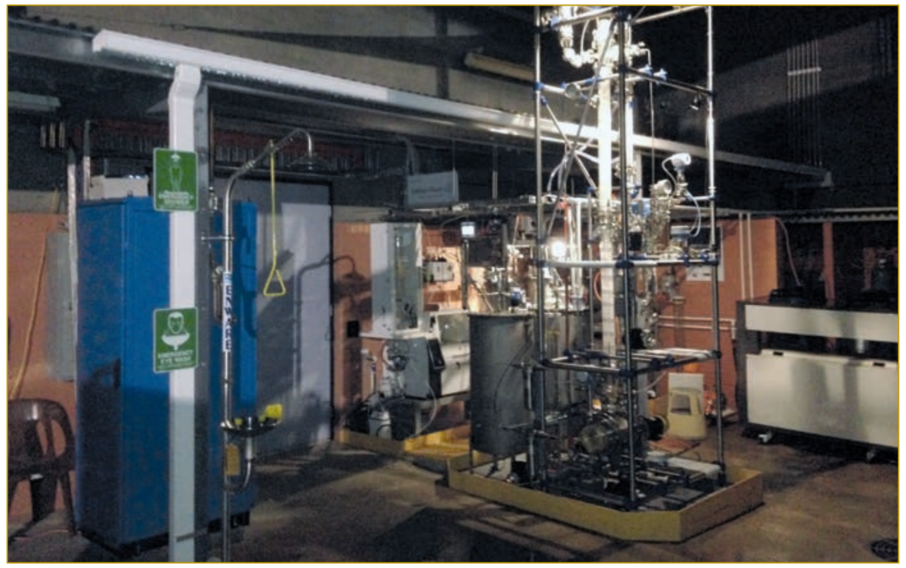
The CCEIC research laboratory is well equipped with modern scientific equipment. Some of these facilities include Optical 3D-microscope (Infinite Focus) and Jet-Impingement cells for high pressure and high temperature work. In addition, the laboratory has now state of the art analytical equipment for studying MEG chemistry and corrosion inhibitor (Ion chromatography and HPLC), which allows the centre to perform research on optimising production chemical processes, residual corrosion inhibitor concentrations, etc.

Testimonials

The following testimonials are just some examples of the high business impact the centre has provided to industry:

"The AU$56,000 project had an estimated direct saving impact of $15,000,000 on the Gorgon project. The responsiveness of Professor Gubner and Dr Laura Machuca to Chevron's need had meant that an immediately needed engineering solution was researched and developed in a short and time-pressured environment of project execution"
Roy Krzywosinski, Managing Director, Chevron Australia

"A good example of a successful research project performed by the Curtin Corrosion Engineering Industry Centre is the development of an internal cathodic protection system that protects our 316 clad pipelines against corrosion failure due to seawater ingress"
Shaun Gregory, Senior Vice President, Strategy, Science and Technology, Woodside

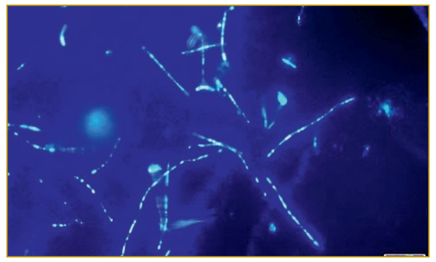


Monoethylene glycol regeneration and reclamation facility at CCEIC.

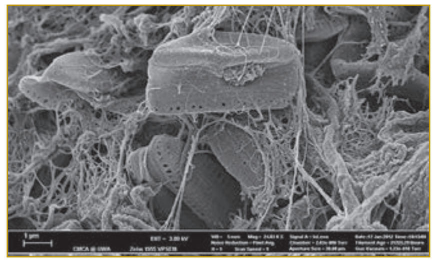
Track record:

The following projects have recently been successfully completed:

Company	Project title
Apache Energy	Corrosion inhibitor qualification
Chevron	Gorgon and Wheatstone upstream production chemical independent laboratory qualification
Chevron	MEG degradation study
Chevron	MEG benchtop regeneration/reclaimer facility
Chevron	Corrosion of carbon steel under pH neutralization with MDEA and calcium scale assessment
Chevron	MEG chemical additives qualification
Chevron	Susceptibility to pitting corrosion of 316L SS in MEG seawater
Chevron	Investigation of water treatments and preservation of corrosion resistant alloy subsea equipment (MIC)
Baker Hughes	Oxygen Scavenger Laboratory Study
Roc oil	Assessment of Microorganisms in Cliff Head Field: Parts I and II
Santos	Investigation of Corrosion Under Insulation
Strategic chemistry	Corrosion inhibitors performance evaluation using jet impingement cell
Talison lithium	Material qualification for Kwinana lithium plant
Woodside	Carbon steel for low cost development of flowlines – 5 subprojects – Corrosion resistant alloy selection criteria – High temperature inhibition – Seawater ingress 316 SS – Weld qualification field test – Condensing water corrosion
Woodside	Investigation of the Mechanism of Stress Corrosion Cracking of Weldable Martensitic grade Stainless Steel
Woodside	BROWSE LNG DEVELOPMENT - Pipelines Internal Coating System Test Program

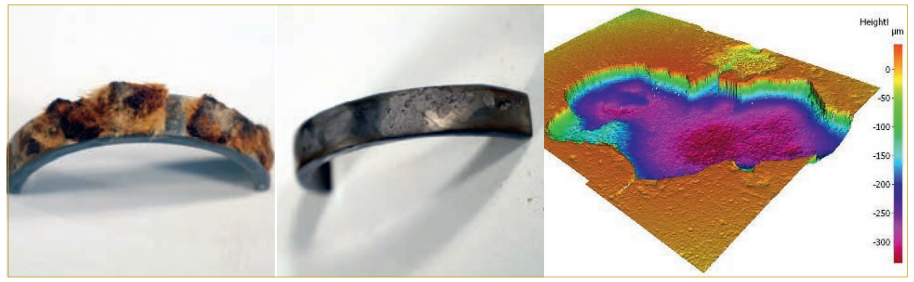


Microbiologically influenced corrosion (MIC) - optical fluorescence image of planktonic bacteria.

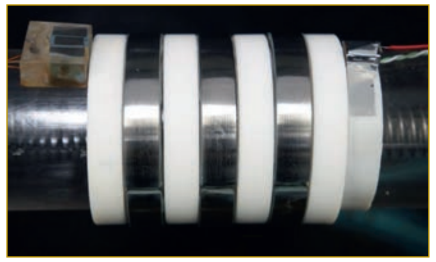


MIC scanning electron microscope image of biofilm grown on corrosion resistant alloy.

Corrosion under insulation (CUI) test rig.



Localised corrosion produced in CUI test rig.



CUI test rings for weight loss and surface profilometry measurements with sensors for monitoring dry-out.

Corrosion Researchers

The corrosion team includes:

Prof. Brian Kinsella

Prof. Brian Kinsella is the Deputy Director, Applied Corrosion Research and Testing. He founded the Western Australian Corrosion Research Group in 1987 from which CCEIC developed. His main interests are CO_2 and H_2S corrosion, electrochemical monitoring and corrosion inhibitors. His focus over many years has been corrosion in oil and gas production and the numerous corrosion mechanisms associated with the different environments created. In this area he has authored or co-authored over 100 papers. Brian works closely with the Postdoctoral research staff in their specialist corrosion areas.

Prof. Kinsella is a member of the Australasian Corrosion Association, the NACE International and the European Electrochemical Monitoring Group.

Prof. Rolf Gubner

Prof. Rolf Gubner is the Deputy Director, Advanced Learning, and the inaugural Chevron-Woodside Chair in Corrosion Engineering. His current research focus covers monoethylene glyclol regeneration and reclamation, top-of-line corrosion and its inhibition, automotive corrosion, corrosion in soils and the study of organic and inorganic coatings for the marine and offshore environment.

Prof. Gubner is a Member of the Australasian Corrosion Association, NACE International and was Vice President of the European Federation of Corrosion (EFC, 2009-2011). He is also an active member on the editorial boards of peer valued journals like ‘Corrosion Science and Technology” and “Materials and Corrosion”

Dr. Kateřina Lepková

Dr Kateřina Lepková joined the Curtin Corrosion Engineering Industry Centre at Curtin University (CCEIC) as a Research Fellow in 2009. Katerina is an electrochemist and her key research areas are investigating the mechanisms of corrosion under deposits and corrosion inhibition. Her research activities at the CCEIC have been related to oil and gas industry applications, mainly CO_2 corrosion and its inhibition, and include method development for the analysis of organic films at corroding metals. Katerina is currently involved in the supervision of numerous PhD projects, and is a member of NACE International and the ACA.

Dr. Thunyaluk (Kod) Pojtanabuntoeng

Dr. Pojtanabunteong is a research and teaching fellow at CCEIC. Her main research interests include CO_2 corrosion mechanism in pipelines both TLC and bottom of the line corrosion, development of electrochemical monitoring to evaluate TLC, and CUI.

She is a Member of the Australasian Corrosion Association and NACE International. She is also an active member of ACA Oil and Gas technical group.

Dr. Laura Machuca-Suarez

Laura L. Machuca Suarez is a Research Fellow at the Corrosion Engineering Industry Centre University (CCEIC), School of Chemical and Petroleum Engineering. Laura is an environmental microbiologist and a corrosion specialist whose research activities focus on the interaction of microbes with metals particularly the field of microbiologically influenced corrosion (MIC).

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Resources and Chemistry Precinct at Curtin University.

Curtin Corrosion Engineering Industry Centre.

PROJECT PROFILE

Cathodic Protection of a Sewage Treatment Dissolved Air Flotation Tank

T Tjandra, Freyssinet Australia Pty Ltd

Dissolved Air Flotation (DAF) Tanks are used to clarify waste waters by removing suspended solids, oils and other contaminants. A pressurised stream of air saturated, clarified water is mixed with the sewage effluent in the DAF separation chamber. With the release of pressure dissolved air comes out of the solution producing a cloud of microscopic bubbles. These bubbles attach to the solids, floating them to the surface to be mechanically skimmed and removed from the tank. The clarified effluent overflows from the DAF tank via an over / under weir to the next stage of treatment.

DAF tanks are exposed to varying temperature, pH and hydrogen sulphide (H_2S) levels. Corrosion protection is generally provided by application of a suitable coating and selecting corrosion resistant materials for various components. DAF tanks are periodically drained and cleaned to prevent sludge build up and to undertake repair / maintenance works.

A Water Authority recently took off-line their DAF tank located at its Sewage Treatment Plant for five-yearly cleaning and maintenance. Upon inspection, extensive corrosion was observed inside the tank, requiring recoating of the entire tank and upgrade of several components. The Water Authority contacted Freyssinet for discussion on the possibility of installing a cathodic protection system to minimise the internal corrosion, extend the life of the new coating system, and lengthen the time between planned shutdowns.

Following site investigations and a review of tank drawings, a decision was made to install a galvanic anode cathodic protection system to provide protection to the internal wetted steel surfaces of the DAF Tank.

The galvanic anode cathodic protection system was preferred over an impressed current system for the following reasons:

i. To simplify installation and minimise maintenance.

ii. To eliminate the need to supply DC electrical power.

Magnesium alloy anodes were selected to limit the number of anodes required to achieve maximum protection in the given environment inside the DAF Tank. In order to ensure uniform protection of all immersed elements of the tank including the moving parts, raking arms and so on, the entire surface area to be protected was categorised into various components and suitable anodes were selected to provide protection to these components. In total, thirty nine (39) magnesium anodes of four different styles were selected to provide protection to all components including floor and walls, internal and external areas of the central drum, the skimmer box frame, run-off water trough, influent pipe and rotating arms.

A paint coating system, consisting of *Jotaprime 505* epoxy primer with a second and third coat of *Jotacote 605* high solids epoxy, was applied to the tank surface with a minimum total dry film thickness (DFT) of 350 microns.

The system was designed with a minimum design life of 5 years, equivalent to the period between maintenance shut-downs with potential to replace anodes at this time.

The design of the cathodic protection system was undertaken in accordance with the following Standards:

AS 2832.4	Guide to Cathodic Protection of Metals, Part 4: Internal surfaces
AS 2239	Galvanic (sacrificial) anodes for cathodic protection.
AS 1554.1	Welding of Steel Structures

The design included the fixing of anodes using mild steel studs welded to the tank at selected locations. The anodes were secured with nuts, flat and spring washers. The bolted connections were selected to facilitate easy replacement of consumed anodes during future shut-down periods. The bare anode straps and bolted connections were coated with a bituminous coating to reduce the amount of exposed steel to be protected. The anodes on the tank wall and influent pipe were installed with an offset from the wall and the pipe. At all other locations anodes were flush mounted using an insulating gasket to prevent direct contact between the anode body and the tank.

The anode manufacture, dimensions, tolerance, testing and supply was in accordance with AS 2239-2003, and were cast to Magnesium Alloy designation M3 (low potential grade).

As several of the components installed within the DAF Tank were fabricated from stainless steel, including a new skimmer box, these were isolated from the carbon steel tank metalwork using suitable insulating materials including bolt isolation sleeves and washers.

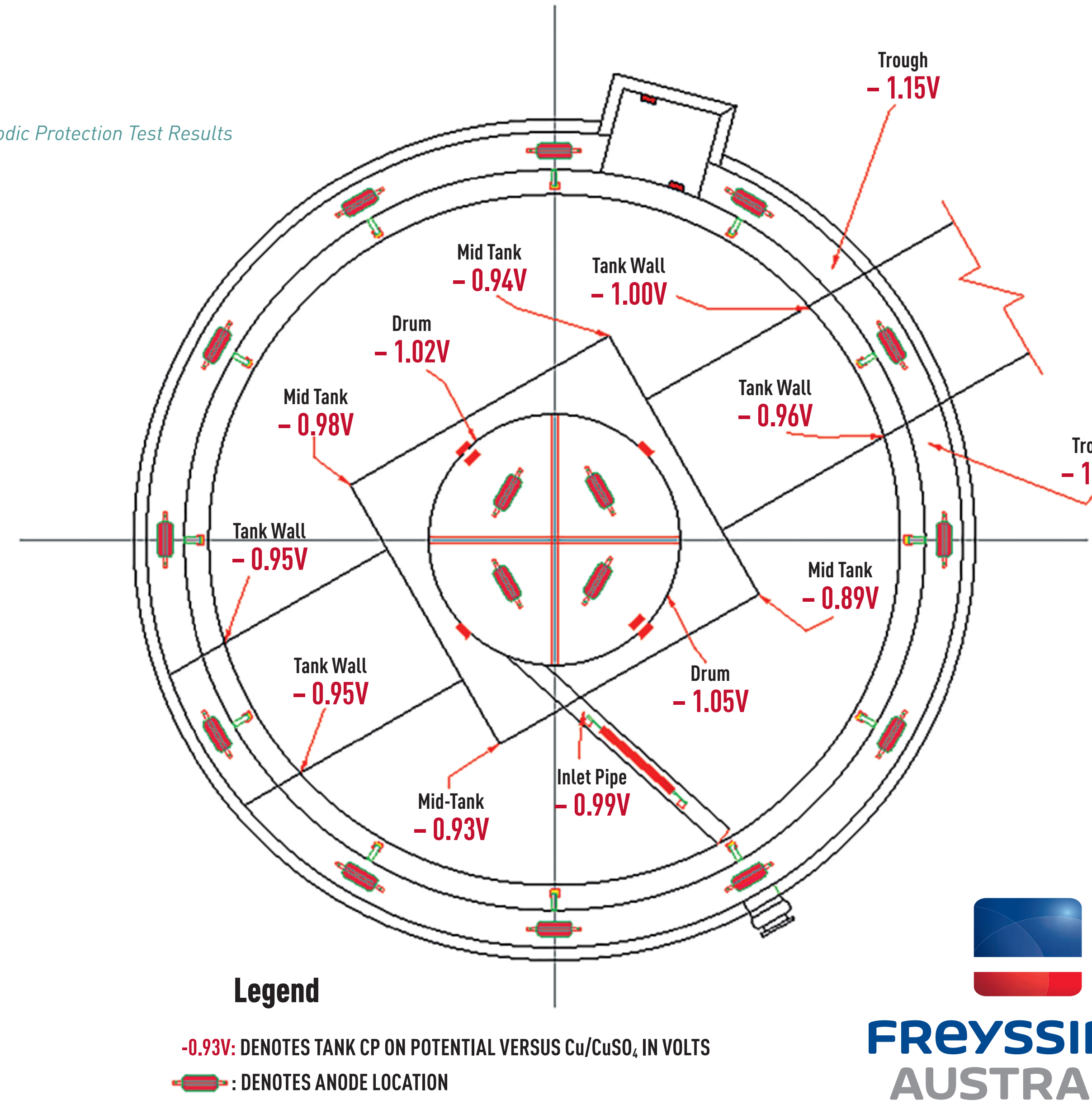
The protection criteria used for the design and commissioning of the system is as per AS 2832.4, Cathodic Protection of Metals, Part 4: Internal surfaces, which states that the potential at all surfaces should be equal to or more negative than -0.850 volts with respect to a copper / copper sulphate reference electrode.

The Standard states that accurate potentials, i.e. free of voltage gradients effect, can be obtained using the "structure off" method of potential measurement. For a galvanic anode system it is impractical to measure "Off" potentials. For this structure, CP "On" method of potential measurement was used to confirm the achievement of full protection. Due to the low resistivity of sewage and even distribution of the anodes, the voltage gradients were expected to be minimal.

Evaluation of the cathodic protection system was undertaken after the DAF Tank was placed back on-line with effluent being processed. The CP "On" potentials of the DAF Tank were measured at different locations against a portable copper / copper sulphate (Cu/$CuSO_4$) reference electrode using a high input impedance voltmeter. The results are shown in the diagram below.

Test results indicate that the cathodic protection system is operating satisfactorily with CP "ON" potentials at all locations being equal to or more negative than -0.85 volts versus a copper / copper sulphate reference electrode. Further evaluation of the system will be undertaken during the next maintenance shut down.

Cathodic Protection Test Results



FREYSSINET AUSTRALIA

50 Years of Coatings Testing at SA Water

Paul Vince, Principal Materials Engineer, SA Water

Background

SA Water owns and has managed South Australia's water infrastructure for over 150 years and provides water and wastewater services to 1.6 million people. With 43 water treatment plants, 24 wastewater treatment plants, 26,000 km of water mains and 8,500 km of sewers with asset value at $13 billion in total, it is important to consider the measures of minimising deterioration of these assets and to maximise their service life; as well as to provide knowledge for future designs of water infrastructure in the South Australian environment.

Under some of the most aggressive operating environments, the demanding role of containing and transporting pressurised water and corrosive wastewater challenges many construction materials that must be able to resist reaction with their environment.

In this article 'environment' is defined as the surroundings which candidate materials are exposed to in their real life applications. The test sites simulate these surroundings, and typically account for; local climates, the soil in which the pipe was laid, the substances being contained, or a combination of the above.

History

In the early 1960's, the necessity to choose economic and corrosion resistant coatings and products with proven performance was recognised. In order to obtain independent performance measurements, three test sites were established on the River Murray for testing coatings in 1965. These test sites utilised atmospheric condition, half immersion and full immersion into river water to represent the application environment of candidate coatings. More than 300 samples were tested in the first five years. Products showing satisfactory performance were reinstated into similar testing environments established at Morgan in 1971. Various materials and protective coatings have been exposed at these test sites since then.

On the wastewater side, a sewage/sewage gas test chamber was installed at Bolivar Waste Water Treatment Plant (WWTP), and two test sites were established in Glenelg WWTP. One made use of the treated sludge while the other was exposed to the local mild marine atmosphere, and all of these sites commenced testing of coating products in 1965. The Bolivar test continues to this day and is believed to be the longest running sewage exposure test facility in the world.

During the late 1960's, a soil burial site was constructed at Bolivar WWTP to determine the effect of severely corrosive soil on materials and external pipeline coatings.

In 1974, testing began at the eighth test site, located at Christies Beach WWTP under severe marine atmosphere conditions.

Aim of SA Water Testing Program

- To review the performance of products specified by manufacturers by subjecting their products to test conditions resembling their service environments
- To produce estimates on serviceable operating life of new infrastructure and assets
- To provide alternative means for possible life extension of existing infrastructure and assets
- To ensure coatings and materials for use in SA Water infrastructure are suitable for their intended application.

Over the past 50 years, more than 600 products and 2300 test samples have participated in the test program. Many tests have been running for more than 20 years at SA Water's sites. There are currently well over 100 samples under test. When all is said and done the commitment of SA Water to quality assurance and continuity of service to our customers is paramount.

Inside the sewage environment test chamber at Bolivia.

From test results generated across the eight environmental test sites, laboratory testings and special projects, some observations and conclusions on product performance were drawn as follows.

Key findings of coating performance

i) Products from the same generic group (e.g. epoxy) can vary widely in their performance. In some cases, the operating life of one brand is twice as much as another.

ii) Product cost is not a useful guide for product performance.

iii) Coatings applied on new structures and assets perform better than recoating on refurbished surfaces. This is usually due to poor accessibility, surface contamination from daily operation and the low priority given to maintenance jobs.

iv) Epoxy coatings, coal tar epoxy and micaceous iron oxide epoxy in particular, are best for sewage application and river immersion. They are economical, easily applied and can be repaired at faulty spots. Epoxies also perform well in corrosive atmosphere, though they might chalk badly when exposed to UV but this has little effect on durability.

v) Inorganic zinc silicates have been proven to be excellent under atmospheric conditions after they were first applied to the Morgan-Whyalla Pipeline in the 1940's. It can be used as an original complete coating or as an overcoat for life extension. They should not be used for immersion service as zinc depletes rapidly. Blistering occurs when inorganic zinc silicates are over coated by most other products.

vi) 'Sintakote' used on new steel mains has outperformed coal tar enamel in corrosion resistance, deformation, splitting and sagging. Sintakote also has a low current demand for cathodic protection. (Sintakote is a proprietary fusion bonded medium density polyethylene coating)

vii) Petrolatum tapes work well, even on poorly prepared surfaces.

viii) Some vinyl coatings have performed well in all environments and are easily repaired and maintained onsite. However, their very low volume solids (% volume of dried to wet coating film) means four to six coats are required to obtain the desired thickness and this incurs uneconomically high costs for application. For this reason they are now rarely used.

ix) Numerous rust treatments, conversion coatings (turn metal surface into part of the coating) and maintenance coatings for rusted steel have been examined. Many of these products have provided satisfactory performance in atmospheric exposure but none offer long term protection in immersion environments.

x) Aluminium pigmented epoxy mastic maintenance coating applied to hand cleaned salt laden rusty steel surface has outperformed traditional metal primer or topcoat maintenance systems. The minimum dry film build must be at least 200µm for effectiveness as low dry film builds (<150µm) have resulted in very early failures.

xi) There is no substitute for good surface preparation for long life coatings on steel. Abrasive blast cleaning according to AS 1627.4 Class Sa 3 is recommended for immersion exposure.

xii) Advancement in exterior acrylics have improved their performance over alkyd enamel, though the latter is still specified for mechanical plant and pipe work in buildings for its oil and petrol resistance.

xiii) To ensure consistent product quality APAS (Australian Paint Approval Schemes) approved products are specified when suitable.

Key findings of material performance

i) Type 316 austenitic steel is the minimum requirement for immersion service in sewage and potable water. Type 303, 304, 431 and 3CR12 have all suffered severe corrosion and SAF 2304 also performed poorly in sewage systems and should therefore not be specified.

Rack of samples for River Murray exposure.

Racks for Rural Atmospheric Exposure at Morgan.

River Murray Pontoon used for river exposure samples.

ii) All grades of aluminium have given excellent results in the River Murray and performed very well in a coastal atmosphere although some surface pitting and oxidation occurs. In sewage environment, aluminium suffered from severe corrosion. Since aluminium is anodic to most other metals, direct contact should be avoided to minimise galvanic corrosion. Alkaline environment must also be avoided including contact with damp concrete.

iii) Fibre glass reinforced with isophthalic polyester pultrusion has given excellent results in all test environments with only some surface loss of resin under UV exposure.

iv) Ductile iron pipe sleeved with LLDPE (linear- low-density polyethylene) and laid in high resistivity, free flowing backfill sand has performed well during a five-year test in an aggressive soil environment, when compared to the same material laid on a mixture of the same backfill sand and natural soil. The importance of a defect free sleeve was also evident from the test; as rapid corrosion occurred at a purposely made sleeve defect.

v) Non-metallic materials for pipeline such as uPVC (un-plasticised polyvinyl chloride), glass reinforced polyester and polyethylene provide excellent corrosion resistance to water and sewage environment. Care needs to be taken during transportation, handling and installation as damage can shorten their working life. The mechanical properties, both short and long term, need to be considered and well understood by designers and those who specify them.

The Future

The results achieved by the test program are used to inform SA Water standards and to provide guidance in the formation of tender documents associated with the supply and fitting of major water infrastructures. Information gained from testing done by paint manufacturers and other test agencies such as APAS are used to supplement data from the SA Water program. Testing in the actual environment where products are deployed still provides excellent knowledge of product performance. This in-service reliability is particularly important for sewage applications. Unfortunately the sewage test chamber has been off line for significant parts of the last two years but will be back on line soon for future testing. The sewage environment remains the most demanding due to a complex combination of hydrogen sulphide gas, humidity, acids, bacteria and contaminants. Coatings, liners, cementitious products, chemicals and antibacterial products have been trialled and all have shown some success. SA Water is constantly learning and adjusting and implementing the lessons learned through the testing program. Ultimately the aim is to maximise the life of SA Water's assets and the testing program is making a positive contribution. As the Federal Government and other state governments take up the challenge of producing more sustainable infrastructure the performance data from the SA Water exposure testing sites is likely to become a national performance standard. In an ideal world it would be good to see a substantial return on investment in these long term monitoring and assessment programs come back to South Australia after so many years of commitment and service in corrosion mitigation.

References

DJ Ellis, GC Moore (1992) Materials and Coating Selection for Water Supply and Sewerage – An Essential Component of Asset Management, Corrosion Australasia, Vol 18 No 4.

P Vince (2009) Accelerated Testing of Coatings for Wastewater Applications, Corrosion & Prevention 2009, Australasian Corrosion Association, Coffs Harbor, Paper 13.

Down the Drain: CCTV Changing Sewer Asset Management

Article courtesy of Select Solutions

Water authorities have long struggled with the challenge of maintaining assets beneath the ground. Stormwater and sewer drains, in particular, are subject to unpredictable damage and blockages from tree roots that are seeking water. The results are shifting pipes which lead to severe cracking and blockages which gradually extend throughout the network.

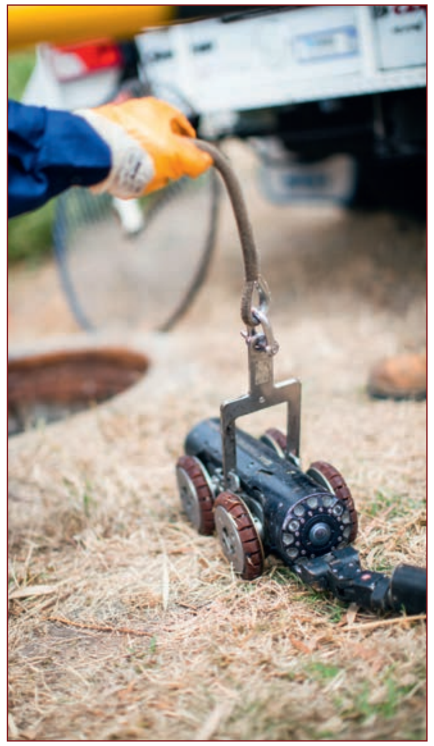
Traditionally, these problems have been treated reactively with a degree of guess work. Where a blockage is identified the action taken was to clear it and hope that the problem goes away. This may involve using methods such as machine rodding cutting to remove tree roots which would halt the immediate problem but without understanding the damage already caused.

Cameras have proven a significant advancement for the plumbing and building industry to be able to inspect pipes and identify causes of blockages, to pin point problems and prioritise maintenance works. As with all technology, cameras and associated equipment are continually evolving. We have moved from VHS to CD, to digital storage; and with these advancements, the quality and detail of the images captured are evolving as well.

With current camera technology, operators can easily identify damage and its cause meaning they can accurately decide which method of cleaning or repairing will be most effective – high pressure water jetting, rodding, or sewer machine cables for instance. In the past, a wrong decision could be costly. For instance high pressure water would be effective in clearing a blockage, but if concrete piping is in the early stages of corrosion, this process may blast away the surface, dramatically reducing the life span of the drain. For this reason the use of camera technology has become a critical tool in inspection and assessment.

Select Solutions, a multi-utility service provider working closely with a number of Australian water authorities in sewer and pipe maintenance, has experienced the advancement of surveillance technology firsthand. Damian Bradley, Select Solutions Plumbing and Civil Group Manager, says "Prior to camera technology the extent of below ground damage was all guess work. Now the guessing game is over."

In fact, camera technology has proven such a vital tool that Select Solutions has embraced the latest advancement,



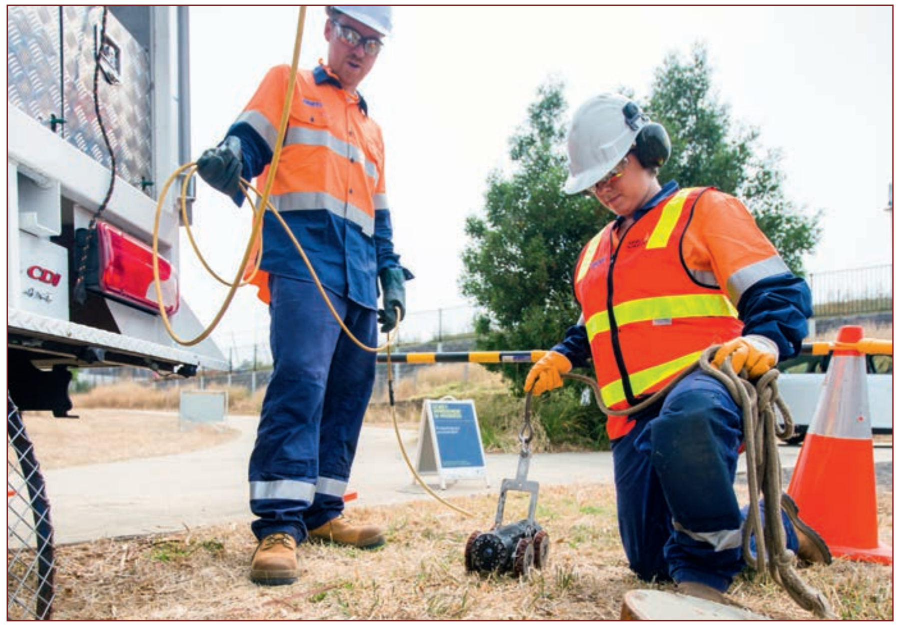
investing in an integrated camera and software unit that delivers detailed panoramic 360° views from inside a pipe. Where traditional push-rod camera systems act as a video recording system allowing the operator to only see the drain in one direction as they travel through it, this latest advancement captures images from inside the drain in both forward and away directions, weaving them into a 'flat' picture giving a true 3D image of the pipes interior.

The immense level of detail captured with the dual lenses, optimal lighting at the point of capture, and ability to see all sides of an object through the woven image, gives the operator a new level of information to make informed decisions about the health of a pipe. It is possible to identify hairline cracking and other early indicators so that quick remedial action can be scheduled to prevent costly rectification works in the future.

The effect is achieved by two 185 degree fisheye lenses which take high resolution photos every 5cm in both the forwards and backwards direction. The images are transmitted to the operator console and stitched together by the software to create a true 3D internal view of the pipe. This method eliminates the blurring that can occur with traditional cameras, as well as overcoming the limitations of single direction camera angles. It is very similar to using Google street view inside a drain.

A further benefit of these new devices is their ability to cover hundreds of meters of straight pipe. Push-rod cameras are limited to the amount of bends or drops in the piping, where-as this new device is controlled by the computer system, either on four wheels or mounted on a flotation device. With features to zoom and pan 360° operators can look into inlets such as housing connection branches and closely examine objects such as displaced joints and protruding pipe connections. With an option to allow vertical surveying of manholes with a separate camera these new cameras have a clear mobility advantage over traditional CCTV systems.

For water authorities and councils, who are under constant pressure to reduce operating expenses, drain surveillance technology is enabling a shift of focus from costly rectification works on demand to a predictable model using routine inspection and schedule preventative maintenance. With each advancement in camera technology and improved imagery there are fewer pipes and drains that can't be thoroughly examined, saving water authorities, councils, businesses and households the cost and disruption of unexpected blockages and collapses of water infrastructure.



PROJECT PROFILE

Tie in Channel Lining Works - Retrofitting 'Off the Shelf' Products for a Better Outcome

By Gianni Mattioli, Mattioli

Challenge:
During the installation of a new section of their sewage grit and screen filter system at Melbourne Water's Eastern Treatment Plant, a major future corrosion issue was identified. The articulation joint between the new sections were comprised of two at risk substrate materials; steel and concrete. Each needed a protective coating to shield them from hydrogen sulphide gas and other sulphur containing corrosive materials found in sewage.

Melbourne Water engaged Mattioli to develop a solution to protect each substrate with the one coating system that had to be applied within a strict six hour window of opportunity. After reviewing a number of products not one product could be identified that would protect the various substrates at once using the above criteria. The additional challenge was that the stainless steel section of the joint had to be uncoated to allow free movement so a coating would have to be fixed to the HDPE as an anchor between the two.

Solution:
Mattioli engineered a solution based on a standard solvent free elastomeric urethane and went back to the drawing board to see how this product could be retrofitted to achieve the correct outcome. Some of the areas that were considered at an early stage were;

- A product to give the correct adhesion to concrete
- Adhesion to the HDPE and anchor points for application of a woven geo-textile fabric
- Protecting the stainless steel from degradation without affecting its movement
- Strong chemical resistance
- Fast curing
- Abrasion resistant qualities were paramount

The outcome resulted in installing pre-fabricated fixing straps on the HDPE outer sections of the area needing coating to allow a geotextile polyester fabric to be punched into the straps and then be coated with the elastomeric urethane at the final stages.

Stage 1: The team abrasive blasted and remediated the concrete surfaces to create a sound substrate as well as saw cut the concrete and HDPE (through to the concrete) to create anchor points for the final coating on each side of the moving steel.

Stage 2: The next stage was to mechanically fix the straps to the edge of the section which would be later used for the geotextile fabric. The fabric was laid across the area to bridge over both substrates, that once coated provided the tensile strength for the lining system.

Stage 3: Before coating the fabric to hang across the fixing straps on the outer sections, the entire surface was sprayed with the elastomeric urethane for initial adhesion. The pre-treated fabric was then sprayed again with the secondary coating, compressed and tightened to get the tensile strength needed before multiple coats were spray applied at approximately 3mm in wet film thickness. As the product started to cure it was not directly stuck to the steel substrate allowing for free movement.


Stage 1: Concrete remediation and abrasive blasting


Stage 2: Installing fixing straps between the steel sections for the geotextile fabric

Benefits:
There was no time available to undertake appropriate R&D needed for this special application so it was essential to go for an off the shelf product. Free movement of the steel substrate was achieved through a non-standard approach (fabric) over a standard product and a superior bridging capacity was achieved by using a single product. Fast curing allowed the team additional time to ensure the system was applied currently with enough time to double check that the application system was viable.

Conclusion:
It was found that by direct engagement with Melbourne Water and through a series of open ended discussions with the client that the optimum combination of treatments would result in a product coating system that would bring about a successful marriage of inherently incompatible systems which would result in improved materials performance. The lessons learned from this project are that better initial design and tighter materials performance specifications can lead to outcomes that are more sustainable and which, after due monitoring and management, could lead to incorporation into new standards of materials for the waste water industry.

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INNOVATORS IN PROTECTIVE COATINGS

This Paper was originally presented at C&P2014.

Corrosion of Stainless Steel Elements in Water Pumps

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AECOM, Melbourne, Australia

1. Introduction

The sudden failure of a high capacity centrifugal water supply pump was found to be due to the failure of an impeller wear ring. One of the impeller wear rings had fractured into a number of pieces without prior warning or indication of imminent failure and this severely compromised the operational ability of the pump.

Centrifugal pumps require a precise tolerance between the impeller and the casing to prevent leakage between the inlet and outlet sides of the pump. Therefore wear of either of these components is not acceptable, unless regular planned maintenance can readily and cost effectively be undertaken. To prevent wear of the casing or impeller at the point of contact in high capacity centrifugal pumps, each component has a wear ring installed on the mating surfaces. These casing and impeller wear rings are usually designed as replaceable items. Wear of the rings results in a very slow reduction in the efficiency of the pump. However while these components are expected wear slowly with time, sudden fracture is neither expected nor acceptable.

Centrifugal water supply pumps are commonly available in a range of materials including cast iron and stainless steel, cast iron fitted with bronze components, or cast iron fitted with stainless steel components. The selection process for a specific environment needs to consider the corrosion resistance in the pumped media, wear resistance requirements, and maintenance requirements for the pump over the design life. Additionally, the maintenance requirements, including repair of coatings or replacement of consumable components, must be aligned with the availability of the pump for maintenance and designated operating costs. The corrosion resistance evaluation needs to consider both the flowing and stagnant environments as water supply pumps are not usually continuously in operation. In addition, as pumps are frequently made from a number of different materials, the risk of galvanic corrosion should also be considered. The final consideration should always be the method in which the component is manufactured as some methods affect the properties of the materials and have the potential to lower their corrosion resistance.

In general the common materials of construction for pumps are considered to be resistant to corrosion in fresh water, though in the case of cast iron, a protective coating is required to optimise the corrosion resistance. The failed pump was manufactured from a combination of materials rather than one of the four materials package options presented above. The wetted materials included cast iron (casing), nickel-aluminium bronze (impeller), and stainless steel (impeller and casing wear rings). To ensure that the wear rings had adequate wear resistance they were manufactured from a martensitic grade of stainless steel, specifically cast alloy ASTM A743 CA15. Due to the unexpected nature of the failure that occurred in the impeller wear ring, and the presence of a number of identical pumps within the pump station, an investigation was undertaken to assess the likely cause of failure of this martensitic stainless steel element.

2. Martensitic Stainless Steel

2.1 Properties and microstructure

Martensitic stainless steels are predominantly iron-chromium alloys with moderately high levels of carbon up to a maximum of 1.2% eg EN 1.41250 (Grade 440C). The final properties of the martensitic alloys are dependent on the quenching and tempering processes. In general the quenching process which is used to produce the martensitic microstructure results in the formation of a material which is hard and brittle. The subsequent tempering process does however improve the toughness transforming it into a useful engineering material. Depending on the carbon content of the alloy and the quench and tempering processes utilised, martensitic alloys can be manufactured with yield strengths ranging from 275 MPa to 1900 MPa [1].

Martensitic stainless steels are commonly chosen for applications that require strength and hardness (or wear resistance) in environments that are considered to be only mildly corrosive. Martensitic stainless steels as a class typically have a lower corrosion resistance than more highly alloyed stainless steels. The cast alloy CA15 is considered to be suitable for mild atmospheric, fresh water and mild chemical exposures [2].

The quenching process is undertaken at cooling rates specific to the individual alloy to ensure that the microstructure fully transforms to martensite. Incorrect quenching can lead to a small amount of retained austenite or a transformation of a small amount of material to ferrite. The presence of either ferrite or austenite can alter the mechanical properties of the material. The austenite usually transforms to martensite during the following tempering process but may often be more brittle than the surrounding martensite formed during quenching processes. It is therefore essential in the processing there is a complete transformation to martensite during the quenching process to optimise the mechanical properties.

2.2 Cast martensitic alloys

Martensitic alloys can be produced as wrought or cast alloys. Wrought alloys are those that are processed from a cast ingot into the final shape by processes such as hot rolling or hot forging; processes which also produce the final properties. Cast alloys are produced into the near final shape direct from the molten phase, though the castings can be subject to processes like tempering to optimise the mechanical properties.

There are grades of wrought and cast alloys which are considered equivalent based on the similarity of the mechanical properties, in particular yield and tensile strength. For example, the cast alloy CA15 (UNS J91150) is considered to be equivalent to wrought alloy grade 410 stainless steel (UNS S41000). There are usually small differences in the composition of equivalent wrought and cast alloys as specific elements need to be added to optimise the casting process. For example small amounts of silicon are usually added to improve the fluidity of the molten metal and castability of the alloy.

The martensitic casting alloys which are produced primarily for corrosion resistance typically have less than 0.2% carbon [3]. The corrosion resistance of these alloys can be negatively impacted by a lack of homogeneity, micro-segregation or local contamination introduced from the mould.

Cast alloys can have greater variations in mechanical properties than equivalent wrought alloy due to the presence of large dendritic grains, segregation of alloying elements, and the presence of intergranular phases, porosity, cracks and inclusion [4]. The main advantage of a cast product is the reduced waste associated with the near final shape and the ease with which intricate shapes can be made. The design of the casting mould and the quenching and tempering process does however need to be undertaken to minimise the formation of the defects noted above. In corrosive environments, the presence of surface-breaking defects are of more concern as these are where corrosion usually initiates.

3. Impeller Wear Ring Failure Investigation

Dismantling of the pump shortly after failure quickly established that one of the wear rings was missing (Figure 1). Following retrieval of a number of pieces of the impeller wear ring (Figure 2) from the downstream piping a failure investigation was initiated. Prior to the start of the investigation it was thought that the most likely causes of failure of the wear ring were:

- The composition of the material did not comply with the specification
- Galvanic corrosion had contributed to the failure
- The alloy had inadequate resistance to corrosion in the fresh water

The investigation was broadly planned to look at these potential causes. During the course of the failure investigation the following was undertaken: visual assessments, optical and SEM examination, chemical composition verification, investigation of the fracture face, hardness testing, microstructural examinations, and review of the water quality records.

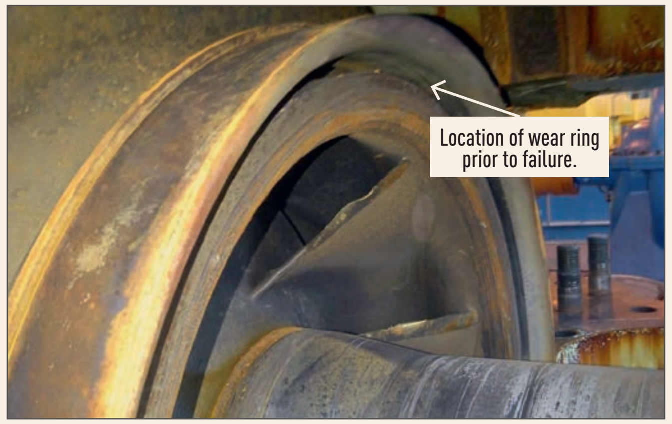

Figure 1: Partially dismantled failed pump showing the location wear the impeller wear ring had been installed.

Figure 2: Failed impeller wear ring.

3.1 Visual and optical examination

The initial examination of the pieces of the failed ring noted the presence of a crack that had not fully penetrated through the impeller wear ring. Examination of this crack indicated that cracking had initiated on the outer surface (Figure 3 and Figure 4). It was postulated that as residual stresses in the ring associated with the interference fit of the ring to the impeller may have contributed to the crack initiation. It is understood the interference fit was achieved by applying heat to expand the impeller wear ring then allowing cooling to fix the ring onto the impeller. The residual stress levels were expected to be slightly higher on the outer surface of the wear ring.

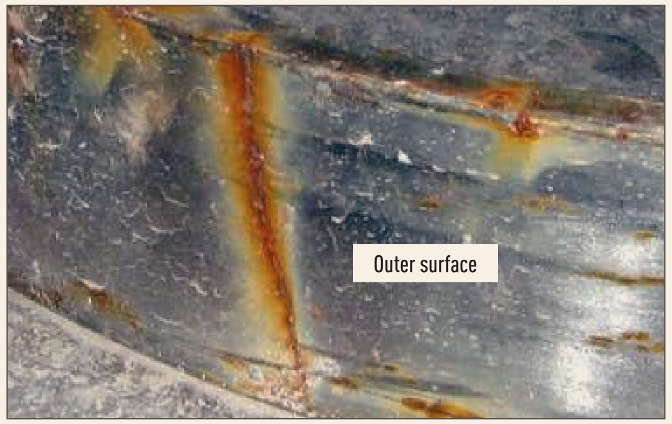

Figure 3: Crack initiation on the outside surface of the impeller wear ring.

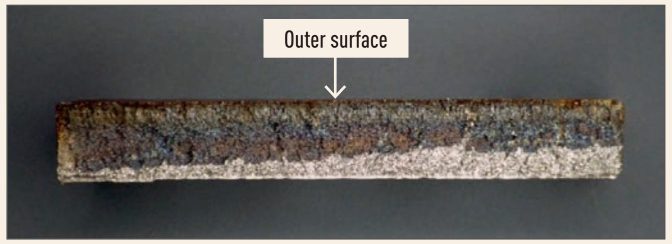

Figure 4: Fracture face after crack shown in Figure 3 was stressed to the point of failure. The darker area shows the depth of the existing crack.

Further investigation of the surface of the failed wear ring noted the presence of corrosion pits on some sections of the outer surface and on the ends adjacent to the impeller (Figure 5 and Figure 6).

Optical examination of the cross-section prepared through the ring from the outer surface to the inner surface revealed the presence of a band of materials which was different in appearance from the bulk material (Figure 7). Subsequent analysis indicated the band contained a higher concentration of chromium carbides than the bulk material. This zone was termed the carbon rich zone. This feature is similar to centreline segregation which can occur in continuously cast high carbon steel.

Examination of the impeller wear rings from several other pumps also detected the presence of a carbon rich zone (Figure 8). The carbon rich zone was found to vary significantly in its proximity to the outer surface of the wear ring. Examination of a several sections from a single wear ring indicated the location of this band was not consistent even on an individual ring. This suggested the manufacturing process was not producing a consistent product.

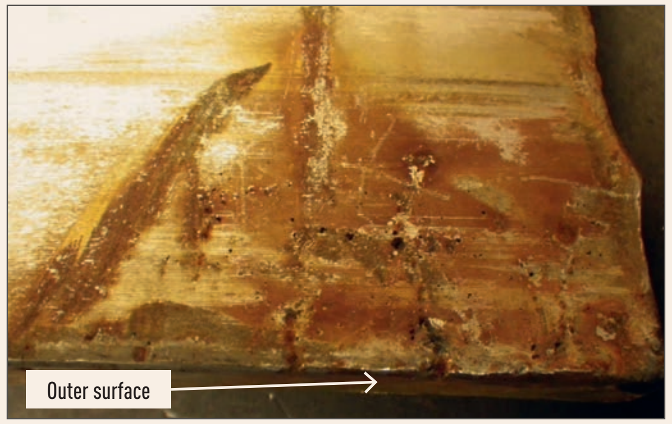

Figure 5: Corrosion pits on the end of the wear ring at the outer surface of the impeller wear ring.

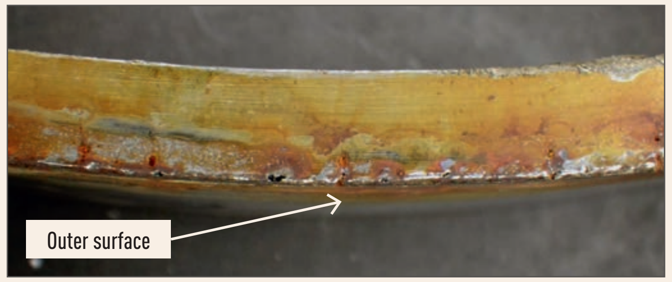

Figure 6: Corrosion pit on end of the wear ring which faced the impeller.

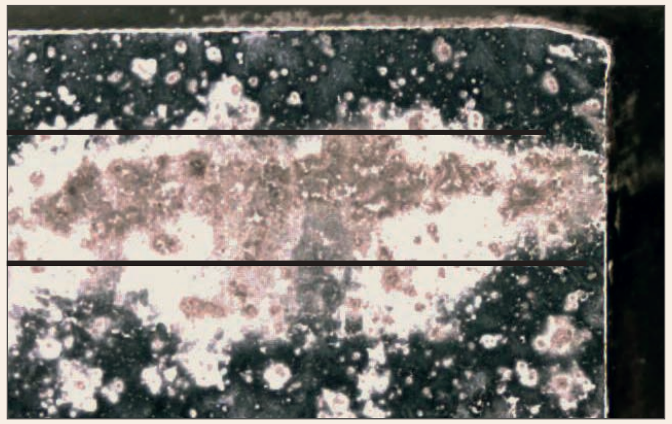

Figure 7: Cross-section through the ring showing the carbon rich zone depicted between the black lines. The outer surface is orientated at the top of the picture.

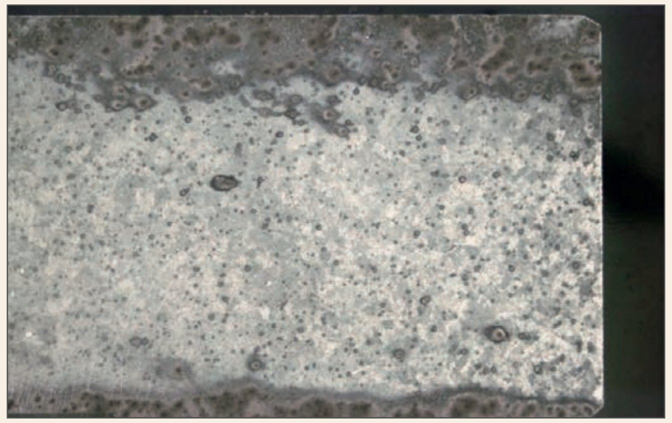

Figure 8: Cross-section through a non-failed ring showing the carbon rich zone at the outer and inner surfaces of the ring. The outer surface is orientated at the top of the picture.

3.2 SEM examination

The SEM investigation focused on the fracture face, the corrosion pits and the microstructure. Examination of a number of samples indicated the cracking on both the fracture face (Figure 9) and in the cross-sectioned alloys was predominantly intergranular in nature, that is, the cracks propagated along the edges of the martensitic grains. The cracks evident on the outer surface (Figure 10) and observed in the cross-section samples all appears to have initiated at corrosion pits (Figure 11 and Figure 12).

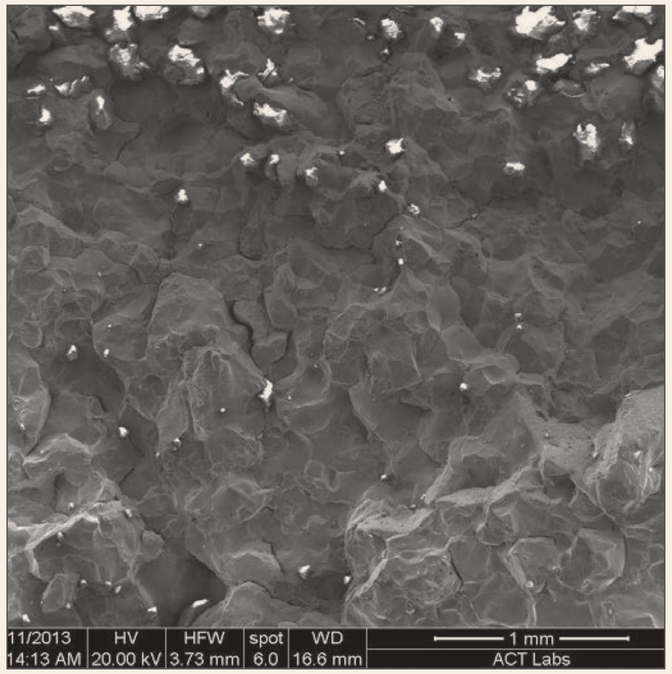

Figure 9: Fracture face showing predominantly intergranular cracking.

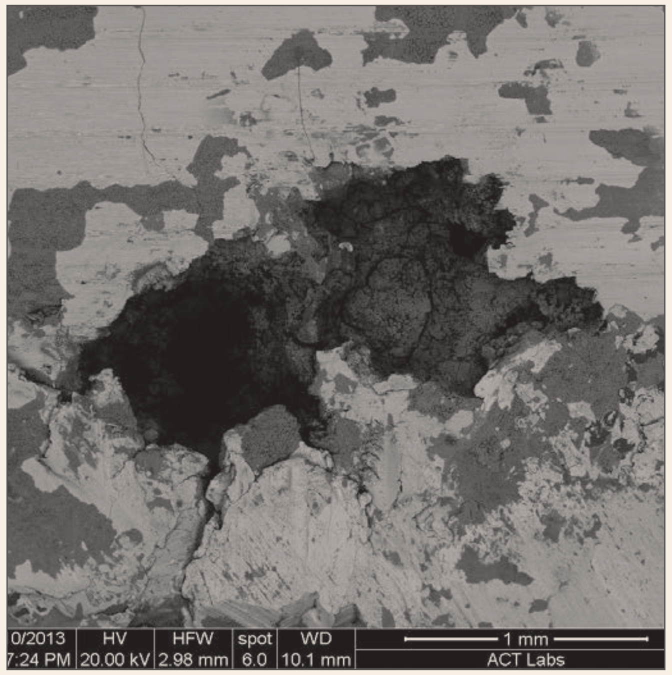

Figure 10: Surface cracks appear to originate at the corrosion pits on the outer surface of the wear ring

The microstructure for the tempered martensitic alloy is expected to have a finely dispersed carbide precipitate within the grains of martensite. Examination of the microstructure of the failed impeller wear ring and several rings which had not failed indicated the bulk microstructure was different to the microstructure in the carbon rich zone. The bulk microstructure was tempered martensite with occasional pools of ferrite and a discontinuous grain boundary chromium carbide network. In the carbon rich zone the discontinuous grain boundary chromium carbide network was more extensive and interdendritic chromium carbide dispersion was observed. Within this zone, shrinkage porosity was detected suggesting the quenching process for the casting resulted in a non-uniform cooling.

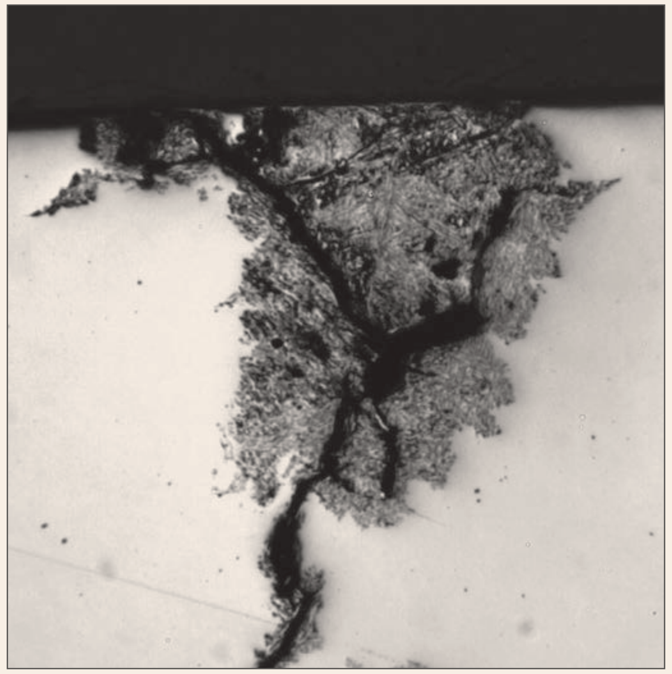

Figure 11: Intergranular cracking originating at a corrosion pit surrounded by a zone of heavier carbides (unetched)

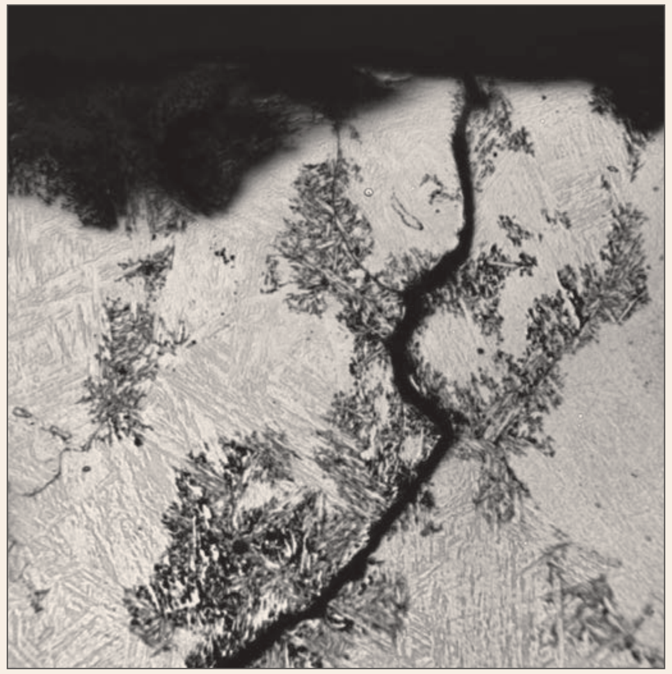

Figure 12: This section shows cracks propagating from corrosion pits through a zone of heavier carbides. The large crack is both intergranular and transgranular and the smaller cracks are intergranular.

Further examination of the sections through the corrosion pits indicated the pits had formed in areas containing relatively high levels of carbides compared with the bulk tempered martensite microstructure (Figure 11 and Figure 12)

3.3 Chemical and Physical Tests

The bill of materials for the pump indicated the wear rings were ASTM A743 grade CA 15. The chemical requirement of this alloy is: 11.5-14% chromium with alloying additions not to exceed 0.15% carbon, 1% manganese, 1.5% silicon, 0.04% phosphorous, 0.04% sulphur, 1% nickel and 0.5% molybdenum. Chemical analysis of the bulk conformed to these chemical requirements. However, the analysis of the carbon rich zone indicated the carbon content exceeded the maximum allowable level of 0.15% carbon. A carbon content of 0.275% was recorded from the analysis of the carbon rich zone of the impeller wear ring from one of the pumps. Comparative hardness testing indicated the carbon rich zone was harder than the bulk material for individual samples. Comparison of the bulk material hardness between several impeller wear rings indicated the tempering process was poorly controlled as the hardness was found to range from 23 to 40 HRC.

An assessment of the water quality data indicated the water was low in both chlorides and residual chlorine, both of which are common contributors to corrosion of stainless steel elements. Therefore the water is not considered to be aggressive towards the CA 15 alloy.

4. Contributing Factors to Failure

The carbon rich zone in the wear ring is effectively a large casting defect, containing shrinkage porosity and a microstructure that is different from the bulk microstructure. The discontinuous grain boundary chromium carbide precipitate network that was observed in some parts of the bulk microstructure can also be considered a casting defect. These type of casting defects are generally only considered a significant issue if the defects are exposed on the wetted surface of the casting. Internal defects typically have less impact on the corrosion resistance.

On the impeller wear ring the presence of chromium carbide precipitate exposed on the wetted surface, that is the ends and the outer surface, has provided a site for corrosion initiation. The formation of chromium carbide precipitates in the grain boundaries results in the depletion of chromium in the zone adjacent to the grain boundary. As chromium is the alloying element that is predominantly responsible for corrosion resistance, a significant depletion can result in a loss of corrosion resistance. The CA 15 alloy is a low chromium stainless steel and the impeller wear ring were analysed with chromium contents ranging from 12.1 to 12.5%. This level is quite low and it would not take a significant reduction in chromium levels to take the depleted zone below the minimum 11.5% resulting in inadequate corrosion resistance to the fresh water environment. It is possible that locally the chromium level may have been reduced below the minimum 10.5% required to classify the material as a stainless steel.

The discovery of grain boundary carbides, corrosion pits and intergranular cracking tends to indicate the corrosion propagated along the grain boundaries. It is likely that as the corrosion pits reached a certain size they acted as stress concentrators for crack propagation. This stress concentration effect combined with the residual stress associated with the interference fit method of wear ring installation is thought to be sufficient for the cracking to continue to propagate. There was no apparent cracking surrounding the very small corrosion pits, suggesting the corrosion pits do not act as a stress concentrator until the diameter of the corrosion pits had reached a certain size.

It is believed the residual stresses in the wear ring are slightly higher on the outer surface of the impeller wear ring. This is expected to contribute to the propagation of the cracks from the outer face to the inner face.

Galvanic corrosion was initially considered a possible contributing mechanism for corrosion and subsequent cracking of the impeller wear ring. The stainless steel impeller wear ring is in direct contact with the nickel-aluminium-bronze impeller. Galvanic corrosion is generally a less significant issue in fresh water that contains low levels of chlorides and residual chlorine compared with seawater environments due to the lower conductivity of the environment. If a galvanic effect were to be observed in an environment with low conductivity, like fresh water, it would typically be localised around the interface between the two metals. Inspection of the interface region of the wear ring and the impeller did not identify a galvanic effect. Review of the available information concerning galvanic corrosion in fresh waters indicated that most stainless steel alloys and copper alloys in general have the same potential in moderately hard fresh water [5]. As the potential difference between the two types of metals is expected to be minimal in fresh water, a galvanic reaction is not expected between the impeller wear ring and the impeller.

The investigation into the failure indicated that initial hypotheses into the cause of failure were unlikely. Neither galvanic corrosion nor corrosivity of the fresh water appears to have contributed to the failure. Initial chemical analysis of the bulk microstructure implied the alloy complied with the requirements of ASTM A743 grade CA 15 and therefore it seemed unlikely this had contributed to the failure. However the discovery the microstructure was not homogeneous and the carbon content of the carbon rich zones exceeded the maximum allowable level of 0.15% carbon, indicated the local composition may have contributed to the failure.

The various tests undertaken indicated the casting process had resulted in the production of an alloy which had a non-homogenous microstructure and properties. In the fresh water environment which should have not been unduly corrosive to the CA15 alloy, corrosion pits initiated in the chromium depleted zone adjacent to the chromium carbides which formed during the casting process. Propagation of these corrosion pits and subsequent development of cracks resulted in failure of the impeller wear ring.

5. Conclusions

Based on the composition of the selected martensitic stainless steel alloy it should have had satisfactory corrosion resistance to the fresh water environment. However the introduction of defects and a non-homogenous microstructure through the casting process resulted in the reduction of the corrosion resistance along the grain boundaries. This reduced corrosion resistance coupled with the residual stresses introduced by the interference fit installation method of the impeller wear ring resulted in corrosion initiation and intergranular cracking and unexpected failure of the wear ring.

The process of selecting materials for the components of the pumps needs to consider not only the likely corrosion resistance based on the composition of the alloy but also the likely corrosion resistance based on the method of manufacture, in this case casting.

6. References

[1] Lippold, J.C; Kotecki, D.J: Welding metallurgy and weldability of stainless steels. John Wiley and Sons, 2005

[2] Bauccio, M (Ed): Metals Reference Book. ASM, 1993

[3] Castings - Stainless Steel and Nickel Base. Nickel Institute Reference Book Series (11022), 2000

[4] Tuthill, A.H: Procurement of quality stainless steel casting. NiDI Technical Series No. 10 021, 1988

[5] Francis, R: Galvanic Corrosion: A Practical Guide for Engineers, NACE International, 2001

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