Vol. 4 Issue 3 | 2018

Corrosion Exclusively










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- The risks of ignoring maintenance – Moradi Bridge
- Field joint coatings
- Eliminating coating failures
- The worlds largest moveable structure
- Darlington Upgrade Project
- Feedback on AfriCORR

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While looking back we are extremely proud of our history and our heritage, but looking forward is much more important to us. One man that is always looking forward is the Director of Transvaal Galvanizers, Francesco Indiveri. With Mr Indiveri at the helm, Transvaal Galvanizers has expanded into new markets focusing extensively on renewable energy projects.

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We constantly aim to continually improve ourselves by adapting to changing times and markets whilst ensuring that we always stay focused on client satisfaction. It is this focus that has brought us to where we are today, and we know that this focus will take us to even greater heights over the next 33 years.

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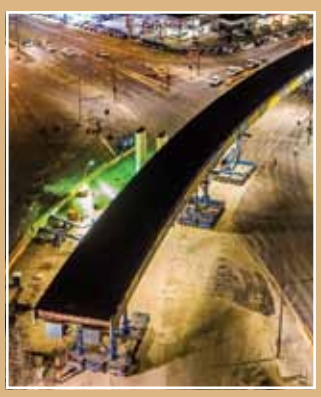

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President's Comment

Its hard to believe that 2018 is almost over. So much has happened in the space of twelve months at CorrISA, my personal life, my work life as well as in our beloved country South Africa.

Just the other day we were full of praise for Nene and now we are full of praise for Tito. May our new finance minister direct the South African ship through choppy waters and into the sea of prosperity!

The last quarter has seen CorrISA hold yet another successful Africorr. We are already planning for Africorr 2020 with our friends in Texas and this event promises to also be successful.

The management and council have been hard at work behind the scenes in finalising CorrISA's SAQA offering to the industry and we will hopefully be ready to launch our course offering soon.

I would like to thank Petra from Artep Central for her hard work and dedication in getting CorrISA to where we need to be.

In September we held our AGM and as always, this event brought up pertinent points that have now been addressed.

I am proud of our staff who pushed through the 2018 financial year with great financial success and we look forward to continuous success in 2019 under the directorship of Hendrik Rasebopye.

In October we held two very well attended NACE CIP courses and will be holding an additional two NACE courses in November 2018.

In November, The Corrosion Institute of Southern Africa will be holding our annual golf day. Please book your four ball as this event is always well attended.

The Corrosion Institute of Southern Africa has applied for our Section 18A Certificate which enables companies to obtain additional BBBEE points when sponsoring certain CorrISA events. Please contact the staff at CorrISA for further details.

The Cape Region will be holding a technical evening for "Corrosion in the Refinery Industry" in November, please contact Graham Duk for more information.

The Cape Region held a mini expo in September which was well attended and supported by exhibiting companies.

The Cape Region will be hosting their annual dinner on the 23rd November 2018. Please book tickets as soon as possible as this even is historically very popular.

The Kwa-Zulu Natal Region will be hosting a joint technical evening in conjunction with Occa which is titled "Surface Preparation standards for project Success ", all are welcome to attend.

Additionally, Kwa-Zulu Natal Region will be holding their annual golf day at The Kloof Golf Club on the 30th November 2018 please contact admin@corrisa.org.za if you would like to book a four ball.

In September "The Core" hosted three universities WITS, TUT and VUT for a corrosion debate. We would like to congratulate The University of The Witwatersrand for winning this event.

In the spirit of the festive season I would like to wish you all a restful break and happy New Year.

Donovan Slade, President – Corrosion Institute of Southern Africa

OBJECTIVE OF THE MAGAZINE

"The objective of ***'Corrosion Exclusively'*** is to highlight CORRISA activities, raise and debate corrosion related issues, including circumstances where inappropriate material and/or coatings have been incorrectly specified, or have degraded due to excessive service life. Furthermore, it shall ensure that appropriate materials or coatings, be they metallic or otherwise, get equal exposure opportunity to the selected readers, provided these are appropriate for the specified exposure conditions on hand."

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Cover: Some of the exhibits at Ditsong National Museum of Military History, Johannesburg, including some unavoidable corrosion which has happened over the years in service, plus our entertainment at the recent Johannesburg Awards Evening.

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Editorial Comment

We must apologise for only publishing three editions in 2018, where four was the prerequisite. The reason for this was the purposeful delay in our second publication, *Vol 4 Issue 2*, this year due to AfriCORR.

Hopefully this edition will have been worthwhile waiting for?

Our feature articles for this third issue of 2018 are:

The risks of ignoring maintenance of major infrastructure, which the authorities in this country often seem to do – "The collapse of the Moradi Bridge" part of the Polcevera viaduct on the A10 motorway in Genoa, Italy.

We feature two NACE articles which have previously appeared in Materials Pro: Field Joint Coatings by Lee Wilson and Eliminating Coating Failures by Ed Darrimon and Doug Weybright.

Warren Brand of Chicago Corrosion Group together with the European Bank for Reconstruction and Development, discuss "The world's largest moveable structure – you have most probably never heard of?

From the Australian Corrosion Association (ACA) we feature the "Darlington Upgrade Project", a corrosion love story.

From the KETTLE, a regular contribution on hot dip galvanizing we discuss surface condition F20 – Distortion; the result of inappropriate design and fabrication as well as F21 – Ungalvanized surfaces caused by oil based marking paint, cutting / rolling oil or dye penetrant testing material.

Hendrick Rasebopye the Director of CorrISA, residing in Johannesburg presents his message.

We report on many of the CorrISA activities in Gauteng, including AfriCORR held at the Ditsong National Museum of Military History, Johannesburg where amongst the armed vehicles, aeroplanes and attack guns we had a successful corrosion conference. Later in that week the Annual Awards Evening took place at Moya Restaurant in Parktown, where amongst the receipt of a number of awards, many had their faces painted; the AGM; technical evenings where two reciprocal memberships were presented. CorrISA staff attended a successful Electra Mining exhibition and the winning students of a corrosion debate presented by CorrISO, were awarded.

Finally, we present the President's Dinner and the annual fishing day.

Graham Duk and Mark Terblanche together with Karyn Albrecht the Western Cape and KZN joint chairmen respectively give account of their activities.

In the Cape Region, we report back on the recent Fireside Chat where mature members reflected on their experiences of bygone years; tour of SAT where we learnt about abrasives; the Cape Region AGM; the Mini Exhibition as well as the Surcotec plant tour seeing techniques of metal spraying.

Blast from the PAST, features the original Plascon paints factory built in 1948.

In "The RUST Spot" Rob White who has been part of CorrISA for as long as I can remember, gives us an account of his involvement with CorrISA over the years.

We wish to thank both our loyal advertisers, kind contributors and readers for their amazing support, during 2018 without whom the magazine would not be successful and furthermore wish all of you a Good Rest, Good Health, Peace and Happiness and restful break at the year-end holidays.

Should a reader wish to comment on any of the previously published articles or select a specific subject for discussion in a future edition of the magazine, kindly contact me.

Terry Smith

The risks of ignoring maintenance of major infrastructure

Ponte Morandi (English: Morandi Bridge) is part of the **Polcevera viaduct** on the A10 motorway in Genoa, Italy. The bridge, on one of the major links from Italy to France and part of the European route E80, crossed the Polcevera river between the Sampierdarena and Cornigliano districts of Genoa. The viaduct was built between 1963 and 1967, costing £3.8 billion (€2 million), and opened on 4 September 1967; the bridge was named after its designer, Riccardo Morandi.

On 14 August 2018, the bridge partially collapsed, killing 43 people.

History

Design

The bridge was designed by Riccardo Morandi. It is similar to his earlier 1957 design for the General Rafael Urdaneta Bridge, located at the outlet of Lake Maracaibo in western Venezuela, which partially collapsed in 1964 when the tanker Esso Maracaibo collided with the approach spans. [Morandi's cable-stayed bridges are characterised by a prestressed concrete structure for the piers, pylons and deck, very few stays, as few as two per span, and a hybrid system for the stays constructed from steel cables with prestressed concrete shells poured on. The concrete was only prestressed to 10 MPa, resulting in it being prone to cracks and water intrusion, which caused corrosion of the embedded steel.

Construction

The viaduct was built between 1963 and 1967 by Società Italiana per Condotte d'Acqua. It had a length of 1 182 metres (3 878 ft), a height of 45 metres (148 ft) at road level, and three reinforced concrete pylons reaching 90 metres (300 ft) in height; the maximum span was 210 metres (690 ft). It featured diagonal cable-stays, with the vertical trestle-like supports made up of sets of Vs: one set carrying the roadway deck,

Ponte Morandi in 2010, viewed from west.

while the other pair of inverted Vs supported the top ends of two pairs of diagonal stay cables.

The viaduct was officially opened on 4 September 1967 in the presence of Italian President Giuseppe Saragat.

Maintenance and strengthening

The bridge had been subject to continual restoration work since the 1970s due to an incorrect assessment of the effects of creep of the concrete. This resulted in excessive deferred displacement of the vehicle deck so that it was neither level nor flat; at the worst points, it undulated in all three dimensions. Only after continual measurement, redesign and associated structural works was the vehicle deck considered acceptable, approaching horizontal by the mid-1980s.

In a 1979 report, Morandi recommended: "remove all traces of rust on the exposure of the reinforcements, fill the patches with epoxy resin, and cover everything up with elastomer of very high chemical resistance". In the 1990s, the tendons on pillar 11 appeared to be most damaged. As of the collapse of the bridge, only pillar 11 had been internally inspected in the 1990s, showing severed and oxidized strands. From 1990 onward, the eastern most pillar 11 had its stays strengthened by flanking them with external steel cables. Pillar 10 had the stays at the top strengthened with steel sheathing in the 1990s. Following the collapse many questions have been raised about the stays. In 1979/1980, a sister bridge of the ponte Morandi in Venezuela suffered one or more stay cable failures with collapse imminent.

The former Italian Minister of Infrastructures and Transports, Graziano Delrio, who was in charge until 1 June 2018, was informed several times during 2016 in the Italian Parliament that the Morandi Bridge needed maintenance.

In Genoa, in 2017, a confidential university report noted disparities in the behaviour of the stays of the now collapsed pillar 9. The report of a February 2018 government meeting indicated resistance and reflectometry measurements had been performed indicating an "average" reduction of the cross section of 10 to 20% of the tendons. A crack in the road had appeared at least fourteen days before the collapse near one of the southern stays of the now collapsed pillar 9. The crack may have indicated that the stay had stretched. At no point was there a suggestion to reduce the load on the bridge. Traditionally, bridges were only designed for a 50-year life span.

On 3 May 2018, the Autostrade Company announced a call for tenders for a structural upgrade of the viaduct to the value of €20 159 000, with a deadline of 11 June 2018. The work on the reinforcement of the stays on pillars 9 and 10 would have needed to be finished within 5 years.

Workers were installing new heavy concrete Jersey barriers on the Ponte Morandi before it collapsed, reducing the compressive pre-stress on the concrete of the stays and increasing the loads.

2017 Modal analyses

In 2017, Carmelo Gentile and Antonello Ruccolo of the Polytechnic University of Milan studied the modal frequencies and deformations of the stays of the bridge. On pillar 9 they were only able to identify 4 global modes. Two of the identified modes had not fully compliant deformations. Modal frequencies were more than 10% different, specifically on the southern stays. In concrete pre-stressed beams such difference can represent the entire effect of the non-linear pre-stresses. As little as a shift of 2% could represent severe damage. The pre-stress in the Ponte Morandi has been characterized as relatively small from the start. In contrast, for bare tendons which are relatively

The bridge after the partial collapse in August 2018.

under-constrained such as the strings in a piano, the effect of pre-stress is dominant in determining the resonant frequency. Other than pre-stress, changes in geometry, such as corrosion in the tendons could impact the resonance frequency. The effects would be reduced by the composite nature of the stays when observing global modes. Gentile had performed similar modal analyses on pillar 11 in the 1990s. Other related methods were applied on the stays of Ponte Morandi in the 1990s such as reflectometry, which was able to measure the tension but not strength of the tendons.

Replacement proposals

By the mid-2000s, the A10 route through Genoa and over the bridge had become highly congested. The City council requested proposals for improvement of traffic flow through Genoa, with the Autostrade Company in 2009 proposing the "Gronda di Ponente" project to improve flow, by moving traffic to a newly built Autostrada interchange system located to the north of the city. As part of the initial study and report, the Autostrade Company measured that the bridge carried 25.5 million transits a year, with traffic having quadrupled in the previous 30 years and "destined to grow, even in the absence of intervention, by a further 30% in the next thirty years". The study highlighted how the traffic volume, with daily queues at peak hours joining the Autostrada Serravalle, produced "an intense degradation of the bridge structure subjected to considerable stress", with the need for continuous maintenance. The study showed that in the option for improving what was termed as the "low gutter", it would be more economical to replace the bridge with a new one north of its current location, and then to demolish the existing bridge.

In the 1990s the bridge had shown signs of weaknesses. At this point material support was added. Rust on metal materials of the bridge became more evident since then. In 2013, fears were expressed that the structural condition of the bridge was poor. Warnings that the bridge was in danger of collapse were dismissed by the Five Star Movement as a "fairy tale" on their website. In 2016, the bridge was characterised by Antonio Brencich, a Professor of Structural Engineering at the University of Genoa, as a "failure of engineering", mainly due to high maintenance costs.

Partial collapse

Location of the collapse, which resulted in the A10 motorway being severed and the closure of the railway lines from Genoa to Milan and Turin.

On 14 August 2018 at around 11:36 local time (09:36 UTC), during a torrential rainstorm, a 210-metre (690 ft) section of Ponte Morandi collapsed. This was centered on the westernmost pillar 9 which crossed the Polcevera river as well as an industrial area of Sampierdarena. Eyewitnesses reported that the bridge was hit by lightning before it collapsed. Between 30 and 35 cars and three trucks were reported to have fallen from the bridge.

A large part of the collapsed bridge and the vehicles on it fell into the rain-swollen Polcevera. Other parts landed on the tracks of the Turin–Genoa and Milan–Genoa railways, and on warehouses belonging to Ansaldo Energia, an Italian power engineering company, which were largely empty because the collapse occurred on the eve of the Italian public holiday, Ferragosto.

The initial hypotheses were that a structural weakness or a landslide caused the collapse. The bridge was reportedly undergoing maintenance at the time of the collapse, including strengthening the road foundations.

It has been reported that the southern stays gave way explosively due to corrosion and damage. With only four stays, if one of them had given way, the structure could have lost stability. An investigative preliminary report suggests the pillar itself may have collapsed instead first. This conclusion was criticized, as a video provided by the adjacent Ferrometal company showing the southern stays gave way first and which is in possession of the prosecutors had not been seen by the investigative committee. There is speculation that lightning may have struck the stays, or a landslide could have destabilized the base.

According to Corriere della Sera, this was the 11th bridge collapse in Italy since 2013.

Victims and rescue efforts

Forty-three people were confirmed dead and sixteen injured. Multiple survivors were transported to nearby hospitals, many in critical condition. Davide Capello, the former goalkeeper for Cagliari, survived without injury and was able to walk away from his car, even though it dropped 30 metres (100 ft) before becoming wedged between parts of the fallen bridge.

The area under the remaining part of the bridge, including several homes, was evacuated. As of 02:00 the following day

(midnight UTC), twelve people were known to be still missing, and voices could be heard calling from underneath the debris; rescue efforts were continuing by floodlight using techniques commonly deployed after earthquakes.

Aftermath and reactions

The railway between Genoa Borzoli and Genoa Piazza Principe was closed immediately as a result of the bridge's collapse. A bus replacement service was established between the two stations.

The day after the collapse, Prime Minister Giuseppe Conte declared a state of emergency for the Liguria region, which would last for a year. According to Deputy Minister of Infrastructure Edoardo Rixi, the entire bridge will be demolished.

The Italian Football Federation announced that a minute of silence would be held for the victims of the collapse before all football events across the country during the weekend that followed the incident. On 16 August, the Lega Serie A postponed the opening 2018–19 Serie A matches for both Genoese association football clubs Genoa and Sampdoria that were originally scheduled for 19 August.

The Italian Transport Minister Danilo Toninelli described the incident as "an immense tragedy". Governor Giovanni Toti said that the loss of the bridge was an "incident of vast proportions on a vital arterial road, not just for Genoa, but for the whole country". The disaster resulted in a drop in the stock price of the road's operator, Atlantia, by 5% the same day and by 25% two days later.

A state funeral was held on 18 August, inside the Fiera di Genova event arena, for 18 victims of the collapse, along with recognition for the firefighters and other rescue workers. Some of the victims' families refused to attend the service and instead hosted private funerals. The funeral was attended by Italian politicians such as President Sergio Mattarella, Prime Minister Giuseppe Conte, Interior Minister Matteo Salvini, Transport Minister Danilo Toninelli, and Secretary of the Democratic Party Maurizio Martina.

Infrastructure

The collapse raised concerns about the general condition of infrastructure in Europe, with studies in Italy, France, and Germany suggesting that a significant number of bridges are in need of renovation or replacement due to corrosion and structural deterioration. Infrastructure investment in Italy was reduced dramatically after the 2008 financial crisis. A resident of Genoa told reporters: "The central government will scapegoat the bridge company, the company will scapegoat someone else – they're all to blame. We all know how bad our infrastructure is in Italy."

The ruling coalition put pressure on managers of the road, Autostrade per l'Italia (who are part of the Atlantia group). Deputy Prime Minister Luigi Di Maio claimed that they were "definitely to blame." Minister of the Interior Matteo Salvini also blamed supposed EU spending limits for infrastructure, but this was immediately dismissed by EU officials. The position of the Benetton family, whose company owns 30% of Atlantia, has also come under view. Autostrade per l'Italia's chief executive, Giovanni Castellucci, said that the bridge would be rebuilt within eight months.

Investigative committee

The investigative committee was to be chaired by Roberto Ferrazza and to have as an expert member Antonio Brencich. However, these two committee members were immediately criticized for being among the signers of the February 2018 government report that failed to impose precautionary measures on the weakened bridge. On 23 August 2018, Brencich resigned from the inspection commission, and Minister Danilo Toninelli removed Ferrazza as the chair, for "reasons of opportunity in relation to all the institutions involved in this affair".

Symbol

A Volvo FH truck 12 380 belonging to Damonti Trasporti S.R.L. and in services for Basko Supermarket, painted in blue and green, became a widely publicized symbol of the disaster because it remained standing almost at the edge of the collapsed section. The 37-year-old driver at the time of the accident recounted to the media how he looked in shock as the bridge busy with dense traffic collapsed in front of him, as he brought his vehicle to a stop and ran back until he reached firm ground.

Full acknowledgement and thanks to Wikipedia.

Field joint coatings

By Lee Wilson, Corrosion Control and Solutions, Tyne and Wear, United Kingdom

Engineering and selecting the most adequate and appropriate pipeline coating depends upon a multitude of factors. Careful analysis of several critical factors must be considered, such as the pipe diameter, the service pressures or operating temperatures of the transport materials, the soil conditions if installing a landline, construction techniques for installation, cathodic protection (CP), and whether impressed current CP or sacrificial CP will be used. These are all factors that will determine the material selection for pipeline protection; and it is important to understand that the critical field joint zone and girth weld will be subjected to precisely the same factors, stresses, and service conditions.

A field joint coating system must be integrated into a pipeline's construction conditions.

What is a field joint?

The area where two pipe spools or pipe joints are welded together is known as the field joint.

This is a significant area because the pipe is welded here and its surface is uncoated. Subsequently, the field joint is exposed to the environment and susceptible to corrosion. Field joints are often considered the weakest point within a pipeline primarily due to compatibility issues between the factory-applied or mainline coating and the selected material used to protect the field joint. Some of the most important properties that field joint coating systems must provide are:

- Long-term corrosion protection and thermal insulation performance
- Excellent adhesion to the substrate that is to be protected
- Exceptional compatibility with the factory or mainline coating system
- The ability to be applied under extreme environmental conditions
- Ease of application — to ensure rapid application and reduced field joint cycle time.

Challenges when engineering the most suitable anticorrosion protection systems for the transport pipeline include cost effectiveness, safety of operators and applicators, the proposed lifetime of the structure, local legislation, and coating in conjunction with CP. There are many other factors as well that depend greatly upon the pipe itself.

Field joint on riser.

A close up of a welded and repaired field joint.

Corrosion is one of the leading causes of failures of subsea and land-based pipeline transportation systems, with both internal and external corrosion recorded as significant factors in pipeline coating failures. Significant catastrophic failures recorded in recent history have linked corrosion failure to health, safety, and environmental consequences for operators and the public, and fines for negligence have cost hundreds of millions of dollars. The criticality of engineering a suitable field joint coating to cope with extreme environmental and service conditions is imperative.

Coating a field joint

In recent years there have been significant changes to the way field joint coating systems have been engineered. Traditionally the field joint coating was often overlooked and protection for this crucial zone was based upon compatibility with the mainline coating, regardless of whether or not the field joint coating requirements were different.

Several factors differ between the mainline factory coating and the field joint coating. For example, the mainline coating is often applied in ideal factory conditions using specialized equipment, and time spent on surface preparation and application is not critical. Since field joint coatings are applied in the field, they are subject to extreme environmental factors with differences

Protecting buried pipelines involves prevention of third-party drainage to coating and CP systems, as well as effective corrosion control.

in ambient conditions. Historically, the application of field joint coating systems has been rushed to adhere to critical cycle and production times, which has subsequently led to quality issues and premature failures. Simply put, the field joint coating system must be integrated into the pipeline construction conditions.

To develop a successful field joint coating system, the engineer needs to consider additional factors such as specifying the correct product to ensure compatibility of the material to the mainline coating, and the overall coating systems performance with respect to pipeline operating conditions. The corrosion rate depends on various parameters, including but not limited to pipeline operating temperatures, soil or water conductivity, external accelerators, acids and alkalis, microbiologically influenced corrosion, chemical attack, stray current corrosion, and pipeline stresses that lead to stress corrosion cracking.

Based on the nature of the parent coating or factory-applied coating, the field joint coating system may consist of single or multiple layers of selected protective coating materials. These are applied for numerous purposes that include corrosion control, mechanical protection, thermal insulation, and adhesion. While there are a variety of materials used as a pipeline field joint coating, the following are the most predominantly used and specified systems for pipeline protection: cold applied polymeric tape, polyethylene (PE) and polypropylene (PP) heat shrink sleeves used in conjunction with or without a primer, fusion-bonded epoxy (FBE), liquid epoxy, PP coatings applied on FBE, PE coatings applied on FBE, polychloroprene coatings, polyurethane (PUR), three-layer polyethylene coatings (3LPE) , three-layer polypropylene coatings (3LPP), and three-layer polyolefin coatings (3LPO).

Standard for field joint coatings

All coatings have distinct advantages and disadvantages, with many property and characteristic variables that should be taken into consideration. There have been many developments in recent years regarding standards for field joint coating systems.

In 2016, the second edition of ISO 21809[1] was published. This standard specifies the requirements for a field joint coating on seamless or welded steel pipes for buried and submerged sections of pipeline transportation systems used in the petroleum, petrochemical, and natural gas industries as defined in ISO 13623.[2]

ISO 21809 has clear definitions, scopes, requirements, and recommendations for engineers to follow. For example, it elaborates on surface preparation techniques; material selection; material testing; material field testing; acceptance and rejection criteria requirements for joint preparation and repairs; and testing methods such as thickness checks, holiday detection, peel strength, adhesion testing, hot water immersion testing, degree of cure, cathodic disbondment, impact resistance, indentation resistance, oxidation induction times, and flexibility.

It is essential that the pipeline is fully protected from corrosion so petroleum products are contained, and this standard is a major leap in achieving this.

References

1 ISO 21809-3:2016, "Petroleum and natural gas industries – External coatings for buried or submerged pipelines used in pipeline transportation systems – Part 3: Field joint coatings" (Geneva, Switzerland: ISO, 2016).

2 ISO 13623:2009, "Petroleum and natural gas industries – Pipeline transportation systems" (Geneva, Switzerland: ISO, 2009).

About the author

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Eliminating coating failures –

A case study for achieving long-term cost savings in the oil field

By Doug Weybright and Ed Darrimon

Failure of a produced water storage tank lining within one to two years was common. Poor surface preparation was the main cause. This article shows how proper blasting, salt removal, and the use of a heat-resistant lining material will give the tanks the service life desired by the owner.

This case study provides a historical perspective to demonstrate that giving special attention to surface preparation and eliminating surface contaminants prior to coating can essentially eliminate premature coating failure. The pivotal and critical variables are the rigorous testing for and elimination of surface residual salts. Utilization of advanced inspection procedures is also a major factor. This process leads to the prevention of premature lining failures.

This is the case history of one of several major oil producers in the San Joaquin Valley, whose core competency is thermally enhanced production and recovery from various oil fields in California. The company's significant asset base produces a large share of the heavy, viscous oil extracted through steam injection in one of California's most prolific producing areas. Oil fields with low-gravity crude oil are steam flooded *(Figure 1)* with softened water injected into production zones. With the heat, the oil becomes less viscous, allowing it to be pumped to the surface along with formation water and water condensate.

The crude oil and water mixture returning to ground level at temperatures of ~160°F (71°C) goes through a separation process. The water is typically accumulated in 5 000- to 10 000-bbl (795 000 - to 1.59 million-L) produced water tanks. These steel tanks store valuable recovered water and are found all over the producing areas of the San Joaquin Valley, which until recently represented almost 10% of all crude oil produced in the United States.

Since the crude oil is nitrogen rich, it has significant levels of naphthenic acids, and contains an average of 1.1% sulfur. It is common for the water held in the produced water tanks to have significant levels of chloride, nitrate, and sulfate soluble salts, and a pH value of 6.8. This high concentration of anions occurs because the geological formation waters are typically salt brine – similar to seawater. It is also common that acidic gases (such as hydrogen sulfide [H_2S]) are recovered along with the production of the oil and water, which lead to corrosion in the vapor spaces of the tanks. All of these factors require the application of a complete, durable internal lining of tanks as a corrosion prevention measure.

History

California has been vital in meeting the energy needs of the United States. The 2 billionth barrel was produced in 2007 from reserves calculated at 60 billion bbl (9 540 billion L). These oil fields are some of the oldest and most prolific. In Kern River, a small area of central San Joaquin Valley, oil was discovered in 1899. In 1960, in situ steam recovery began and has since been expanded and made dramatically more efficient to remain competitive with the swings in global oil prices. Thermally enhanced oil extraction had its inception in this area and experience here has been transferred to the tar sands of northern Alberta, Canada and the heavy tar oil fields of Venezuela. Kern County continues to produce low-gravity oil at a rate of ~550 000 bpd (87.4 million L/d).

Coating specification revision

Prior to 2003, the company's surface preparation specifications for produced water tank lining projects required only a white metal blast, repair of pits, surface testing by conductivity for residual contaminants, and coating with a thermally tolerant lining. The surface area for preparation involved the entire tank interior, including the roof, or ~7 500 to 9 500 ft^2 (697 to 947m^2). The common experience was that the coating system would fail in less than two years, with many documented cases of coating failure in less than a year. Various thin-film coatings had been used and it was originally thought that the coating systems were unable to tolerate the rising operating temperatures, which increased incrementally through the years as thermal injection became more efficient. More robust thin-film, solvent-based, and thermally resistant coatings were applied, yet failures continued unchecked. Forensic analyses of

Water is typically accumulated in 5 000- to 10 000-bbl (795 000 - to 1.59 million-L) produced water tanks.

Figure 1: Steam injection platform.

failed coatings indicated 12 to 16 mils (300 to 400µm) of dry film thickness; however, it was not the coating that was intolerant to the service but rather inadequate surface preparation that led to osmotic blistering and spot coating failures *(Figure 2)*. Modification of surface preparation methods by incorporating the use of ultra-high water pressure blasting did not resolve the problem.

The company worked closely with Bay Area Coating Consultants (Modesto, California), an industry-recognized third-party consulting and inspection firm, to change its specification, and tendered it for contractor bidding in August 2003. The initial changes included testing for chloride, sulfate, and nitrate ions immediately after white metal abrasive blasting or ultrahigh pressure (UHP) washing. Special attention was given to testing around weld seams and where metal loss or pitting was apparent. These were the locations where forensic analysis of coating failures showed the largest number of osmotic blistering and coating degradation. Other changes instituted were post-cleaning, use of 100% solids material, more aggressive anchor profile and blast cleanliness, use of climate control equipment, and prequalification of application contractors.

Given the anion concentration in the produced water stored in the water tanks, the chloride, sulfate, and nitrate ions were prevalent on the metal surfaces and tested at double-digit µg/cm^2 levels or above, even after the white metal abrasive cleaning or 40 000 psi (276 MPa) pressure washing. Educating contractors and ensuring the specification requirements were followed were key factors for ensuring the success of the process. The inspectors were hired as a third party to document compliance with the specification; and they were also tasked with monitoring the deionized water used in the wash process and testing the abrasive material to make sure anion concentrations of both media were within acceptable limits.

The revised work process

The recoating of a produced water tank can take several weeks. After taking a tank out of service, all surfaces are cleaned to remove oil, grease, and sediment using a >3 000-psi (21-MPa) pressure washer and an acceptable surface degreaser in accordance with API 653.[1] Welding and structural repairs follow. The next step is a thorough commercial blast using an abrasive with specified limits of 4 ppm chloride, 20 ppm nitrate, and 20 ppm sulfate. These limits are confirmed with the CHLOR*TEST "CSN"† test kit to ensure salt contaminants are not added to the surface.

After the initial abrasive blast, CHLOR*RID† is used as the soluble salt remover. It is applied with a 35 000-psi (241-MPa) UHP washer with a spinner nozzle to the entire internal surface of the tank in a diluted solution with a ratio of 1:100 salt remover/water.

New tanks do not require UHP and pressure can be reduced to 5 000 psi (34 MPa). Surfaces are then abrasive blasted to NACE

Figure 2: Corrosion on the inside of the produced water tank.

Figure 3: White metal blast, as defned in NACE No. 1/SSPC-SP 5.

Figure 4: Surface testing.

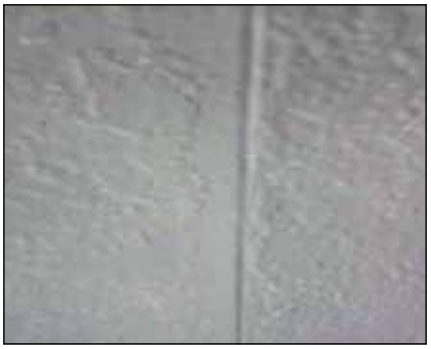

Figure 5: Coating at a weld seam.

No. 1/SSPC-SP 5[2] (white metal) *(Figure 3)* and followed by surface testing to ensure the salt limits have been met. The test kit is specified for testing surface chloride, nitrate, and sulfate ions. The limits are non-detectable levels of chloride, 5 µg/cm^2 for nitrate, and 5 µg/cm^2 for sulfate. The anchor profile required is 2 to 4 mils (51 to 102µm) *(Figure 4)*.

A rigorous review of comparative project costs to determine the impact of the specification changes to ion-specific testing and incorporation of salt decontamination determined there is no added incremental cost. The ion-specific testing and test kit provide one decontamination step *(Figure 5)* to replace inadequate conductivity surface testing and multiple high- pressure washes with an undetermined outcome.

Enviroline 405HT†, an epoxy novolac high-solids coating, proved to be thermally tolerant at operating conditions with temperatures of ~160°F (71°C), and allowed temperature excursions up to 190 °F (88°C). It was first used on a produced water tank in late 2004. To be applied properly at 20 to 40 mils (508 to 1 016µm) *(Figure 5)*, the plural-component coating requires a learned technique.

No coating failures occurred within 10 years after initiating the new regimen of critical surface preparation that tests for and removes residual soluble salts. This is a dramatic change from the previous average of two years between maintenance recoats. The successes of corrosion mitigation and dramatic cost reduction for produced water tanks have been impressive. The direct cost for recoating a produced water tank as part of a corrosion mitigation project averages between $170 000 and $250 000, depending on tank size. By increasing the corrosion protection from about two years to almost 10 years, this represents a savings of ~$1 000 000 in nominal terms for a 5 000-bbl tank. More importantly, it can be expected that these coatings will last a minimum of 20 years, which doubles the savings.

The indirect costs related to such a project are more difficult to quantify but important to consider. Reduced management overhead, less tank downtime and a reduction in lost or deferred oil production, and lower environmental waste disposal costs due to improved life cycle coating performance are all very real. Additionally, the environmental impact of mobilizing crews to conduct frequent maintenance recoats has been reduced. Loss of revenue associated with a shut-down in crude production (if the tank was in service prior to the maintenance coating project) is a prominent factor to consider and a motivator to return the tank to service expeditiously. These additional avoided costs and loss of revenue exponentially magnify the financial incentives associated with initially giving critical attention to surface preparation.

Conclusions

The cause of early lining failure in the produced water tanks was determined to be improper surface preparation. The revised coating specification required proper blasting, salt removal, and the use of a heat-resistant lining material. The work provided the owner with a long-lasting lining and saved the cost of relining the tanks every few years.

† ***Trade name***

References

1 API 653, "Standard for Tank Inspection, Repair, Alteration and Reconstruction" (Washington, DC: API, 2013).

2 NACE No. 1/SSPC-SP 5, "White Metal Blast Cleaning" (Houston, TX: NACE International).

About the authors

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The world's largest movable structure you've probably never heard about

By Warren Brand

"It is the mark of a truly intelligent person to be moved by statistics" George Bernard Shaw

So let's start with the numbers:

- Weight: 40 000 tons – roughly the weight of 3 Eiffel Towers, 107 fully loaded 747s or the USS Missouri battleship.
- Height: 180m – roughly tall enough to house London's St Pauls or Paris' Notre Dame Cathedrals or the height of the Seattle Space Needle or the Washington Monument.
- Length: 162m long – roughly one and a half soccer fields.
- Clear span: 257m – roughly just over two soccer fields wide, with the frame being a huge lattice construction of tubular steel members, supported by two longitudinal concrete beams.
- Design life: Minimum 100 years. The sophisticated ventilation system eliminates the risk of corrosion.
- Environment: It provides a safe working environment equipped with heavy duty cranes for future dismantling of the existing shelter and waste management after the completion of the NSC.
- Designed to withstand temperatures of between minus 27ºC and plus 95ºC and winds up to a class 3 tornado (332kph) – calculated at a once-in-a-million-year event – and a 5.4 magnitude earthquake, a one-in-ten-thousand-year-event.
- Cost: US$ 2.3 billion (R32.2 billion) contributed from more than 40 nations.

It's called The New Safe Confinement (NSC). Picture a massive, movable hanger-like dome designed to cover the highly radioactive disaster which is Chernobyl, in Ukraine.

Never before has such a huge structure been constructed at a heavily contaminated site.

Overcoming the risks and difficulties inherent in the project required years of groundwork and preparation, as laid down in the Shelter Implementation Plan (SIP). Its construction was financed via the Chernobyl Shelter Fund, managed by the EBRD and their procurement policies and rules and implemented in line with the Bank's Environmental and Social Policy on behalf of the contributors to the fund.

Work on the New Safe Confinement at the site started in late 2010 and construction

Photo: https://chnpp.gov.ua.

Cladding

The external cladding covers an area of 85 000m^2. It is a multilayer system of physical barriers restraining the spread of moisture, air and heat. The external cladding provides for resistance against atmospheric effects (rain, snow, extreme temperatures) for the whole 100-year operational life of the NSC, and is designed to withstand a tornado of class 3. It supports tightness of the annular space with possible atmospheric leakages of 65 litres per m^2 per hour at the beginning of the NSC operation and 275 litres per m^2 per hour at the end of the NSC 100-year service life.

The internal cladding of the arch consists of a smooth surface on the internal side of the building to minimise the risk of dust deposition and accumulation. It is made of 300mm wide and 0.5mm deep flat panels of corrosion-resistant steel. It is fire resistant, non-magnetic and supports tightness of annular space leakages to the same specifications as the external layer.

Annular space corrosion control

The New Safe Confinement has an annular space of 12m between the inner and outer layers of the structure across the whole arch span of 257m. As a consequence of the radiation conditions around and above the Object Shelter, this vast annular space has to have an active corrosion-control system. The ventilation system being installed has to maintain low relative humidity of less than 40%, and around 50 pascals overpressure with regard to the pressure in the main volume and outside the structure to avoid water ingress from outside and dust from inside the main volume. This system will recirculate around 45 000m^3 of air per hour. The temperature and moisture regime in the annular space of the Arch is supported by the operation of the inlet drying system and nine recirculation systems with over 100 air-handling units.

is scheduled to be completed in 2018. The structure was moved into position in November 2016.

The consortium worked with local sub-contractors and others from across the world. For instance, the arch was made of structural elements designed and built in Italy. The cranes were manufactured in the US. The arch cladding contractor was from Turkey, and lifting and sliding operations were carried out by a Dutch company.

Going back to the numbers, Chernobyl remains the single worst disaster in history. On April 26th, 1986 plant operators were conducting a test on an emergency water cooling system. At around 1:30 in the morning, pressure in the reactor built up and exploded, lifting and destroying the 1 000-ton concrete lid covering the reactor and spreading radioactive dust, well, everywhere.

Dozens of people died within the first few days and depending on who you read, it's estimated that between 10 000 and 100 000 have died over the years from exposure and another 70 000 have varying degrees of disabilities. It released more than 100 times more radioactivity than both atomic bombs dropped on Nagasaki and Hiroshima.

Let's just say April 26th, 1986 was a very, very bad day for those working at, and living around, the facility.

The Soviet Union (back in the day) hastily built a concrete and steel containment structure called the Object Shelter to try and

stem the continuous release of radioactivity. The shelter, however, continues to succumb to the environment and our collective nemesis, corrosion, and there is considerable concern that it might fail or collapse completely.

Hence the development of the NSC.

So, how does this fit in with a blog about corrosion fundamentals? Well, I'm a self-confirmed corrosion nerd, and when I first heard about the NSC being built around 2011, I was fascinated.

How do you build something so big, designed to last for 100 years, and corrosion protect it? This is what I do every day for our clients. I try to figure out creative, technically sound, vendor-neutral systems and practices for corrosion mitigation.

Anyone trying to corrosion protect anything gets pulled by vendors who firmly believe that their systems and ideas are best. If you talk to a paint company, they'll tell you to paint it. Talk to a metallizing company, and TSA is the way to go. Talk to cathodic protection company, and that's the ticket. And so on.

However, while coatings are the most prominent solution to most corrosion issues, they are never our first choice. Why? Because the second you install a coating system, you've created a maintenance issue. Now, we've designed coating systems with an estimated service life in excess of 100 years. However, at some point, virtually all painted or coated surfaces and assets will require maintenance.

Just yesterday I was consulting with a large oil company in Europe about a 1.2 million gallon, concrete waste water tank. The tank was built about 15 years ago, and started to leak. This was anticipated, and the plan was to keep crack-injecting it (chasing the cracks) until it stopped leaking. And, after several years, the tank is now watertight.

They contacted our firm because they were going inside to inspect it for the first time, and were considering lining the interior. They wanted me to review the coating options presented to them by a variety of vendors and coating companies.

The coating options were mediocre, and some were unsuitable, but my first question

Arch main structure

The height of the steel arch is 108m, the length is 162m and the arch span is 257m. The main load-bearing structure of the NSC consists of 16 steel arch trusses. Each arch truss consists of two chords and a triangular truss girder. The distance between arch truss chords is 12m. The arch trusses are gathered in one supporting area on foundations.

The trusses are coupled with a system of beams and connections. Upper cladding purlins are supported by the upper chord of the arch, while internal cladding structures are fixed on the lower chord. The main steel structure weighs around 30 000 tons.

Main crane system

The main crane system is the central piece of equipment inside the arch to support long-term deconstruction of the shelter. It is installed inside the NSC just below the ceiling at 80m above ground level and will be controlled by a remotely controlled system and a video surveillance system that allow the operators to remain outside the NSC. It has been specifically designed for dismantling the main structures of the destroyed reactor and original sarcophagus and for handling heavily shielded waste disposal. It is composed of two bridges that are designed to carry three interchangeable carriages. The bridges are 96m in length and travel on six runway rails. There are two carriages for lifting, the secure and classic carriage with 50-tonne capacity, and one carriage that is a tool-delivery platform. It was designed and manufactured by PaR Systems Inc.

was why are you going to do anything to the interior?

The liquid stored inside the tank was not erosive to the concrete. There was no indication that rebar was being attacked. There was no evidence of any issues with the vapor-space. And the tank was no longer leaking.

While coatings are one of the tools in our toolbox, I saw no technical justification to do anything on the tank interior, unless there was a technical reason to do so once tank entry was made.

And I was interested to see what solutions engineers would come up with for the NSC.

And the technical solutions did not disappoint.

First, let's understand how the dome works. It was built in two sections roughly 200 metres away from the Object Shelter (due to the radiation at the site itself) and then slid roughly 330 metres into place. This was done twice, once for each half. An added fascinating fact (for fellow nerdlings) is that the jacks used to raise and move the dome are the same ones that were used to raise the Russian submarine Kursk from the bottom of the Barents Sea (108 metres below the waves) in 2001. For those that don't recall, the Kursk was an ill-fated nuclear Russian sub which sank, killing the entire crew of 118.

The dome has a 13-yard annular space, as is often the case with large domed-structures. I've walked inside the annular spaces of both the Duomo in Florence, Italy and at the Vatican, St. Peter's Basilica's Dome. It's a common means of making structures like this, and allows for interior maintenance.

However, the NSC is designed to contain a nuclear waste pile which is still actively giving off radioactive contamination, and will do so for decades.

The entire goal of the NSC is to contain radioactivity emanating mostly in the form of dust particles.

From a corrosion perspective, there are three surfaces and environments which require consideration:

1. The primary containment surface, which, you would see if you were looking up at the dome from ground-level.
2. Interior of the annular space (and associated supporting structures).
3. The exterior shell, which is exposed to the elements.

Primary containment surface

This surface is designed to resist corrosion for 100 years, and, further, also has to hold the framework for two interior construction cranes, each able to lift and move more than 50 tons.

To solve the problem, the interior containment was made of 87 000 square metres of type 304 stainless steel, which is the most common form of stainless steel used worldwide. The 20-mil thick plates are tightly fitted to a galvanized deck with no ribbing or other modifications to the surface, to minimize the likelihood of radioactive dust clinging to the surface. The annealed stainless steel panels were sealed with tape and radioactive-resistant silicone to maintain an airtight space within the dome.

Sadly, I was not able to find application details, which would be interesting, as would the QC that went into the erection.

Interior of the annular space

The massive 10 metre high annular space is a complex web of carbon steel supports, beams and structures, all painted to reduce corrosion. However, the long-term solution to corrosion prevention is simple and brilliant.

The entire space will be maintained at a slight, positive pressure to ensure no radioactive particles migrate up and into the space (conversely, the containment area will maintain a slight negative pressure). And for corrosion protection, the lightly pressurized air will receive desiccant dehumidification to maintain the RH at below 40. As we all know, for corrosion to take place, we need ACME:

Anode; **C**athode; **M**etallic Pathway; **E**lectrolyte

The first three (anode, cathode and metallic pathway) simply live within all steel surfaces. The only thing corrosion professionals can modify (other than with CP, metallic coatings, etc.) is removing the electrolyte. That's all barrier coating systems do. However, with humidity maintained at below 40 RH, there is not sufficient humidity (electrolyte) for corrosion to take place, or, to take place at such a low rate as to be irrelevant.

We've consulted on, and lined, many sulfuric acid tanks. And our first question to our clients is if they are able to control the humidity and moisture inside the vessel. 66 Baume sulfuric acid (roughly 93%) is not corrosive at all to carbon steel, if you can keep out moisture. The problems start if water or humidity gets into the mix.

The exterior shell

The exterior shell was made of 96 000 square metres of Type 316L stainless steel (same as my Apple watch!) with 2% molybdenum for enhanced corrosion resistance.

All in all, I thought the corrosion mitigation design was simple, and technically sound. That being said, I am well out of my area of expertise when it comes to the effects of radioactivity on polymers, metallics, and all of the other materials involved in the project.

I'm anticipating some questions pertaining to chlorides. That is, stainless steel can be susceptible to corrosion if exposed to chlorides, and I could not find any documentation relating to the presence of chlorides within the effected, or surrounding, areas.

My concern would be that even if there are very, very small amounts of chlorides, somewhere, there may be a long-term risk if they are able to build up and become concentrated over time.

Of course, the long-term success of this venture remains to be seen. How well will the air pressure systems and desiccant humidification be maintained? Are there any unanticipated consequences in building something so large and unique for such a unique environment? What will happen when the deteriorating Object Shelter continues to deteriorate and, ultimately collapses?

As in all things, time will tell.

And update on the Chernobyl Sarcophagus:

This blog was originally published in PaintSquare Magazine in 2016 and is as relevant today as it was then. Further, here's a link to an update – https://www.ebrd.com/what-we-do/sectors/nuclear-safety/chernobyl-new-safe-confinement.html"

With kind acknowledgement to both Warren Brand of Chicago Corrosion Group, PaintSquare Magazine and European Bank for Reconstruction and Development.

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Darlington Upgrade Project – *A corrosion love story*

The Darlington Upgrade Project is another important stage in the delivery of Adelaide's North-South Corridor and will deliver an upgrade of approximately 3.3 kilometres of the existing Main South Road, including:

- A non-stop motorway between the Southern Expressway and Tonsley Boulevard
- A lowered, non-stop motorway passing underneath Flinders Drive, Sturt Road, Sutton Road/Mimosa Terrace and Tonsley Boulevard
- Grade separation of the Main South Road/Ayliffes Road/Shepherds Hill Road intersection
- Main South Road (at grade) surface roads along both sides of the lowered motorway to provide connections to Flinders Drive, Sturt Road and most local roads
- Full free flow interchange at the Southern Expressway/Main South Road with dedicated ramps providing direct access to the new motorway and Main South Road

The $620 million project is jointly funded by Australian and State governments ($496 million federally funded and $124 million state funded) and is due to be completed in 2019

This landmark Australian owned and built project is focussing on using Australian approved and manufactured components.

Roads and bridges are threatened by corrosion and degradation as they are continuously exposed to climatic elements and vibration from vehicle movements. The cost of corrosion mitigation to national economies around the world is estimated to be billions of dollars every year. The impact can be both economic through the cost of repairs and maintenance as well as a physical threat to workers, the public and even other nearby structures.

One of the two main ways to protect an asset from corrosion is to physically isolate a structure from the environment by applying a protective coating.

Protection of the various structural elements was integral to the design of the Darlington Upgrade Project.

Three of the eight bridges constructed for the project consisted of a steel box-girder design with reinforced concrete decks.

Half of the girder sections for these three structures were constructed by Haywards Engineering in Tasmania, with McElligott's then responsible for applying a protective corrosion resistant coating to the girders.

Installation of Ayliffes Road Bridge.

The other half of the girders were constructed and coated by Bowhill Engineering in South Australia.

The 22 bridge girder sections coated by McElligott's weighed more than 1300 tonnes in total.

According to Ivan Berry, General Manager at McElligott's, each girder was manufactured and delivered to the company's workshop. "Our facility is a continuous covered line where structures to be coated are profiled, primed and coated," Berry said. Each girder section was abrasive blasted to Class Sa2½. Profiling a substrate produces an even textured surface that increases the adhesion of a coating. Once profiled, the girders moved down the line where they were primed and then had two layers of top coat applied.

Jeremy Hawkes, Managing Director of Bowhill Engineering, concurred that moving the 48 metre by 4 metre high units of open top box girder within their facility was a challenge. Abrasive blasting and painting in the same facility produced its own difficulties. "For that size structure, we used a lot of abrasive garnet to profile the steel. The used garnet had to be collected and cleaned for reuse," Hawkes said. "We began using shovels and brooms to collect the material but a short while into the project we managed to acquire a surplus 3 stage vacuum system that automatically separates the material and prepares it for reuse."

Hawkes stated that the weather was also a challenge. "There was often only a small window of opportunity when the temperature was the correct level above the dew point allowing us to work within the manufacturer's specifications," he said. Bowhill upgraded its workshops to install ducted gas fired heating which allowed them to get the girder sections to an overall even surface temperature. "It was important to heat the girder sections so that the coating materials adhered to the substrate and cured effectively," Hawkes added, "but the size made it difficult to evenly heat the girders."

The duration of the project meant that some of the coating work took place during the Tasmanian winter requiring McElligott's to adjust its work schedule. "To meet overall deadlines, abrasive profiling was conducted overnight and painting took place during the day in order to reduce the amount of extra heating required," Berry added.

Ayliffes Road Bridge.

The coating system was a Zinc Rich Epoxy, followed by an Aluminium Pigmented Epoxy and the final coat was Hardtop AS, manufactured by Jotun. The total surface area coated by each coating company was approximately six and a half thousand square metres of exterior surface and nine thousand square metres of internal surfaces.

Rob Butcher, State Manager – Protective Coatings (SA and Victoria) at Jotun said his company's challenge was to specify a material that could be used by two separate companies located in quite different climatic environments. "One company is two hundred kilometres inland in South Australia where it can get very hot and dry, whereas the other is on the northern coast of Tasmania where there can be days when the temperature is close to zero," he said. The specification of the coating material had to accommodate its application in both places.

It was essential that the finished coatings from both applicators matched as much as practical. "We were able to use the Australian Standard 2312.1. This standard has been tried and tested in our industry for many years and is well accepted," Butcher stated.

The Australian Corrosion Association has been a part of the research into the performance of coatings in Australia for many decades. It was involved in the report

Main South Road Bridge to surface roads.

that led to removal of lead paints from Australia in the 1990s and continued this by contributing to international standards relating to coatings safety.

"When applying the coating, the big sections made it challenging to maintain a 'wet edge'," Berry said. "We had to continually adjust the hardeners and thinners in order to extend the drying time of each coating layer." A 'wet edge' refers to the process of avoiding obvious join lines between sections of coating. They also applied a 'stripe coat' over welds and other joints.

Berry stated that the massive girders—the heaviest weighed 86 tonnes—were the largest components that his company has been involved with. Scissor-lift platforms were required to allow the applicators to safely reach the highest areas on the outside and scaffolding for those on the inside.

"These girder sections were huge and comprised 20 individual sections each," said Hawkes. "The Ayliffes Road bridge will be a total length of 390 metres long, which is a pretty decent bridge in anyone's terms—especially when you have to move it."

The three steel box girder structures for the project were constructed using an innovative method whereby the structures were built off-site, transported and precisely manoeuvred into place using Self Propelled Modular Transports (SPMTs).

This method of bridge construction is common place throughout Europe and the Americas. However, this was the first time SPMT's have been used in Australian by the Infrastructure sector to install a fully completed structure, an amazing achievement.

When a coating is properly applied, inspected and qualified it should easily provide 25 years or more of protection, although many projects today are even specifying 50 and 100-year life expectancy.

New capital investment in some areas may be slowing down, but governments around the country have recently announced plans for large-scale road and rail projects which will provide many opportunities for corrosion control and prevention companies.

The ACA works with industry and academia to research all aspects of corrosion in order to provide an extensive knowledge base that supports best practice in corrosion management, thereby ensuring all impacts of corrosion are responsibly managed, the environment is protected, public safety enhanced and economies improved.

Corrosion & Prevention 2018 , the largest corrosion conference and exhibition in the Southern Hemisphere will have taken place in Adelaide, SA on 11 - 14 November, 2018. For more information go to conference.corrosion.com.au.

From the KETTLE

The role specifiers and end-users have in selecting a corrosion control coating, suggests that all aspects of a hot dip galvanized coating be highlighted and if necessarily de-mystified. The intension of this series of surface conditions is to ensure that the customer or specifier has a greater understanding of the coating so that it is not necessarily rejected or accepted for the wrong reasons, resulting in wasted time for all personnel. See F20 and F21.

Legend

#1 While double dipping is occasionally seen to be necessary due to a limited bath size, the galvanizer must inform the customer that this practice can increase the propensity for distortion, before he commences with the work.

A Accept **R** Reject **REP** Repair

F20

DESCRIPTION:

Distortion as a result of inappropriate design and fabrication. Distortion is the unwanted warping that occasionally becomes evident after hot dip galvanizing.

CAUSE:

When steel components are heated to the hot dip galvanizing temperature of approximately 450°C, some internal stresses can be released resulting in distortion.

When very high internal stresses are generated in a steel structure, it is possible that the highest levels of stresses that are above the elasticity of the steel (Young's Modulus is partially reduced at the hot dip galvanizing temperature) then the steel may no longer accommodate the higher level internal stresses. Such stresses are released as plastic deformation and distortion may result.

Double end dipping of slender components can exacerbate the problem. #1

Refer also to the "Steel Protection Guide", Chapter 9 and "Facts about Hot Dip Galvanizing – Practical Guidelines"– "Design for hot dip galvanizing" available from HDGASA.

EFFECT / REMEDY:

Use symmetrical designs; Use sections of similar thickness; Stiffen unsupported thin wall sections; Use preformed members with the correct minimum bend radii; Use balanced or staggered welding techniques; Make use of temporary braces on thin walled sections such as troughs, cylinders and angle frames. Bolt two opposing trough sections with intermediate bolts and flat washers so that the combined section becomes symmetrical for stiffness purposes.

Avoid quenching after galvanizing and allow to air cool. Cover the thinner wall sections of the component with thermal blankets to achieve uniform cooling rates and add suitable weights to the component while ensuring it is laid on a flat surface.

While it is impossible to predict all distortion situations, most galvanizers will generally try to inform the customer of the potential for distortion before galvanizing.

Some components can be reasonably straightened after hot dip galvanizing.

ACCEPTABLE TO SANS 121: A

ACCEPTABLE FOR DUPLEX AND ARCHITECTURAL FINISH:

R – Depending on customer.

When delivered components are already distorted due to weld imbalances, galvanizers are to notify the client and suggest alternative corrosion control.

Varying thickness of steel making up a frame can cause differential expansion when dipped into molten zinc.

When hot dip galvanizing unsymmetrical components such as this, opposing residual forces can result in distortion.

Varying thickness of steel making up a girder can cause differential expansion when dipped into molten zinc. The component may distort after hot dip galvanizing.

When hot dip galvanizing unsymmetrical components such as this, opposing residual forces can result in distortion.

Long thick components welded to long thin plates that are unsymmetrical, can cause distortion of the thinner plate due to different heating cycles in the molten zinc.

F21

DESCRIPTION:

Ungalvanized surfaces caused by oil based marking paint, cutting / rolling oil or dye penetrant testing material.

CAUSE:

Residues, such as oil based paint, grease or material from die penetrant testing on the steel surface can result in localised ungalvanized areas in an otherwise continuous hot dip galvanized coating.

Defects after galvanizing can vary in colour from grey black to brown while no hot dip galvanized coating has been formed.

EFFECT / REMEDY:

Ensure all paint, grease or cutting / rolling oil is comprehensively removed prior to hot dip galvanizing.

Some oil based paints are extremely difficult to remove, even when using paint strippers and paint etching marks by a grinding disc. Ideally, make use of suitable (water soluble) marking pens for temporary identification.

Should marking paint not be detected prior to hot dip galvanizing, leading to uncoated areas, it should be appropriately repaired.

ACCEPTABLE TO SANS 121:

A and REP

ACCEPTABLE FOR DUPLEX AND ARCHITECTURAL FINISH:

R

Family Fishing Day at Brookwood Farm

CorrISA's 11th Annual Family Fishing Day was held on the 30th of June 2018 at the Brookwood Farm with their family members arriving from as early as 06:00. The day was a fun filled one.

A prize giving took place after delicious boerewors rolls were handed out by our sponsor, Mr Greg Combrink, CorrISA's 1st Vice President. From the biggest fish to the smallest crab each participant was presented with a gift prize. A big thank you to our sponsors and participants that had an impact in making the day a memorable one.

This year we had the privilege of being tutored by the SA Ladies Fly Fishing team.

Executive Director's Message

South Africa has officially entered into a Technical recession after Stats SA announced the decline (0.7% in second quarter, 2.2% in the first quarter) in the GDP few months back but the government expenditure grew by at least 0.5% which is good sign for the future. The main positive contributors were mining, up 4.9% and the finance, real estate and business services industry, which increased 1.9%.

Members should be optimistic about the future of business since the President's Stimulus plan is what the economy needed and with a new Minister of Finance who has a vast experience with treasury and world economics. Government is finally listening to business and getting business to play its role in growing the economy. We saw a few initiatives like YES programme and Jobs Summit coming to light which has more business orientated initiatives.

Despite all the economic ups and downs, CORRISA is taking the opportunity to grow its partnership and membership. We are engaging with other associations like AFSA, CSSA, SAISC, HDGASA, SASSDA, etc. as reciprocal members with an agreement to market each other. We are partnering with Africa Energy Indaba for the 2019 exhibition where our company members will benefit with a 5% discount. We also partnered with Electra Mining 2018 which was a success and we are getting enquiries from people who visited our stand. We are now busy setting up company categories which will be published on our website and in the magazine.

In terms of courses, we have set up a calendar for courses from November 2018 until December 2019 which includes Durban and Cape Region. I believe that we can increase the number for the scheduled courses with a bit of improvement on our marketing strategy. Durban region has an additional Council Member Pravesh Ramburan who will be responsible for marketing and growth opportunities. We would like to acknowledge and thank Sasol for requesting and hosting a NACE CIP level 1 course in Secunda where 27 delegates attended the course. We also acknowledge Rand Water for the request of Corrosion in the Water Industry for its employees.

This is our last edition for the year and I would like to thank all the members who have renewed and the others who are still likely to renew their memberships plus all those who made it to the AGM, which was a success. The professional body is in progress and it will go live soon for the members benefits.

Corrosion Champ, Hendrick Rasebopye – Executive Director

Comment – Chairman of the Cape Region

The Corrosion Institute Cape Region has had a few changes since my last report. At our AGM in September we bid farewell to 3 of our committee members and welcomed 4 new additions.

Thanks to Sieg Le Cock, Leonie Du Rand and Tammy Barendilla for their contributions. Tammy has kindly agreed to stay involved until after the not-to-be-missed Gala Dinner in November. We welcome Eric van der Spuy, Dan Durler, Hilton Olivier and David Goldblatt – a great combination of youth and experience. Dan has been the ex Chairman of the Cape Region twice before so we look forward to his input.

Since the last edition we have had the exceptionally entertaining and informative Fireside Chat which Terry Smith co-ordinated and Emplast hosted. We had stalwarts in the industry regaling stories from their experiences and we will definitely make this a yearly event.

In July we visited Charles Dominion from Simple Active Tactics and learnt all about how grit, shot and glass beads are made which was very interesting. Some of the applications were an eye opener!

After our AGM in August which included some corrosion related video clips we had the Mini Expo in September which was a good experience for all who attended. We hope it will be bigger and better next year – see the separate report.

Our last get together in October was a site visit to Surcotec hosted by Ian Walsh. It was exceptionally interesting seeing 3 different methods of Thermal Spraying with all who attended being suitably impressed with the demonstration where ear muffs were a necessity!

All that's left for this year is our Gala Dinner on Friday 23 November at Kelvin Grove with a trilogy of comedy, magic and mime presented by the fabulously talented Regardt Laubscher and Leigh Collins. It promises to be another fun filled evening.

In January we have a site visit lined up for Gabriel Shock Absorbers which should be a not-to-be-missed opportunity of seeing this plant. We hope to see you there.

Yours in Corrosion

Graham Duk on behalf of Dan Durler, David Goldblatt, Thinus Grobbelaar, John Houston, Daryl Livesay, Indrin Naidoo, Hilton Olivier, Terry Smith, Gilbert Theron, Eric van der Spuy, Flippie van Dyk and Pieter van Riet.

Comment – Chairman of KwaZulu Natal

KZN hosted two very different meetings. The first was a Meet and Greet with Hendrik Rasebopye, CorrISA Director. The meeting was well attended, and we covered many of the pertinent aspects related to the Institute and its running. Hendrik also shared some of the vision for future development and growth. The second and other meeting was a joint OCCA/CorrISA meeting, hosted by CorrISA. Historically OCCA and CorrISA enjoyed a very close technical relationship. This had died off over the passage of time, we are now committing to re-introducing these annual joint meetings.

We're looking forward to our Golf day, which will be completed by the time of publication. More on this later.

Regards,
Mark and Karyn

AGM, Gauteng and Cape Region

We had a very successful 44th AGM on the 13th September where new council members were voted in. Congratulations to the following 2018/2019 council members:

Gauteng Region: Aaron Raath, Nomagugu Mthimunye, Mark Terblanche, Dustine Botha, Ross Mahaffey and Tebogo Bhulose.

Cape Region: Graham Duk, Dan Durler, Daryl Livesey, David Livesey-Goldblatt, Eric Van Der Sput, Flippie van Dyk, Gilbert Theron, Hilton Olivier, Indrin Naidoo, John Houston, Pieter van Riet, Terry Smith and Thinus Grobberlaar.

KZN Region: Mark Terblanche, Karyn Albrecht, Justin du Toit, Marco Ashburner and Pravesh Ramburan.

An Asset Owner Membership was handed over to Rand Water.

A presentation was given on the Professional Body.

Attendees at the AGM.

Electra Mining Conference and Expo

As an endorsing partner of the Electra Mining Africa we had the opportunity to exhibit at the EMA18 Conference and Expo held at the NASCREC Expo Center from 10th - 14th September 2018. This was an unusually large expo with 8 halls showcasing products from around the continent. Thanks to EMA for affording us the opportunity to market our courses and events.

African Corrosion Congress (AfriCORR) 2018
presented by Corrosion Institute of Southern Africa and NACE International

Corrosion Institute of Southern Africa (CorrISA), in partnership with National Association of Corrosion Engineers (NACE) International, successfully conducted the African Corrosion Congress (AfriCORR) 2018 on July 16 - 20, 2018 at the Ditsong National Museum of Military History, Johannesburg, South Africa.

AfriCORR is a forum for African and international researchers and industry leaders to explore different corrosion challenges in the area and present the latest technologies to prevent and control corrosion. AfriCORR 2018 creates a platform that links research to action, ultimately finding African solutions for African problems while ensuring to be in touch with worldwide trends.

AfriCORR 2018 presented papers in the areas of corrosion mechanisms, detection methods, measurement techniques, case studies, prevention, and mitigation methods in the following fields:

- Industrial Corrosion
- Corrosion in Mining and Mineral Processing
- Traditional and Advanced Materials
- Protective Coatings
- Atmospheric Corrosion
- Corrosion Modeling
- Failure Analysis
- Advances in Corrosion Inhibitors
- Tribocorrosion and Erosion Control
- Cathodic and Anodic Protection Systems
- AC Induced Corrosion

Pre-conference workshops kicked off the knowledge-sharing event on July 16 and 17, 2018. Workshop on Corrosion Research Techniques was conducted in University of Witwatersrand on July 16 and the workshop on Pipeline Integrity Management in University of Johannesburg on July 17. Over 20 young professionals participated in the workshops.

More than 80 corrosion experts attended AfriCORR 2018 as it officially opened on

Chaired by Prof. Lesley Cornish, the panelists during AfriCORR 2018 are Hendrick Rasebopye representing CorrISA, Solomon Thwala representing the industry, Prof Rob Knutsen representing academia, and Lungile Harya representing CorrISO (CorrISA's student arm).

Over 80 corrosion professionals attend the technical sessions of AfriCORR 2018.

International guests Jacob Adams and Reygie de Borja (right) of NACE International, enjoyed the traditional South African face paint during the Annual Awards Dinner at the Moyo Restaurant, Zoo Lake, Johannesburg.

July 18, 2018 at Ditsong National Museum of Military History, Johannesburg. AfriCORR Convener Vanessa Sealy-Fisher and CorrISA President Donovan Slade welcomed all the attendees in their opening speeches. Highschool students from two universities were invited to attend the first day of the congress to learn from the discussions on corrosion, as they will be the future generation of corrosion professionals.

The three-day congress provided a good platform for all students and industry leaders to connect and discover the latest studies in corrosion both in academic and the industry. A technical exhibition was held in conjunction with the technical sessions within the conference venue. Over 10 companies showcased the latest technologies used for corrosion mitigation, displaying and demonstrating their products and services.

In the evening of July 19, the congress joined CorrISA members during the Institute Awards Dinner held at the Moyo Restaurant, Zoo Lake, Johannesburg. The guests enjoyed several social activities during the evening. Congress' Best Student Presentation and Best Student Poster were awarded to the young professionals who raised the bar on presenting their corrosion studies.

Bruce Trembling, a Past President (2014 to 2015) was awarded the Bronze Medal Award for outstanding service to the Institute and in addition he was also awarded a certificate as a Fellow of CorrISA.

The conference wrapped up with a Panel Discussion on "African Corrosion Challenges – Making Solutions our Own". The discussion was chaired by Prof. Lesley Cornish, with representatives from the government, industry, academia, young professional and entrepreneurs.

The congress coincided with the celebration of Nelson Mandela Day, and to participate in Nelson Mandela's 100 for his 100th, the congress raised over 100 calculators to be handed to a select number of highschool students.

Reygie de Borja, NACE International

Students from two universities who attended the first day of the congress receive their certificates and calculators raised by the congress for Nelson Mandela's 100 for his 100th.

AfriCORR 2018
Summary of speakers and topics

DAY 1

MORNING SESSION chaired by **Mr Donovan Slade:** President, Corrosion Institute of Southern Africa.

J. Zhang - Carbon induced corrosion at high temperature – mechanisms and prevention.

Ntebogeng Mogale – An investigation on the effect of SiC additions on the properties and corrosion performance of alumina-silicon carbide composite material.

Nomsombuluko Masia – Studying the performance of high chromium white cast iron (HCWCI) in combination milling in raffinate leach processes.

Prince Cobbinah – The effect of SiC content on the corrosion and tribocorrosion performance of SPS produced Al/SiC nanocomposites.

Johan Westraadt – Oxidation of 316L stainless steel in the PWR primary water environment.

AFTERNOON SESSION chaired by **Prof Lesley Cornish:** Wits University

Rob Knutsen – Recent applied studies in corrosion at the UCT Centre For Materials Engineering.

Vuyo Motsweni – Mass loss comparison behavior of 316L SS and 316L SS weld alloyed with ruthenium.

Dario DellOrto – Temporary Coatings for In Process or Storage Applications.

POSTER SESSION 1

Annastasia Mantshiu – Biocompatibility evaluation of nano-sintered Ti-15Zr-4Nb-2Ta-0.2Pd alloy for biomedical applications.

Mithavini Mahundla – Evaluation of the corrosion behaviour of titanium alloys fabricated by spark plasma sintering.

Jerman Madonsela – Corrosion assessment of biomedical Ti-24Nb-4Zr-8Sn alloy produced using SPS in various simulated body solutions.

Veronica Morudu – Effect of Temperature and Exposure Time on the Metal Dusting of Alloy 800.

Sunday Aribo – Theoretical model and its verification for the flow assisted corrosion of reinforced duplex stainless steel 2205-TiN composite in aerated 3.5 wt. % Na.

DAY 2

MORNING SESSION chaired by **Ms Tebogo Bhulose:** Eskom.

Deon Slabbert – Learning from corrosion related failures.

Lesley A. Cornish – Modeling and Measurement of Naphthenic Acid Corrosion in a Crude Oil Refinery's Distillation Units.

Franklin Okafor – Risk Based Approach to Asset Maintenance Painting in the Oil and Gas Industry

Market Place Spotlight on: Reignite (Pty) Ltd, TCC SA , Weartech (Pty) Ltd, Wits University.

Robert White – Galvanized Autobody Partnership: Recent Results Corrosion Performance of Advanced Galvanized Sheet Steels.

Chwayita Madikizela – Micro-galvanic corrosion of Ti-6Al-4V in- situ alloyed with molybdenum via selective laser melting.

Graham Duk – Ongoing developments in the data transfer, storage and reporting of Coating Inspection Data.

Market Place Spotlight on: BAMR, Cathtect Engineering (Pty) Ltd, GPT (Garlock Pipeline Technologies), Hot Dip Galvanizers Association SA.

AFTERNOON SESSION chaired by **Dr Babatunde Obadele:** University of Johannesburg.

Phumlani Mjwana – Effect of Calcareous Deposit Formation on the Efficiency of Cathodic Protection on Carbon Steel in Simulated Soil Solution.

Ryno Van der Merwe – Effect of nitric acid contamination on mild steel corrosion in hydrofluoric acid.

Mavis Khathutshelo Nemavhola – The effect of Fe addition on the corrosion behaviour of (Ti-34Nb-25Zr-xFe) based alloy for orthopaedic device application fabricated by SPS.

Herman Potgieter – The effect of halides, pH and temperature on the corrosion of Ni-Cr dental alloys in artificial saliva.

Market Place Spotlight on: Isinyithi Cathodic Protection, Kansai Plascon, Metrohm SA, SUB SEA SYSTEMS INT'L NIG LTD.

POSTER SESSION 2

Lukman Olasunkanmi – 6-phenyl-3(2H)-pyridazinone and 3-chloro-6-phenylpyrazine as corrosion inhibitors.

Mofu Tsoeunyane – Corrosion Inhibition of Mild Steel by synthesized poly(ethylene succinate)-L-Histidine composite.

Samuel Akinwamide – Studies on Corrosion Behavior of Al (Mg-Tife-Sic) Matrix Composite in Acidic and Chloride Media.

Tshimanga Ngalula – Characterization of locally sourced abrasives and their influence on the corrosion rate of 304 stainless steel in a SO_2 gaseous environment.

DAY 3

MORNING SESSION chaired by **Mr Jacob Adams:** NACE International.

Craig Botha – Benchmarking International Cathodic Protection and Alternating Current Mitigation Standards to Determine Suitable Protection Criteria.

Mandlenkosi Mahlobo – Modelling electrochemical mechanisms of carbon steel buried in unsaturated artificial soil in the presence of cathodic protection.

Neil Webb – Corrosion Protection of LPG Sites.

Fortunate Moyo – Corrosion characterisation of ruthenium implanted AISI 304L in proton exchange membrane fuel cell environments.

Josias Van der Merwe – The electrochemistry and the prediction of stress-corrosion cracking.

Gregory Combrink – A review of corrosion research on metal additively manufactured components.

Darelle Janse van Rensburg – Atmospheric corrosion maps of South Africa and the Greater Johannesburg Metropolitan Area (GJMA).

AFRICORR PANEL DISCUSSION –
African Corrosion Challenges – Making Solutions our Own chaired by **Prof Lesley Cornish.**

A panel discussion including **Mr Solomon Thwala** – industry; **Prof Rob Knutsen** – academia.

Ms Lungile Harya – CorrISO (CorrISA's student arm).

Reciprocal memberships for AFSA and Concrete Society


AFRICORR: 18 - 20 JULY 2018





AFRICAN SOLUTIONS TO AFRICAN CORROSION CHALLENGES

2018 Annual Awards Evening

AfriCORR Prize Giving:

- Best Student Oral Presentation: Chwayita Madikizela, Wits University
- Best Student Poster: Laetitia Ngalula Tshimanga is from the University of Johannesburg

Corrosion Institute Education Category:

- CorrISA Corrosion Engineering – Top student (July 2017 – June 2018): Marinki Malatse from Sasol
- CorrISA Economics of Corrosion – Top student (July 2017 – June 2018): Thapelo Precious Thaba from University of Johannesburg
- The 2018 Ivan Ogilvie Research Scholarship has been awarded to: Miss Laetitia Ngalula Tshimanga is from the University of Johannesburg and is registered for MTech Degree in Metallurgy. Her research topic concerns the use of a variety of locally sourced and manufactured abrasive blasting media on the corrosion resistance of grade 304 austenitic stainless steel.

Certificate of Fellowship:

Bruce Trembling has been awarded Fellow Membership Status

Certificate of Honorary Life Membership:

Graeme Stead has been awarded Honorary Life Membership Status – Graeme started his membership with the Corrosion Institute on 09 November 1993!

Certificate of Recognition:

It is with gratitude that we would like to recognise and say thank you to one of our past Silver Medal Recipient's, who is synonymous with the Water Industry. Nic Trebicki, the creator of Corrosion in the Water Industry Forum has always been willing to share his knowledge, offer theoretical clarity and guidance to anyone who was willing to learn. Nic has now retired and we wish him Bon voyage on his retirement travels!

Medal Category:

The Bronze medal for exceptional and long-standing service to the Institute Is awarded to Bruce Trembling

Project Category:

There were three nominees:

Sunrise Energy – Isinyithi Cathodic Protection

MeerKAT – RBI Technology

Malibongwe Ridge Pipeline – Stopaq

Winners of the 2018 Annual Project Award: Malibongwe Ridge Pipeline Project by Stopaq.

Vanessa Sealy-Fisher with her husband Peter (above left); Armin Schwab accepted RBI's project nomination award on their behalf (above right).

The winner of the 2018 CorrISA Annual Project Award went to:

Malibongwe Ridge Pipeline Project

Project Team

Johannesburg Water / Gibb / Basil Read / Phambili Pipelines / LMC Corrosion / Stopaq

Stopaq Homogenous Pipeline Coating Systems – Malibongwe Ridge Pipeline Project

The Malibongwe Ridge pipeline was installed in order to deliver water to Cosmo City and surrounding areas in the north west of Johannesburg. Due to harsh conditions that pipelines in South Africa are subjected to, including extremely high levels of stray current, it has become a priority to find coating solutions that will be able to withstand these harsh conditions.

It has been identified by many corrosion experts both internationally and in South Africa that pipeline weak areas are field joints and specials, due to the disparity between the coating which is applied to the pipes under factory conditions and the field applied coatings which present

Above from left to right: CorrISA Economics of Corrosion Top Student, Thapelo Thaba (July 2017 - June 2018); Laetitia Ngalula Tshimanga from the University of Johannesburg received the award for best student poster and won the 2018 Ivan Ogilvie Research Scholarship; Graeme Stead received the Honorary Life Membership award for being a member of the Institute from 9 November 1993; Nic Trebicki received the Certificate of Recognition; Bruce Trembling was awarded the Certificate of Fellowship as well as the Bronze Medal for exceptional and long standing service to the Institute.

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many application challenges. Dissimilar coating systems or even similar coating systems when they are field applied are unable to achieve a 100% bond to the parent linepipe coating, and over time this bond weakens and problems such as disbondment, delamination and undercreep begin to manifest. If a completely homogenous coating could be applied over the entire pipeline, one that would be completely self-amalgamating regardless of whether it is factory or field applied, the weakness of the inferior bond between the parent coating and the field applied coating would be eliminated.

The Stopaq GRE linepipe system was selected because this system provides a completely homogeneous pipeline whereby the Linepipe, field-joints and all specials are completely corrosion protected with the same corrosion prevention system and material namely Stopaq visco-elastic Polyisobutene as a corrosion protection layer. This Visco-elastic Polyisobutene coating cold flows thus providing a coating system that is completely sealed at the joint areas between the parent coating and the field applied coating, to form a single homogenous corrosion protection layer throughout the pipeline. The outer mechanical glass reinforced epoxy coating, provides an extremely resilient outer mechanical protection which protects the Stopaq corrosion protection layer beneath it.

CorrISO Annual Student Debate

On the 21st September the 2nd Annual Student Debate was held at the Core. Students from Vaal University of Technology, Tshwane University of Technology and the University of Witwatersrand competed agains eachother.

The topics debated were "What is the best way to spend the limited money we have for corrosion training?" which then went on to "Is it better to train everyone with that little budget or is it better to cultivate experts who have a lot of specialised knowledge?". Other topics were "Many local corrosion researchers prefer to collaborate with scholars from top international universities with established names, who have good understanding of corrosion." followed by "Is this a good approach to dealing with corrosion in SA or is it better to work with local people who have a more intuitive understanding of their corrosion issue and environment?".

The mood of the participants, judges, audience, MC and CorrISA staff was ecstatic. Mboneni Muravha was the MC with Mrs Vanessa Sealy-Fisher and Mr Hendrick Rasebopye the judges.

Each team had 3 participants for each debate session. The first semi-final was between TUT (1st team) and Wits, while the second semi-final was between TUT (2nd team) and VUT. Wits won the first semi-final while TUT took the second one, leading to a final between Wits and TUT.

The final was won by Wits University who were declared the 2018 CorrISA 2nd Annual Debate champions and were awarded the floating trophy.

Katleho Malebongane from VUT won the best speaker of the debate.

President's Council Dinner

The Executive and Council Committee, along with staff members and their partners, joined the President Mr. Donovan Slade at his council dinner on the 31st August at Verdicchio Restaurant and Wine Cellar at Monte Casino.

The evening was filled with lots of fun, chats and laughter as we all came together to celebrate the hard work done this year.

Cape Region Mini Expo

Our second Mini Expo took place on Thursday 20 September. We were honoured to have the Director of the Corrosion Institute, Hendrik Rasebopye as well as Nonkanyiso Mabaso as our guests from Johannesburg. Hendrik opened proceedings with a brief talk which included latest happenings at the Corrosion Institute. We had 11 exhibitors and we appreciate the involvement and commitment of these 11 exhibitors to the Corrosion Institute: BAMR; Blastrite; Corrisa; Corrocoat; Dryforce; Emplast (Pty) Ltd; John Thomson; Simple Active Tactics; Southey Contracts; Surcotec (Pty) Ltd and Weartech

There was a competition for best stand and this will be announced at our Gala Dinner taking place on Friday 23 November.

Considering the tough economic times, the Mini Expo was well attended and we appreciate the time made to all those who did attend. I think everyone found something beneficial from the Mini Expo and we look forward to a bigger and better event next year. An event like this does require a lot of time and investment and a huge thanks to John Houston and his team for all their efforts in making this event a success. A big thanks must also be attended to our host Cindy from Rand Air and for Rand Air in making their premises available for our event. Thanks too to Camera Press for printing complementary Expo promotional leaflets.

Cape Region Fireside Chat

Thanks to David Goldblatt, Dan Durler, Mike Zacharias, Steve Holt, Charles Dominion and John Houston for agreeing to chat tonight. Thanks to John Houston who kindly sponsored the refreshments as well as the prize for the winning chat. Stories ranged from technically serious, embarrassing to fun and laughter. Mike Book who missed the evening contributed the following:

During the 70's the construction industry was booming, unemployment was at its lowest ever. The Rand was powerful (R2 to the British Pound and R1.00 = $1.42). South Africa was working flat out building the infrastructure of the country. Life was at its best with companies like Southey's, Gordon Bennet, VCM Paint Contracting, Mines and Industrial Painting Contractors and Reef Industrial Painters, employing >6 000 personnel each, paying cash wages every Friday, using the old Kalamazoo system (no computers and electronic banking), distributing wages to the various pay points around South Africa, which seems like an impossible task today.

The Reef wages were made up for the employees every Thursday ready for the Friday pay run in Durban and flown from Virginia Airport in the Reef Cessna 210 Beechcraft to the remote sites around South Africa where we would buzz the site, the supervisor would then drive to a predetermined spot, and then we would come in low and throw the money bag out and fly onto the next site and be back in Durban by 15h00.

On one occasion when we got back to Durban we were told that the Vaal Reef Site in Orkney had not been paid and that the supervisor was missing. We assumed that the supervisor had run off with the payroll. We told our client that the pre-arranged drop off site was the veld by old Orkney air strip and requested that he go there. An hour later the client phoned to say that he had recovered the payroll which was laying a few metres away from our unconscious supervisor. When the money bag was thrown out of the aeroplane it hit the supervisor's head squarely resulting in a fractured skull.

The evening was a great success and promises to be repeated.

TECHNICAL EVENT: Surcotec Plant Tour, Cape Town

TECHNICAL EVENT: SAT Plant Tour, Cape Town

One of the largest paint manufacturers in Southern Africa

Extracted from "Johannesburg – Celebrating Seventy Golden Years"
Edited and Published by Felix Stark, Designed and Produced by Municipal Public Relations Bureau

Plascon Paints & Chemical Industries Limited are today recognised as one of the largest paint manufacturing concerns in Southern Africa. They are manufacturers of paint, lacquers, synthetic enamels and various other products, all of which because of their high quality, have won for the firm an enviable reputation throughout the whole country.

The company, like so many other Johannesburg concerns began on a very modest scale. Technical skill and business acumen and the ability to produce the products most suitable to meet the tastes and requirements of the people of South Africa, soon put it in the forefront.

Originally established in Jeppestown, Johannesburg, in 1945, it was 3 years later in 1948, that the activities of the company were transferred to Luipaardsvlei, Transvaal, where a modern factory was erected.

The factory, which covers an area of fifteen acres, is equipped with the latest and most up-to-date plant. It is divided into distinct separate sections, each one of which produces a different product.

One section manufacturers paint, another lacquers and another varnishes. Originally the company's main offices were housed in the factory itself, but in 1955 a two storey building in Doornfontein was taken over by the firm and the administrative staff was transferred to the new premises. A spacious modern building, it is beautifully decorated proving not only a delight to the eye but also a wonderful example of what can be done with Plascon Paints.

The manufacture of paint has changed considerably from ancient times. The Egyptians used lime, ochres, lampblacks and other substances as pigments, in combination with gums, pitches, egg-yolks and white of eggs with waxes as binders. Although the earliest uses of paint were chiefly decorative, other functions have assumed greater significance.

Paint these days not only brightens and beautifies our buildings but protects them from the weather and against corrosion. It also maintains a high standard of hygiene and controls the effect of light.

The manufacture of paint, once a secret art, now utilises all the resources of synthetic chemistry, the techniques of

physical measurement and the device of engineering.

The production of paint is a highly skilful technique and before any paint is put on the market it must pass various severe tests. It is tested for consistency, drying rate, hardness, colour, light fastness, adhesion, covering power and resistance to weather.

For this purpose special laboratory tests have been devised and standardised.

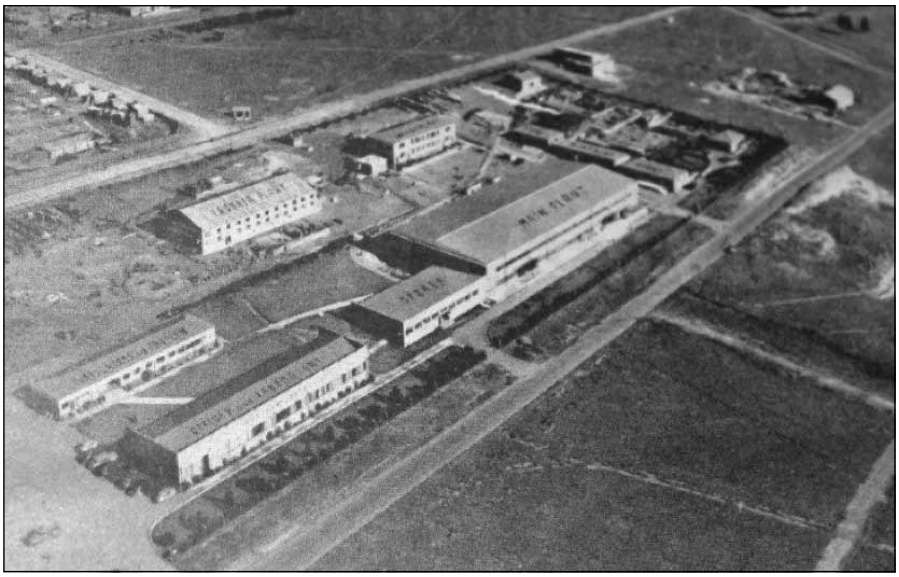
A visit to the Plascon factory is an education in itself, showing the intricate and fascinating processes used in the manufacture of paints and the skill and care which goes into the production of all goods bearing the proud name of "Plascon".

The company manufacturers an extremely wide range of paints and lacquers. In addition to the normal household paints, there are lacquers used in the motor, furniture and leather industry; special finishes for agricultural implements and other products for use in the manufacture of toys, metal furniture, vacuum cleaners and kitchen furniture.

Plascon Paint and Chemical Industries Limited, maintain extensive laboratories at its Luipaardsvlei factory, where comprehensive research is undertaken in the development of new products and methods of manufacture. Many demands are made upon the firm for special heat-resisting and anti-corrosive paints. The research workers at the company's laboratories always seem to find the right answer to the most acute and difficult problems.

The Company are already famous for its wall finishes which are marketed under the trade name "Magic Flow" whilst Plascon "Universal Gloss Enamel" and "Syncote" resin emulsion paints have gained wide popularity. The company have now introduced two new products onto the market, "Polvin" Liquid latex and "Spred-Magic" self-sealing self-priming paints.

In keeping with their policy of maintaining the high standard of their products and a first class service to their clientele, the company's publicity department has on its staff a number of persons specially trained in colour dynamics.



These specially trained colour consultants give effective service and valuable advice to designers of flats, hospitals,offices and to the ordinary householder.

The company is called upon to supply paints for many diverse and specific purposes and in order to meet the demand, has often to seek its raw materials in many parts of the world. Naturally, however, it relies largely on the home market and is an important consumer of various raw materials from this country.

Plascon Paints and Chemical Industries Limited have certainly every reason to be proud of the fact that by their efforts, they are making our buildings and homes more colourful and pleasant, adding to the happiness and brightness of life.

THE INSTITUTE WOULD LIKE TO ACKNOWLEDGE THE ADVERTISERS AND THANK THEM FOR THEIR SUPPORT

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The RUST Spot...

in conversation with Rob White

Briefly explain your background and how you came to be involved in the Corrosion Institute. What year did you join?

After having worked in the water industry for 5 years in the 1970's I found that I was more interested in the engineering side of things than the straight science. As a result I returned to do a post-graduate Masters in Chemical Engineering. I was fortunate to participate in the Royal Navy's submarine rescue programme and was part of a team developing the corrosion protection requirements of diving life support systems for HMS Challenger. I was offered a full-time position at the end of my research project but a wise colleague advised that, as the Navy had been around for a 1 000 years, I was an unlikely candidate to change it. In 1981, I was recruited with Allan Higginson to start and develop a research group focusing on corrosion problems in the mining industry at the then National Institute of Metallurgy (now Mintek). I joined the Corrosion Institute in as an Associate Member in 1982.

What was the state of the industry then and what role did you play within the institute?

South Africa was experiencing boom times in the early 1980's. The corrosion industry had good expertise everywhere although, as today, there were never enough trained people to be had. My involvement with the Institute was largely limited to giving presentations at Technical Evenings and Conferences.

Talk about your years with the institute, your successes during your time with the institute and what changes you've seen over that time?

When I joined Middelburg Steel and Alloys (MS&A) in the late 1980's Jonty Kirkman, the Marketing Manager was President of the Institute and cajoled me into becoming more involved and in joining Council. The Corrosion Institute ran its Corrosion Schools and many conferences all of which were well supported with a large amount of camaraderie amongst the various protagonists.

I guess my major success was Chairing the 14th ICC. The support to bid at the 1996 Melbourne ICC to host the ICC in Cape Town was given at the Institute's 1995 AGM. The opening up of South Africa in the early 90's gave us the opportunity to showcase the country and with the support of the inner circle of the ICC committee in Melbourne we won the vote for the next Congress. At Melbourne we had support from Satour and Captour who hosted a breakfast for voting delegates but the real hard work was done by the South African team.

I was given great advice from David Whitby who chaired the Melbourne conference – "outsource what you can and stay cash positive"! I still remember sitting opposite Peter Surgey, then MD of Plascon and asking for Key Sponsorship – and can we please have it now. And he said yes!! Similarly, old friends at Columbus Stainless were supportive managing and paying for the opening ceremony at the Cape Castle – marimba bands, guard of honour and all! They even illuminated the mountain! The conference itself was a success with over 500 delegates from over 57 countries attending. A small contingent of committed members made it happen. I will always be indebted those who prevented me having a heart attack and will always be most grateful to Alison, Beverley, Linda Holt, Iain Dodds, Dan Durler, John McEwan, Tony O'Donnell, Chris Pistorius, Jake Pressly, Roelf Sandenbergh and Philippe Scheers.

For most of the time before the 14th ICC, the Institute had a light cash reserve. The conference put over R1m into the coffers (R3m in today's money – I checked!) and whilst Council made the precedent of allowing me to continue as President after the conference until the October AGM, I was relieved when it was all over. I always felt that the money should be spent on furthering the aims of the Institute and am pleased to see that education has taken such an important role in its activities since then.

If you could go back, what things would you do differently?

Much of my Presidency was consumed by the conference. It provided an opportunity for the Institute to shine and opened doors for some. So, all in all, not much could have been done differently. Time numbs the senses as to the pain that it caused.

What advice do you have for the industry going forward?

As one ages, one tends to be a little critical of current happenings. Change happens – get used to it! For those driving things today – we didn't have more time in the past but, it's a good story to believe. Without champions and patrons nothing gets done. The industry has always been in a state of flux and that is a good thing as it avoids stagnation and stops smugness developing. The Institute will grow if it remains relevant. So, going forward – time for the champions to step up! Make a difference!

Where and what do you do now?

I have spent much of the last 15+ years travelling extensively supporting the galvanizing industry. That's another tale. Now, in semi-retirement, I would like to get my piano playing back to scratch (my old hands permitting), do some walking, support friends in the industry and, travel with enough time to actually see the sights. I see myself retired in Hampshire but….who knows?

COURSES

- We have the Coating Inspector Program (CIP) Level 2 scheduled for 19th November until the 24th November 2018 in Johannesburg. We urge all the Candidates who completed the CIP level 1 successfully to register and attend the course for the personal career growth and advancement.
- Not Just Rust is planned for the 28th November 2018 for all individual who needs a basic introduction in the Corrosion industry.

  Company members – please remember you have one free seat per annum for the Corrosion – Not Just Rust course.

We would like to acknowledge Sasol Secunda for requesting an in-house CIP 1 course 22-27 October 2018 which has reached a maximum of 27 candidates, first time this year. Also, we would like to acknowledge Southey for organizing the venue and equipment for the Practical day.

We would also like to acknowledge Rand Water for the Corrosion in the Water Industry course request which made the course happen as per schedule.
The 2018/19 course schedule has been finalized with all our local and international (NACE) courses. Other NACE courses are available based on demand and request by the members.

CIP1 TRAINING COURSE: 9 - 14 July 2018

CIP1 TRAINING COURSE: 1 - 6 October 2018

CORROSION IN THE REFINING INDUSTRY: Lecturer, Mr Hisham Hasham, USA

CORRISA COURSE SCHEDULE 2018/2019

NACE CIP 1 – Coating Inspector Program Level 1	
21st – 26th January 2019	The CORē, Midrand
18th – 23rd February 2019	KwaZulu Natal
25th – 30 March 2019	The CORē, Midrand
6th – 11th May 2019	The CORē, Midrand
3rd – 8th June 2019	Cape Town
8th – 13th July 2019	The CORē, Midrand
16th – 21st September 2019	The CORē, Midrand
4th – 9th November 2019	The CORē, Midrand
NACE CIP 2 – Coating Inspector Program Level 2	
19th – 24th November 2018	The CORē, Midrand
4th – 9th February 2019	The CORē, Midrand
29th July – 3rd August 2019	The CORē, Midrand
2nd – 7th December 2019	The CORē, Midrand
NACE CP 1 – Cathodic Protection Tester	
4th – 8th March 2019	The CORē, Midrand
NACE CP 2 – Cathodic Protection Technician	
24th – 28th June 2019	The CORē, Midrand
Corrosion Engineering Exam	
8th – 12th April 2019	The CORē, Midrand
2nd – 7th September 2019	The CORē, Midrand
7th – 11th October 2019	Cape Town
Corrosion Management	
11th – 12th March 2019	The CORē, Midrand
5th – 6th August 2019	The CORē, Midrand
Not Just Rust	
28th November 2018	The CORē, Midrand
27th February 2019	The CORē, Midrand
17th April 2019	The CORē, Midrand
26th June 2019	The CORē, Midrand
28th August 2019	The CORē, Midrand
30th October 2019	The CORē, Midrand
CITWI BPA – Corrosion in the Water Industry	
20th – 23rd May 2019	The CORē, Midrand
18th – 21st November 2019	The CORē, Midrand
NACE OCAT (Offhsore Corrosion Assessment Training)	
19th – 23rd August 2019	Cape Town
Corrosion Control in the Refining Industry	
21st – 25th October 2019	The CORē, Midrand
Marine Coating Technology	
22nd – 25th July 2019	The CORē, Midrand
Corrosion and Protection of Concrete Structures and buildings	
27th – 28th May 2019	The CORē, Midrand

REGISTRATION LINK:
https://docs.google.com/forms/d/1e9ZGDsMO1Sd8aXuCvys2bstXr5SrpVBxuqEQPK9lfUM/viewform?c=0&w=1

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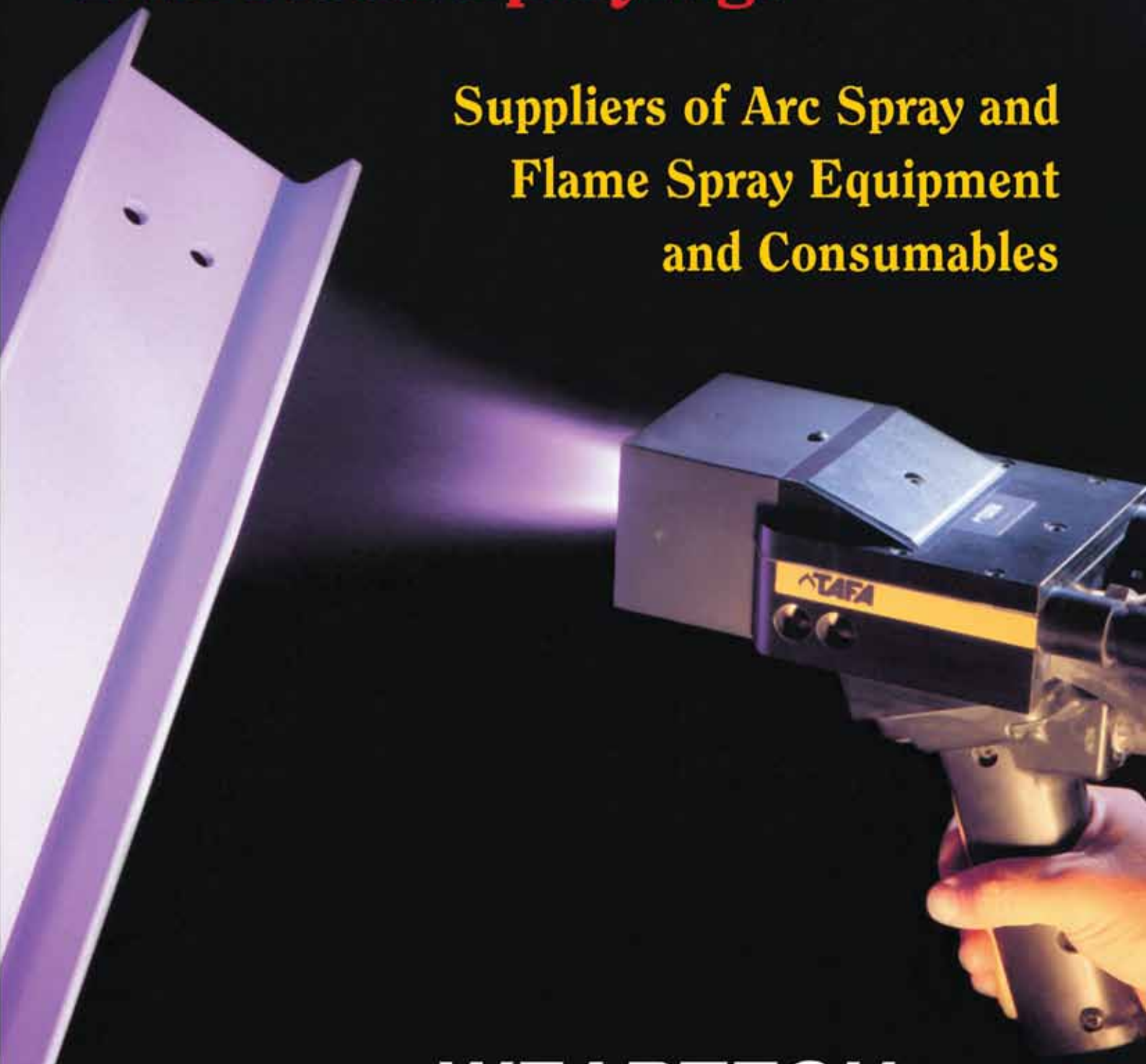

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