Feel Good about Yourself

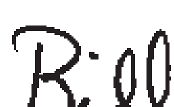
I am writing this editorial on the 40^{th} anniversary of Earth Day, April 22nd. April 24^{th} marks another important day, Corrosion Awareness Day, that has its origins in Earth Day. While it is the 40^{th} anniversary of Earth Day, it is the inaugural Corrosion Awareness Day. I never used to think much of Earth Day and protecting the environment, but now I do. Maybe now that I am older and hopefully wiser, I look back on the harm others and I did and continue to do out of sheer ignorance.

I remember as a teenager I had to help my grandfather pump oil wells in Western Pennsylvania. One of my jobs was to gauge the tank. Before I climbed up on the tank, I would have to drain the water that had settled on the bottom. If you remember from science class, water is heavier than the oil. I would just take a large wrench, open the valve and let the water run out, on the ground, until the oil started flowing. Needless to say, when I first opened the valve I was causing some major pollution and damage to the environment before I ever got down to the pure oil. Now find myself picking up trash off the street and even on the golf course when others are too lazy to do so. It might say something about my game that I am deep in the woods when I pick up beer cans and soda containers! But I feel good about doing it.

Today, when I was coming to work, the radio hosts interviewed a gentleman who had recently made it a mission to clean up areas around Pittsburgh. He is a recent retiree and said he was never an environmental zealot. He said his mission started when he used to go to a cemetery in the Pittsburgh area to visit the graves of family members who were buried there. He said outside the cemetery walls was "green space" but it was just littered with trash and debris. One day he decided that he was going to make a difference and took trash cans, rakes, and shovels and went to work to clean it up. He removed tons of trash. His story came to the attention of the radio station because one of the hosts saw him on a cliffside above a major six-lane highway doing the same thing. He said, "Since I am retired, it gives me something to do, and I feel good about myself."

Starting on page 18 of this issue, we present the Structures Awards photo essay. These feature tanks, facilities, and other structures that SSPC recognized at the last PACE conference. They show the before and after photos of the award winners and how our industry has made a difference. To avoid allowing these structures to fall into a state of complete disrepair, the owners teamed up with paint suppliers, painting contractors, and material suppliers to make something last longer and be aesthetically pleasing to the eye. I only hope that the workers who actually spent the time on the project look at what they did and have a real sense of accomplishment. All involved, especially the blasters, painters, and the general workforce, deserve a pat on the back. Some of these projects like Lucy the Elephant, the Rocket Park Rockets, and the Opelika Sportsplex and Aquatic Center will be enjoyed by thousands of people. I feel good because SSPC members were involved, and our standards were used. Our industry made a difference and contributed to Earth Day and Corrosion Awareness Day. It should make us all feel good about what we do everyday.

Last month I wrote in my "Not David Letterman's Top 10" editorial that you need to laugh often, long, and hard, and you have to laugh at yourself. In this month's issue you will be able to read the President's Lecture Award Paper, "Hubble, Bubble, Tests, and Trouble: The Dark Side of Misreading the Relevance of Coating Testing" by Mike O'Donoghue, Ph.D., V.J. Datta, M.S., Mike Winter, Ph.D., and Carl Reed, of International Paint, LLC. You will also see a drawing by Peter Salvati of the *JPCL* staff. It really resembles another photograph in the *JPCL* (of me!). I was not present when Dr. Mike presented the paper at PACE and at the American Coatings Show, but I heard that he expounded on my attributes as a chemist, which you all know I am not. I was told everyone had a good laugh. I had to laugh as well because Dr. Mike has a history of "pulling my chain" and coming up with things that give everyone in his audience some amusement at my expense. He has told me that I am a good sport, and that in itself made me feel good. I can only wait to see what he comes up with next, but let me assure you that one day I will get back at him, and I hope I make him have a good laugh too.



Bill Shoup
Executive Director, SSPC

Pittsburgh Hosts Annual Bridge Conference; SSPC Sponsors Coating Session

The Engineers' Society of Western Pennsylvania (ESWP) will present its 27th Annual International Bridge Conference (IBC) at the David L. Lawrence Convention Center in Pittsburgh, PA, on June 6–9, and will include an SSPC-sponsored coating session.

On Monday, June 7, the Keynote Session will be held from 8:30 a.m. to noon. Bridge industry leaders from around the world will speak.

Courtesy of VisitPittsburgh

The conference will present technical sessions, seminars, and workshops, all running from Monday, June 7, through Wednesday, June 9. For the technical sessions, attendees may choose from presentations in four concurrent sessions, as new technical presentations are scheduled every 25 minutes. Seminars are offered in 4-, 8-, or 16-hour intensive courses that provide an in-depth focus on a variety of topics. Workshops are focused on specific topics, usually lasting four hours or longer, and are presented by co-sponsors, partners, and other leading industry groups.

SSPC: The Society for Protective Coatings is serving as an official co-sponsor for IBC and is the official sponsor of the Coating Session workshop, scheduled for Tuesday, June 8, 8:00 a.m. to noon. Presentations as of press time will include the following.

- Myint Lwin, Federal Highway Administration, "Sustainability of Transportation Infrastructure and Accelerated Bridge Construction"
- Steven Reinstadter, Bayer MaterialScience—Coatings, "Environmentally Friendly Graffiti Resistant Coatings—Waterborne Polyurethane Coatings for Bridge Structures That Actually Work"
- Dee McNeill, The Sherwin-Williams Company, "Next Generation High Build Aliphatic Polyurethane and Polyurea Technologies for the Bridge Market"
- Wayne A. Senick and Craig Bellinger, Termarust Technologies, "Calcium Sulfonate Coatings: HR CSA or CSA—"What is the Difference?"
- Chris McMillan, International Paint LLC, "Polysiloxane Coatings for Steel Bridges"
- David White, P.E., Sika Corporation, "Sunshine Skyway Bridge Repairs with FRP Composite Materials"
- Aimee Beggs and Heather Bayne, SSPC, "An In-Depth Look at Standards Most Frequently Used By Industrial Painters"

Other workshops will cover topics such as materials for rehabilitation, workzone safety, traffic management, protection of concrete structures, rebar, aesthetics, funding and financial issues, and galvanizing. A forum for bridge owners, a meeting of the Bridge Policy and Promotion Council, and a Western Pennsylvania Transportation Research Forum will also be held.

The following is a list of exhibitors and their booth numbers, as of press time, that are of interest to professionals in industrial and maintenance coatings.

- BASF Corp.–Building Systems......409
- Chase Construction Products.......404
- ChemCo Systems.........................612
- Corrpro Companies, Inc. 731
- Dayton Superior Corporation........602
- Euclid Chemical Company............805
- Evonik/Cyro Industries 904
- Greenman-Pedersen, Inc./Instrument Sales, Inc. a GPI Company...........603
- KTA-Tator, Inc. 738
- North American Galvanizing Co....424
- Poly-Carb Inc. 609
- Rampart Hydro Services 838
- Safway Services, LLC 339, 438
- SIKA Corporation..........................700
- Stirling Lloyd Products, Inc. 908
- Termarust Technologies................601
- Thermion 425
- Transpo Industries Inc. 508
- Vector Corrosion Technologies.....900

Technical sessions will cover accelerated bridge construction; bridge maintenance, rehabilitation, management, and design; long span bridges; pedestrian bridges; and research and evaluation. There will also be two poster sessions and the featured agency session, this year on the Maryland State Highway Association & Maryland Transportation Authority.

For details: www.internationalbridgeconference.org.

SSPC-*JPCL* Webinar on One-Coat Bridge Systems Scheduled for June 8

The SSPC-*JPCL* Education Series Webinar on "One-Coat Systems for Steel Bridge Structures" will be presented June 8 from 11:00 a.m. to 12:00 p.m. The webinar is one of 20 in the series to be offered during 2010.

Education Series Webinars provide continuing education for SSPC recertifications as well as technology updates on important topics.

Participation in the webinar is free, but for those who wish to receive continuing education credits from SSPC, a test is available after the webinar. Cost of the test service is $25. All participants, however, will receive a free certificate of completion.

The webinar on one-coat systems for steel bridges will be presented by Eric Kline of KTA-Tator and will provide results of a two-year study conducted by the Federal Highway Administration that evaluated performance of eight separate one-coat systems. Included in the evaluation were electrochemical impedance spectroscopy, surface failure characterization, rust creepage at the scribe, pull-off adhesion, and visual changes to color and gloss.

Those who wish to participate in the webinar can register free at www.paintsquare.com/education.

Carboline Funds Professorship in Corrosion Engineering

The University of Akron (UA) and The Carboline Co. of St. Louis, Mo., have announced the creation of the Carboline Chair in Corrosion and Reliability Engineering at UA. Through a gift to the university's College of Engineering, Carboline is funding a full-time faculty position dedicated to education and research.

Carboline's partnership with UA's Corrosion and Reliability Engineering program extends opportunities for research and technology demonstration projects, according to Frank C. Sullivan, chairman and chief executive officer of RPM International, Carboline's parent firm.

The faculty position will be posted immediately, and, following a successful search, it is anticipated to commence in fall 2010.

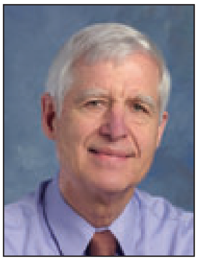
The College of Engineering at UA, in fall 2010, will launch the first baccalaureate program in corrosion and reliability engineering in the nation, with initial funding through the U.S. Department of Defense Office of Corrosion Policy and Oversight in the Office of the Undersecretary of Defense, Acquisition Technology, and Logistics. Housed in UA's Department of Chemical and Biomolecular Engineering, the program will focus on teaching and research.

The UA College of Engineering has a current undergraduate enrollment of 2,142, representing a 55% increase in enrollment between fall 2004 and fall 2009. For further information, go to www.uakron.edu.

Carboline is a supplier of corrosion-resistant products, specializing in high-performance coatings, linings, and fireproofing for industrial structures. For further information, go to www.carboline.com.

Chemists' Group Honors Battelle Scientist for Soy Oil Research

Herman Benecke, Ph.D., a noted scientist at the research and development organization Battelle, has been chosen to receive the 2010 Industrial Uses of Soybean Oil Award by the American Oil Chemists' Society for his research on soybean oil for coatings.


Herman Benecke

Benecke, described by Battelle as one of its "premier scientists," has specialized in the conversion of soybean oil and meal for various industrial products, including polyols that can be used in polyurethane coatings, foams, and other materials.

Benecke will receive the award May 17 at the American Oil Chemists' Society annual meeting in Phoenix, AZ. The award is presented by the Society's Industrial Oil Products Division and is sponsored by the United Soybean Board.

Battelle is based in Columbus, OH.

TF Warren to Expand Tank, Terminal Services

Following the recent acquisition of Tarsco Inc. with partner Atec Steel, the TF Warren Group of Ontario, Canada, has announced plans to expand its services to tank owners and terminal operators worldwide. The expansion includes design, procurement, shop fabrication, field erection, and repair.

Others members of the TF Warren Group—Brant Corrosion, Blastech, and Blastco—provide precoating, shop coating, field coating, and lining services.

Tarsco Inc. is based in Gardena, Calif. Atec Steel is in Baxter Springs, Kan.

For details: www.tfwarren.com.

On Maintaining Suspension Cables on Bridges

What maintenance needs to be carried out on the cables of suspension bridges to prevent corrosion damage?

Barry R. Colford
Forth Road Bridge, UK

The main cables of a suspension bridge are the primary load-carrying members. For centuries, organic rope was used as the material to form the cables. At the start of the 19th century, iron chains were used, enabling longer spans to be achieved. In 1883, the Brooklyn Bridge in New York was completed using steel wire to form the main cables.

Aerially spun cables are made up of thousands of individual 5-millimeter-diameter (⅕-inch), high tensile steel wires laid parallel and then compacted together until the voids within the cable are reduced to approximately 20% of the cross sectional area. The diameter of the cables varies with span and load, and on Forth Road Bridge, their diameter is nominally 600 mm (~27 in.).

The wires are usually galvanized, and, after compaction, a 9-gauge galvanized wrapping wire is wound circumferentially around the cable. Just prior to the wrapping wire being wound on, a red lead paste is applied by hand (it is of interest that on Brooklyn white lead paste was used). Zinc paste is now used as a substitute for red lead paste. After wrapping, a standard steelwork paint system is applied.

While the external surfaces of the cables can be inspected, the inspection does not provide a definitive guide to the condition of the individual wires making up the cable. After the discovery of significant corrosion within the main cables of suspension bridges in the U.S., the U.S. Transportation Research Board commissioned a guide for main cable inspection. The guide became known as NCHRP Report 534. It gave guidance on how and when to open the main cables to allow inspection of the internal wires and detailed a method of evaluating the strength of cables with corroded, cracked and broken wires.

Following publication of the guide, the main cables on Forth Road Bridge were inspected internally. Wire breaks and significant corrosion were found within the cables. These findings were

Continued

unexpected because no external signs of moisture or corrosion had been reported at Forth, and the cables had been well maintained and inspected. Similar internal inspections subsequently took place on Severn and Humber Bridges, with worse corrosion than expected also found on these bridges.

The results of these internal inspections in the UK and work in the U.S., Scandinavia, France, and Japan have reinforced the view that the existing method of protecting main cables by traditional painting seems compromised.

At Forth Road Bridge, it was recognized that while the corrosion was serious if left unchecked, there was no urgency to limit loading on the bridge. Work done indicated that there were no immediate safety concerns, and the bridge could comfortably carry the existing traffic loads. However, it was

Barry R. Colford, BSc., CEng, MICE, is Chief Engineer and Bridgemaster for the Forth Estuary Transport Authority. He is a Chartered Civil Engineer by profession and member of the Institution of Civil Engineers since 1982. After graduation, he worked for the Babtie (now Jacobs) Group in Glasgow in the design office and then on sites both in the UK and overseas, on a variety of industrial and bridges projects. Colford returned to the design office with Strathclyde Regional Council and was involved in bridge design in Glasgow as well as the maintenance of large steel bridges. He joined the Forth Road Bridge Joint Board (now Forth Estuary Transport Authority) as Depute General Manager in 1996 with responsibility for the maintenance and operation of the Forth Road Bridge. In February 2008, he was promoted to the post of Chief Engineer and Bridgemaster. He has written many technical papers on bridge engineering. He is involved with Edinburgh Napier University in its M Eng and MSc courses.

apparent that action needed to be taken to protect the cables from further loss of strength, and that it was essential to take measures as soon as possible to halt or at least slow the rate of deterioration.

There appeared to be only three options to try to stop the deterioration in strength and all involved preventing or slowing the rate of future corrosion.

- Wrapping the existing paint with a neoprene wrap
- Oiling the cable internally
- Applying a system of dehumidification (DH)

The first two options had been used on U.S. bridges with varying success. However, DH, which involves passing dried air at 40% relative humidity through the voids in the cables at a low pressure at around 3,000 pascals, had been developed and used on bridges in Japan. Although the work in installing DH on Japanese suspension bridges and one suspension bridge in Sweden had not been validated, and had been installed on bridges much younger than the 45-year-old Forth Road Bridge, it was decided that this option had by far the highest chance of success.

While there is good reason to have confidence that DH can slow or halt corrosion, DH cannot, of course, restore strength that has been lost. In addition, there is no body of evidence yet available to allow an unconditional assurance that DH will prevent a further reduction in strength loss in the main cables of a 45-year old bridge such as Forth. The reasoning is that individual wires which have already suffered from corrosion are likely to contain some micro cracks along their length. The number and depth of these cracks and their potential to grow within the dehumidified cable are unknown. Therefore, it is not possible to determine how many of these cracks will in turn lead to wire breaks, and, because loss of strength is directly related to wire breaks, the future strength of the cables is also unknown.

Suspension bridges are not only iconic structures but also are extremely valuable pieces of infrastructure that must be well maintained to continue to serve society throughout and even beyond their 120-year design life.

Internal inspection of the main cables of these bridges is essential. It can be reinforced by applying a system of acoustic monitoring to the cables to ensure that any wire breaks are being recorded.

In addition, it is considered vital that a DH system be installed on the cables of new and existing suspension bridges to ensure that corrosion is not an issue in the future. It is also recommended that a DH system be fitted to the main cables of all existing suspension bridges to ensure that any future corrosion is reduced.

The Case of...the Strange Blistering

By Kenneth B. Tator, KTA-Tator, Inc.
Richard A. Burgess, KTA-Tator, Inc., Series Editor

An owner intentionally selected a coating system that used the prevailing cool, humid environment inside the salt water ballast tanks to help cure the coating system during dry docking and coating repair operations. Despite this foresight, the repair coating blistered within a year. Was the coating mis-formulated? Did the contractor apply the coating over contaminated surfaces? Or was the wrong coating selected for the service environment?

Background

A cargo ship servicing the east coast of North America was in a dry dock for repairs. During the dry docking, it was decided to also repair some of the existing ballast tank coating that had deteriorated over the years. The deterioration of the old ballast tank coating was not unusual, occurring mainly on welds and at scattered localized areas throughout the ballast tanks.

Holes were cut through the ship hull into the ballast tanks at various locations to provide access for personnel and equipment to repair the coating. The coating system chosen was a saltwater immersion-grade ketimine epoxy.

This type of an epoxy coating utilizes moisture in the air to react with the polyimine curing agent to cure the coating (Fig. 1). Basically, a ketimine reacts with moisture to produce an amine, which reacts with and crosslinks the epoxy, and a ketone, which is a strong solvent.

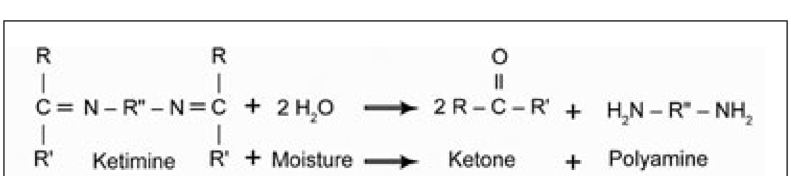


Fig. 1: Mechanism of ketimine curing agent
Courtesy of KTA-Tator

The resulting amine cross-linked epoxy coating system has a relatively long pot life and can be applied as a high-build coat in humid environments. Such a system was considered ideal for relatively cool weather application in a shipyard on the Atlantic Coast. The specification required spot blast cleaning to Near-White Metal (SSPC-SP 10/NACE No. 2) followed by two coats of the ketimine epoxy. The ballast tank environment was heated on cold days for the comfort of the work force and for easier coating application. Work began in mid-February and was completed approximately three months later. The coating manufacturer had a representative on site to inspect work quality during the entire process. All aspects of the work were done properly, and the coating was continuous, adherent, and well applied.

After all repairs were completed, the ship was placed into service. Approximately one year later, during a routine inspection, blisters were observed in the ballast tanks. The blisters occurred only in the repaired areas. Blistering was most prevalent on the horizontal deck plates, and in confined spaces or areas. All blisters were liquid filled. Within the ballast tanks, there was little or no blistering above the exterior water line. In some cases, when the blisters were opened, there was no rusting on the surface, and the underlying steel appeared to be as originally blast cleaned. In other cases, rusting could be found on the steel at the center of the blister and on the underside of the blister cap (Figs. 2 and 3).

Fig. 2: Blister with no oxygen permeation (without rust)

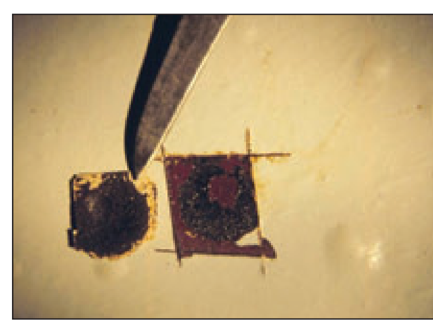


Fig. 3: Blister with oxygen permeation (rust)
Photos courtesy of KTA-Tator

Field and Laboratory Investigation

A site visit was conducted to investigate the failure and to obtain samples of blister liquid and of the coating from both good and blistered areas. The blister liquid was analyzed in the laboratory using Gas Chromatography-Mass Spectroscopy (GC-MS). This analysis combines a chromatograph (used for separation) with a mass spectrometer (used for identification). The chromato-

Continued

graph maintains consistent high heat. The blister liquid was injected through a port, vaporized, mixed with helium, and forced through small coils (column). The separated volatiles were then universally identified by their mass. The blister liquid contained solvents, notably methyl ethyl and methyl isobutyl ketones (from the reaction of the ketimine and moisture/humidity).

The Failure Cause

Based on the laboratory analysis and observations of blistering location and frequency in the tank, the following failure scenario was postulated.

During application at the time of coating repair, heating the ballast tanks reduced the relative humidity of the ambient air. Additionally, within the ballast tanks, forced air ventilation to all areas was difficult due to the complex configuration of the ballast tanks (Fig. 4).

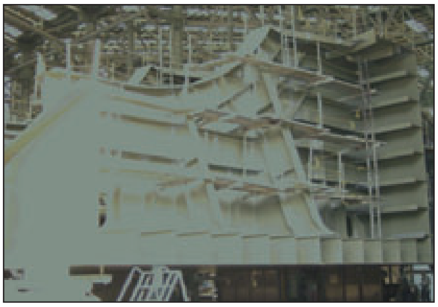


Fig. 4: Photograph of a ballast tank sub section during ship assembly

As a result, air with sufficient moisture was not circulated adequately into all areas of the tanks. Repair areas with insufficient air circulation did not liberate enough polyamine from the ketimine to properly cure the epoxy resin in the coating. Also, where moisture was sufficient to react with the ketimine to provide the proper amount of cross-linking polyamine, the ketones that were also liberated sank to the deck because the solvents are heavier than air. The layer of ketone solvents on the deck slowed solvent evaporation from the deck coating repair areas. On areas of thicker steel, such as on heavier structural members and stiffeners, the steel remained cooler, and ketone solvent evaporation from the coating repair areas was slower. Finally, those areas of the hull plating below the ship's water line were cooled by the water. After the repairs were completed and the ship was re-launched, the steel could never come to sufficient temperature to allow the ketimine decomposition reaction to occur.

Thus, where blistering was occurring, it was determined that the coating had not sufficiently reacted and cross-linked properly (therefore, retaining ketimine), and/or the ketone solvents liberated from the proper moisture reaction with the ketimine had not sufficiently evaporated from the coating system. Ketone solvents are highly polar due to the carbonyl oxygen in their makeup. That polarity will attract and hold water molecules that otherwise permeate the coating when immersed. Figure 5 shows the hydrogen bonding attraction of the ketone carbonyl for the hydrogen atoms of the water molecule.

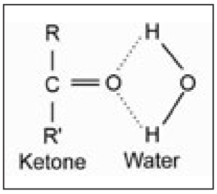


Fig. 5: The dotted line (….) denotes hydrogen bonding attraction Courtesy of KTA-Tator

The Failure Mechanism

The phenomenon that was causing the blisters is called osmosis. Osmosis may occur when a polar solvent or water-soluble material is trapped beneath or retained in a coating. The coating above the trapped material acts as a semi-permeable membrane. As with any coating, moisture, in time, will permeate that coating and come in contact with the trapped solvent or salt. When this happens, the moisture will concentrate and may cause blistering. In this particular case, polar ketone solvents were trapped within the coating next to the steel substrate. This is because the steel substrate was generally cooler, and solvents can more readily evaporate from the coating surface than from deep within the coating cross-section (Fig. 6).

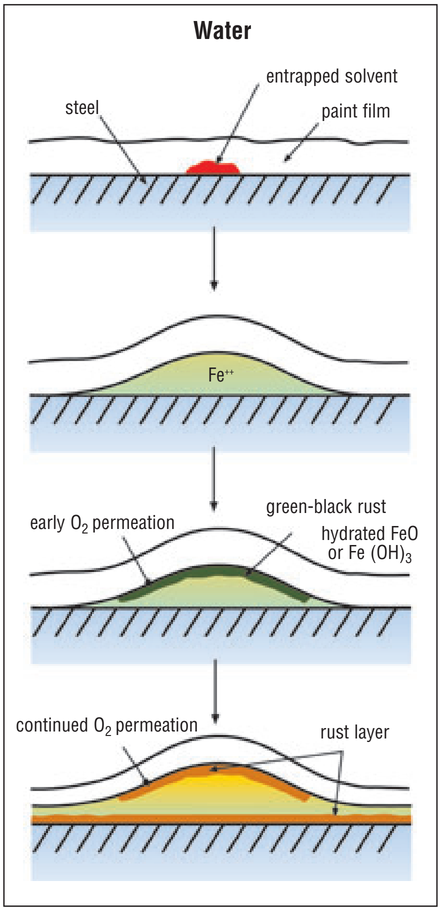


Fig. 6: Osmotic blistering

Initially water from the immersion or wet environment permeates the coating film. The film acts as a semi-permeable membrane, and smaller molecules such as water permeate first and accumulate at the entrapped solvent (or salt), causing a pressure build-up that overcomes adhesion of the coating to the substrate, and causes a liquid-filled blister. Dissolved oxygen in the water is a larger molecule and takes longer to permeate the coating system. However, when oxygen does permeate, it reacts with ferrous ions from the steel to form a hydrated oxide rust layer at the top of the blister cap. Ultimately, rust also forms on the steel surface as more oxygen permeates. Ion permeation, if it occurs, is much slower, and penetration is through capillaries and minute defects in the coating film.

Continued

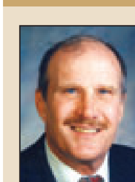
The potential for osmotic blistering should always be considered by an owner, specifier, and applicator when coating a tank or other structure that will be in immersion or a mostly wet or damp environment. Entrapped polar solvents or water-soluble salts are usually the cause of osmotic blistering. Care should be taken to remove any water-soluble salts, particularly in marine environments; to provide sufficient heating and ventilation for adequate solvent evaporation; and to remove any accumulating solvents.

Accumulating solvents may also be an explosion hazard. Safety monitoring for the lower explosive limit of the solvent must be performed whenever working in a confined space applying a solvent-containing coating.

Repair Procedures

It appeared the blisters had stabilized (there appeared to be no further growth of blister size or increase in frequency), based on the ship owner's observations. Accordingly, the recommendation was to leave the blisters alone and keep the ballast tanks in immersion as much as possible. As long as the blisters remained intact, there would be little or no significant corrosion on the steel within the blister cavity. (Within a confined space, dissolved O_2 in immersion is quickly used up, substantially slowing corrosion.) However, if the blister cracked due to drying out as a result of emptying the tank for subsequent coating inspections, oxygen could more readily reach the steel substrate and cause accelerated corrosion. The blistered coating would shield the ballast tank's sacrificial anode cathodic protection system, and prevent the zinc-aluminum anodes from providing galvanic protection to the underlying steel.

Even though periodic inspections were required of the ballast tank coating, the ship owner followed the recommendation until the next scheduled dry docking, about seven years later. At that time, the affected coating was again spot repaired with a compatible solvent-borne, immersion-grade epoxy coating system. Better ventilation, air circulation, and evacuation were used during repair.



Ken Tator of KTA-Tator has been chairman of the SSPC Research Committee and numerous other SSPC and NACE committees; a member of SSPC's first Board of Directors; Director of NACE; and writer for *JPCL*, SSPC, NACE, and ASM.

SSPC Honors Outstanding Work on 8 Structures

Outstanding coating work on eight structures—ranging from intricate monuments to monumentally intricate industrial and commercial facilities—received high honors from SSPC: the Society for Protective Coatings at PACE 2010, February 7–10, 2010, in Phoenix, AZ. SSPC President Steve Roetter and Executive Director Bill Shoup presented the fourth annual Structure Awards at the SSPC Annual Meeting, held on the first evening of PACE, the joint conference of SSPC and PDCA. SSPC gives these awards to teams of contractors, designers, owners, and other professionals for their expertise in high-performance coatings, demonstrated through excellence on particular projects.

Project details as well as photos of the winning structures and representatives of the projects' teams are featured in these pages. Information about the projects was drawn from nomination matrerials submitted to SSPC in 2009.

George Campbell Award: Deer Island Water Treatment Plant Facility

Three projects received SSPC's George Campbell Award, which represents outstanding achievement in the completion of a difficult or complex industrial or commercial coatings project. This might include working in extreme weather conditions, under strict time constraints, or with limited access or in high traffic areas, or working on a structure with complex structural components that requires coordination with multiple trades or subcontractors.

The award is named for the late George Campbell, founder of Campbell Painting Company in New York.

Photo courtesy of Tim Coleman, PPG inspector.

The Deer Island Waste Water Facility is 20 years old, and the previously coated structures in the clarifier tank needed to be repaired. The contractor worked with the coatings representative to assess the area and identify surface preparation needs and a coatings system that would provide resistance to cleaning and abrasion.

The tank structures were abrasive blasted to remove the loose rust and paint. Four coats of a fast-drying, surface-tolerant epoxy were applied to the steel interior as a primer and lining. The coating is NSF-approved and suited for waste water tank applications.

Location: Winthrop, MA
Structure Owner: Massachusetts Water Resources Authority
Contractor/Applicator: SOEP Painting
Coating Material Supplier: PPG Protective & Marine Coatings
Start Date: May 2009
Completion Date: August 2009

(l-r) Bruce Ferro, CQC Manager, Kevin Michalewicz, Project Manager, and Brian Morely, Project Manager, SOEP Painting, Inc.; Steven Feldman, Sales Director, and Anthony Persutti, Industrial Sales Representative, PPG Protective and Marine Coatings. Photo courtesy of SSPC

Six historic rockets owned by the Smithsonian and on loan to NASA's Marshall Space Flight Center (MSFC) necessitated repainting to preserve their structure and maintain them as a main attraction at MSFC. The rockets ranged from the V-2, developed by Germany before World War II, to the Saturn I, used between October 1961 and July 1965. The rockets had rusted areas on bases and rocket bodies, and neglect had advanced to the point that birds were nesting in the rusted-through midsection of the Saturn I.

The landmark preservation project required industrial painting skills using different coating systems, technology, and equipment, as well as collection of hazardous byproducts to protect the environment.

Photos courtesy of Susan Boyd, Vulcan Painters, Inc.

Specifications required an ISO- or SSPC-certified contractor with three years of experience blasting with recyclable media and using the specified paint systems on similar projects. The specs also required SSPC-Guide 6 containment for debris. The contractor selected containment methods for the rocket bodies and bases that allowed workers to remain outside the containment.

A plan for removal, capture, and collection of lead-containing paint chips, blast media, and other debris was required, and the contractor was responsible for recording and submitting for approval all graphic markings, including lettering, for each rocket before surface preparation so each could be repainted to match pre-weathered finish conditions.

The blue rocket support bases were blasted with an aluminum oxide grit encapsulated in polymer sponge to an SSPC-SP 6, Commercial Blast finish. Rocket bases were primed with a high-solids epoxy and finished with a high-solids polyurethane.

Rocket bodies were cleaned to SSPC-SP 3, Power Tool Cleaning, to remove flaking and loose paint. The

painters used the glove bag method of containment, with power tools to remove, contain, and vacuum loose paint and debris. Chalking paint was sealed. Rust spots were primed with one coat of a universal primer, followed by two coats of acrylic coating. The lettering was then reapplied.

The job required 80- and 100-foot manlifts and a 190-foot crane to reach the top of the 162-foot Saturn rocket. The job was delayed after the rusted midsection was determined to be in such bad condition that the repair required additional funding. Once funding was secured, painters used a 125-foot manlift to install a fiberglass mat over the cleaned and primed midsection and painted over the repaired section with an epoxy coating.

Location: Marshall Space Flight Center, Huntsville, AL
Structure Owner: Smithsonian Museum
Contractor/Applicator: Vulcan Painters Inc. (SSPC-QP 1-, QP 2-, QP 3-, QP 8-, QP 9-, and QS 1-certified)
Coating Material Supplier: The Sherwin-Williams Company
Start Date: April 2008
Completion Date: October 2008

(l-r) Randy Kerans, Industrial & Marine Marketing Mgr., The Sherwin-Williams Company; Jeff Theo, Vice President of Field Operations, Vulcan Painters; Steve Roetter, SSPC President; David Martin, Team Lead, Marshall Space Center, NASA
Photo courtesy of SSPC

George Campbell Award: Rockland County Pipelines

Overcoming inclement weather, mischievous teenagers, and raccoons, the contractor managed to abrasive blast, coat, and insulate five exposed sewer pipes at two locations that had been installed more than 20 years ago.

The two pipes at the Naurashaun Brook Siphon location are 36 inches in diameter and span a feeder brook to the United Water reservoir in Blauvelt, NY. One pipe, 55 feet long, was previously coated with an asbestos coating. The other, 29 feet long, was previously covered with insulation and an aluminum jacket, most of which had fallen off. Plant life was growing out of the remaining insulation.

Work at the Naurashaun site took eight weeks to complete due to weather delays. Before the painting crew could start work, they had to install water booms to protect the brook. A scaffold subcontractor tied the scaffolding into the concrete abutment walls supporting the pipes and the shorelines on both sides of the brook. The scaffolding also provided full containment.

Top: Hackensack River Siphon
Bottom: Naurashaun Brook Siphon
Photos courtesy of Alpine Painting and Sandblasting Contractors

A subcontractor removed asbestos. Both pipes were abrasive blasted to SSPC-SP 6, Commercial Blast Cleaning, and the steel strapping that held the pipe to its supports had to be manually removed, power tool cleaned, and painted one strap at a time to eliminate any danger of shifting the pipes.

It was determined the pipes had to be treated as immersion service, and the paint system of both locations was changed to one that could withstand potential immersion and the atmospheric conditions of coating in colder weather. The entire pipe lengths were coated with full prime, intermediate, and finish coats before the insulation sub-contractor reinsulated the pipes and installed a new stainless steel jacket.

The Hackensack River Siphon, in Blauvelt, NY, also feeds into the reservoir managed by United Water Company. At 30 inches in diameter, the three pipes run 285 feet long and are 60 feet above the river. Trees and bushes grew out of the insulation, and raccoons had nested in one of the support columns.

The scaffolders constructed scaffolding approximately 300 feet long, 20 feet wide, and 60–80 feet over the Hackensack River. The site was fully contained, and water booms were installed. A slight setback came when local youths threw some of the scaffolding into the river.

The insulation sub-contractor removed the old aluminum jacket and insulation, and the contractor abrasive blasted the pipes to an SSPC-SP 6 finish, then primed them to prevent rusting. The work was conducted in the winter, with a one-million BTU heater to maintain climate control. When the river began to freeze, ice eaters were deployed below the scaffolding. Pipes were reinsulated the same way as the Naurashaun location.

In order to blast and coat the steel support structure, it had to be fully contained. This concerned the scaffold PE because the location was subject to strong winds. The solution was to remove the containment above as the workers moved down the support structure. The project was completed 100 days fewer than required by contract.

Location: Nanuet, NY, and Blauvelt, NY
Structure Owner: Rockland County Sewer District No. 1
Contractor/Applicator: Alpine Painting & Sandblasting Contractors
Coating Material Supplier: Carboline Company
Start Date: Early 2008

(l-r) Ben Scaturro, Industrial Sales, and Chet Zalusky, Project Manager, Alpine Painting and Sandblasting; Steve Roetter, SSPC President; Sam Scaturro, Director of Operations, Alpine Painting and Sandblasting; John Conway, Director of Sales-Northeast, Carboline Company. Photo courtesy of SSPC

Crone Knoy Award: Opelika Sportsplex and Aquatic Center

Named for the late founder and president of Tank Industry Consultants, the Crone Knoy award recognizes outstanding achievement in commercial or industrial coatings work that demonstrates innovation, durability, or utility. The qualities that represent outstanding achievement include excellence in craftsmanship or execution of work and use of state-of-the-art techniques or products to creatively solve problems or provide long-term service.

The contract for Opelika Sportsplex and Aquatic Center called for painting the new, 72,000-foot recreation center, which included a full-sized gym, a pool, a three-field soccer complex, and other activity areas. The design criteria created a challenge—the specifications called for more than a dozen different coatings systems to be applied to more than two dozen different substrates.

Photos courtesy of David Dunn, project manager at Vulcan Painters, Inc.

Special consideration had to be given to the Aquatic Center components, including roof structure, concrete and masonry walls, concrete floor surfaces, and pool equipment, that are continuously exposed to pool chemicals in a humid environment. The aggressive environment required high-performance protective coatings and polymer coatings not typically specified on architectural projects. The concrete and masonry had to be cured for a minimum of 28 days, and moisture content had to be measured prior to surface preparation and application of polymer coating systems. Articulating boom lifts were used to gain access to roof areas above the pool excavation.

The specifications required that all shop-primed items received an additional coat of primer before subsequent coats could be applied. The compatibility of subsequent coats with the primer was verified. Many of the coatings systems had product-specific solvents and thinners. As part of the contractor's ISO-registered Quality Management System under Field Process Control, a job-specific Project Control Plan, VPA/FRM-QMS-27, was developed. The completed plan was reviewed by an SSPC-certified Protective Coatings Specialist (PCS).

Careful consideration was given to waste minimization since there were both waterborne and solvent-borne paints and coatings used. Solvent-borne materials were purchased in the smallest kit sizes available; areas to be painted were carefully measured; and solvents used for cleanup were contained and reused.

The use of solvent-borne coatings also required consideration of other trades on the jobsite. The contractor and the construction manager worked together to eliminate conflicts. A consultant was contracted to manage scheduling, and meetings were held at least every two weeks. In some instances, the contractor painted materials and equipment before installation to reduce in-place to painting to touch-ups or topcoat only. The consultant's crews also worked when other trades were not on the jobsite.

Location: Opelika, AL
Structure Owner: City of Opelika, AL
Contractor/Applicator: Vulcan Painters Inc. (SSPC-QP 1-, QP 2-, QP 3-, QP 8-, QP 9-, and QS 1-certified)
Coating Material Supplier: The Sherwin-Williams Company
Start Date: April 2008
Completion Date: September 2009

(l-r) Randy Kerans, Industrial & Marine Marketing Mgr., The Sherwin-Williams Company; Steve Roetter, SSPC President; Jeff Theo, Vice President of Field Operations, Vulcan Painters, Inc. Photo courtesy of SSPC

The William Johnson Award, given for four projects this year, recognizes outstanding achievement demonstrating aesthetic merit in industrial or commercial coatings work. The qualities considered for aesthetic merit include color, gloss or texture, or that the coating on the structure complements the environment while also enhancing the structure. The coating may represent a theme, an object, or a specific graphic design.

The award is named for the late William Johnson, a consultant with KTA-Tator whose work in coatings formulation, failure analysis, and surface preparation was instrumental in advancing the industry.

Photos courtesy of Scott McConnell, Tnemec Company.

Silver Lake's original one-million gallon water tank had a tree mural, which was visible from almost all angles of the area. Over the years, the tank had become a landmark within the community. The last several years saw rapid development in the area, and a new 8-million gallon tank was needed to accommodate the growth. The community insisted it be painted with a similar tree mural. Pictures of the previous mural were scanned and computer technology was able to mimic the design. The painting contractor prepared the steel to SSPC-SP 6, Commercial Blast Cleaning.

The exterior of the tank was coated with a two-component, moisture-cured, zinc-rich primer for the interior and exterior of steel potable water tanks. This was followed by a polyamide epoxy; an aliphatic acrylic polyurethane that is highly resistant to abrasion, wet conditions, corrosive fumes, chemical contact, and exterior weathering; and a clear coat used to enhance the finish, extend long-term weathering qualities, and resist most graffiti markings.

Location: Mill Creek, WA
Structure Owner: Silver Lake Water and Sewer District
Contractor/Applicator: T-Bailey
Applicator: National Industrial Painting
Coating Material Supplier: Tnemec Company, Inc.
Start Date: July 2008
Completion Date: August 2008

(l-r) Steve Roetter, SSPC President; Christopher Pickering, President, National Industrial Painting, Inc.; Walt Robison, Facilities Manager, Silver Lake Water and Sewer District; Terry Wallace, Vice President-Sales, Tnemec Company, Inc.
Photo courtesy of SSPC

William Johnson Award: Lucy the Elephant

Lucy the Elephant was built in 1881, after being thought up by James Vincent de Paul Lafferty, Jr. as a way to attract visitors and property buyers to his holdings. According to this national historic landmark's web site, www.lucytheelephant.org, Lucy has since been sold, been used as a home, survived a hurricane, and relocated to avoid demolition. Lucy was granted National Historic Landmark status in 1976.

Richard Helfant, executive director of the landmark, stated in a local newspaper that Lucy had last been repainted in 2000, and the contractors had to use house paint because it was all the Save Lucy Committee could afford. This time, according

to Helfant, the coating manufacturer donated $2,200 in materials used to paint Lucy.

The contractor prepared the area by covering the surrounding surfaces where work wouldn't be performed and placing plastic and tarps underneath the working area to contain paint chips. The areas to be painted were pressure washed using 600 psi or less to remove dirt, dust, and loose and peeling paint. Some surfaces were prepared to SSPC-SP 2, Hand Tool Cleaning, to remove loose rust and peeling paint.

Deteriorated and rotten wood mullions and wood frames were repaired with a flexible epoxy. Existing brittle and deteriorated glaze was removed from the window panes, and a window

Photos courtesy of Richard Helfant, executive director of Lucy the Elephant

glazing compound was applied around the perimeter of each individual window pane.

To avoid overspray, paint was applied by brush and roller. A spot prime coat was applied where necessary, followed by a rust-inhibitive epoxy primer to rusted metal surfaces. All of the gray surfaces of Lucy received two full finish coats of a 100% acrylic, rust preventative, high-performance, satin finish, elastomeric coating. The red, yellow, and brown colors on the carpet, saddle, eyes, trunk, and toes were coated in an acrylic latex, satin finish topcoat.

Location: Margate, NJ
Structure Owner: Save Lucy Committee, Inc.
Contractor/Applicator: Alpine Painting & Sandblasting Contractors
Coating Material Supplier: The Sherwin-Williams Company

(l-r) Ed Bain, Project Manager, and Andrew Scaturro, Alpine Painting & Sandblasting; Steve Roetter, SSPC President; David Scaturro, Account Manager, Alpine Painting & Sandblasting; Doni Riddle, VP North American Sales, The Sherwin-Williams Company Photo courtesy of SSPC

The Turner Valley Gas Plant is the most significant historic resource associated with the development of the Turner Valley Oil Field. It is the oldest and best-preserved example of a gas processing plant in Canada. In 1935, the plant boasted the first sour gas scrubbing plant in the country, as well as the first propane plant in 1949 and one of the first two sulphur plants in 1952. It was in operation until 1985 and is the only one of its kind remaining in Canada.

The contractor was asked to assist the Alberta Government in restoring the spheres to their original appearance. The existing coating system was lead-based, so the entire project had to be completely contained, and the spheres were abrasive blasted to an SSPC-SP 10, Near-White, finish. The new coating system was chosen primarily to offer corrosion protection. A two-coat application of a high-performance, surface-tolerant epoxy was applied at 4–8 mils dry film thickness per coat. To gain the desired aesthetic appearance, a single coat of a quick-dry aluminum enamel was used.

Photos courtesy of David Bedard, International Paint, LLC.

Location: Canada
Structure Owner: Alberta Government
Contractor/Applicator: Frank Derochie Painting-Calgary
Coating Material Supplier: International Paint, LLC
Start Date: February 2009
Completion Date: June 2009

(l-r) Dr. Michael O'Donoghue, Director of Engineering and Tech Services, and Sean Adlem, Operations Manager, International Paint, LLC; Steve Roetter, SSPC President; Frank Derochie, President, Derochie Painting, Ltd.; Kessa Edwards, Project Manager, Alberta Infrastructure and Culture and Community Spirit; Randy Derochie, VP of Operations, Derochie Painting, Ltd. Photo courtesy of SSPC


Spoonbridge and Cherry 354 x 618 x 162 inches
Collection Walker Arts Center, Minneapolis
Gift of Frederrick R. Weisman, in honor of
his parents, William & Mary Weisman
©2010 Claes Oldenburg and Coosje van Bruggen

After 30 years without rehabilitation, the cherry portion of the Spoonbridge and Cherry Sculpture at the Walker Art Center had to be recoated. The cherry had to be removed from the sculpture and transported to a shop for reconditioning. The iconic aluminum structure, which, according to the Art Center, weighs 1,200 pounds (not counting the spoon), was blasted to bare metal, primed, and then faired smooth with multiple coats of epoxy. It was then coated with two coats of marine urethane followed by two coats of clear coat.

Unique issues surrounding this project were the need for a cherry red urethane that would retain its color and gloss in an immersion situation and the need to fair out the structure to make it look perfectly smooth when the skeleton and sheeting were roughly welded aluminum panels.

Location: Walker Art Center, Minneapolis, MN
Structure Owner: Walker Art Center
Contractor/Applicator: Swanson & Youngdale
Coating Material Supplier: The Sherwin-Williams Company
Start Date: March 2009
Completion Date: May 2009


(l-r) Mark Edmonds, Great Lakes Regional Marine Specialist, The Sherwin-Williams Company; Joseph King, Associate Registrar, Walker Arts Center
Photo courtesy of SSPC

Hubble, Bubble, Tests and Trouble:

The Dark Side of Misreading the Relevance of Coating Testing

By Mike O'Donoghue, Ph.D., V.J. Datta, M.S., Mike Winter, and Carl Reed, International Paint LLC

Many people quote, "Hubble, bubble, toil and trouble" as the witches' famous line in Shakespeare's play, *Macbeth* (Act 4, Scene 1, vv. 10-11). So the general populace might assume the quote is correct. But it is not. The real quote is "Double, double, toil and trouble." The incorrect quote is assumed bona fide because of its repeated use.

This article discusses similar assumptions made about many coating specifications and the trouble the assumptions cause. In the discussion, the toil is in the tests. Aside from the use of successful track records, it is common for coating specifications to be based on test criteria deemed important by specification authorities. But are the tests relevant to the intended service environment? Has the meaning of the test data been misinterpreted? Have the tests been ascribed a level of accuracy and dependency that the test method simply cannot deliver? These vital

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questions, addressed in this article, must be considered if a coating specification is to be supported in a meaningful way and to prevent all sorts of problems.

The authors relate tales—from the water storage, Canadian oil patch, and bridge industries—in which specifiers assumed things were in order, where coating tests and specifications were considered to be in harmony, and where repeated use suggested all was well. But all was not well. The coating specifications were built upon inappropriate uses of certain test data, and dark consequences loomed. The authors also propose ways to conduct testing that potentially offer more meaningful correlations with real-world coating performance.

When it comes to coating failures, the problem often starts with the test data in the spec.

Toil and Trouble

Take issues surrounding the use of adhesion measurements. Some coating manufacturers crave large adhesion values to gain a favorable coating specification position. Obtaining and promoting those large values may even be an element of a coating company's strategy to buttress coating superiority claims and have high adhesion values adopted as a de facto *standard* with specification authorities. Other coating manufacturer strategies with specifiers include the deliberate blend of irrelevant test data with relevant data to make it harder for a competitor's coating to obtain "or equal status." And there is no definition of "equal" status.[1,2]

Discrete values of coating adhesion sometimes receive inordinate significance.[3] Specifications that mandate adhesion values of, say, 850 psi minimum, imply the values have great meaning. A clue that an understanding of the significance of coating testing is absent in a coating specification is when a litany of non-relevant test requirements is culled from a product data sheet and physical criteria such as weight per gallon, mix ratio, and volume solids are prescriptive in the specification.

The basic physical parameters of coatings have no value with respect to coating system performance. Ironically, specifications exclude many good coating candidates that should have been chosen judiciously and would have offered superior performance compared to approved products chosen poorly. Perhaps a novice specification writer "researched coating materials" by scouring the Internet rather than conducting a proper literature search. In so doing, specifications may be written around a particular product with no emphasis on coating system performance.

Few would argue that test data in a specification should have reasonable relevance to the intended service conditions for a given system. An example is testing for anticorrosive properties of coatings in aggressive chemical immersion. Laboratory tests on new low VOC coatings or potentially higher heat- and chemical-resistant coatings should always be conducted alongside the same test on a control coating with known performance in the actual exposure environment. Theoretically, taking accelerated laboratory tests to the point of coating failure is far more meaningful for attempted correlation with real life coating performance in the field.

Increasingly, engineers want faster tests and data. But faster tests mean the results are less likely to correlate with real-life performance. One research tool, however, Electrochemical Impedance Spectroscopy (EIS), used with autoclave tests, has been employed to evaluate potential high-temperature-resistant tank linings in 5–8 days and has proven to be a good indicator of real-life performance.[4]

Comparing test data obtained at different times, by different operators, or in different laboratories must be done carefully. Many standard coating test methods were originally designed for comparative testing in a single test series, not for generating an absolute test value. Other methods have options that can significantly affect results. Some ASTM test methods contain precision and bias statements based on round robin studies. Unfortunately, the statements are often ignored when comparing data; equally unfortunately, many test methods have not been studied to properly ascertain their reproducibility and repeatability. Unless you understand the fine details of a test method, you cannot compare data generated at different times and places.[5]

Consequently, unless the details of the test methods used for coatings are understood, the data is often assumed to have a much higher accuracy than the method deserves. During new coating product development, the test method is good enough if it can differentiate between experimental formulations that are obviously unsuited to a certain set of service conditions and formulations that will perform well. With coatings that perform reasonably well, the ability of most methods to finely distinguish different levels of performance is often dubious because of the inherent variability in many test methods (and operators).

ASTM B117 Salt Fog Testing: Potable Water Tank Specifications

Pogo's Observation—We have met the enemy—and it is us.

Awaiting an audience with a respected

Fig. 1: Salt fog (L) test data was incorrectly specified for a potable water tank lining, when data from potable water immersion testing (R) should have been called for. All photos courtesy of the authors

specification writer for a small municipality district, a coating manufacturer's technical representative turned the pages of a coating specification. Suddenly, he was dumbfounded by a strikingly peculiar requirement for immersion-grade potable water linings. Specific results from an age-old test were there in print and used by a coating manufacturer to gain sole specification position in a potable water immersion project. The test: ASTM B117 (Standard Practice for Operating Salt Spray (Fog) Apparatus) where a scribed panel is exposed to a 5% NaCl salt fog, a pH of 6.5-7.2, and a temperature of 35 C.[6]

Salt? In a spec for lining a potable water tank? Decidedly odd at face value, mused the coating manufacturer. How did this test come to be specified? And how could it possibly be meaningful for potable water immersion service? The coating manufacturer scratched his bald spot. Matters worsened. For his particular coating to be accepted, the specification also called for at least 7,000 hours' successful coating performance in test. Wow, he thought, big numbers. If 2,000 hours were good, the specification writer must have thought, 7,000 hours were better.

In the back of the coating manufacturer's mind was the accelerated laboratory testing scene. His mind went into hyper drive. He reasoned: a long-standing industry consensus holds that the mechanisms of corrosion and degradation in the ASTM B117 test do not correlate with real world, atmospheric coating deterioration. Instead, results from ASTM D5894 testing (Standard Practice for Cyclic Salt fog/UV Exposure of Painted Metal) accord far better with in-service coating performance.[7-9]

Something was awry. Quite apart from atmospheric exposures, how could the mechanisms of corrosion in a salt fog testing environment be relevant to those in a potable water immersion environment? Where's the salt?

Soon, the specification writer sat down with the coating manufacturer's representative and discussed the matter in earnest. The specifier appreciated and recognized the representative's technical reasoning. A typical failure in the ASTM B117 test would be scribe undercutting. A typical failure in potable water immersion would be blistering. How different. The higher resistance of potable water would equate to low conductivity and a low corrosion current, and little in terms of corrosion.

Osmotic, or electroendosmotic, phenomena, would be more prevalent with coatings immersed in fresh water compared to salt water: hence, the greater propensity for blistering in potable water service and fallacious reasoning deployed in an attempt to meaningfully correlate ASTM B117 with potable water immersion (Fig. 1).

By the interview's end, the specifier appreciated the coating manufacturer's point that attempting to meaningfully correlate ASTM B117 laboratory results with the anticipated service life of a coating in potable water immersion stretched credulity. The requirement for the ASTM B117 test was withdrawn from the specification. More emphasis was placed on the water resistance of the coating system.

How, one may ask, could things go wrong if the ASTM B117 test criteria had been adopted? The specifier would have inadvertently prevented the facility owner from using the most cost-effective coating system for the potable water immersion project. The coating system that the visiting coating manufacturer offered—with the longest track record of proven success and best life cycle costs—was about to be sacrificed on the altar of thousands of irrelevant, arbitrary hours in a salt fog chamber.

For tank exteriors, many specified coating systems consist of two or three coats of high-performance materials. The test criteria used to approve a system may be based on data for individual coats, not the actual system itself. We found specifications where ASTM B117 requirements are cited for over 1,000 hours for the polyurethane finish alone when it was part of a multi-coat system such as a zinc, an epoxy, and a polyurethane, but the specifier did not cite an ASTM B117 requirement for the three-coat system.

For corrosion resistance, ASTM B117 was the norm for years but the coating industry has largely subordinated it because of its poor correlation with real world coating performance. Nevertheless, the 1,000-hour pass-fail criterion of ASTM B117 might occasionally be deemed to have merit such as in a splash zone on an offshore platform, where the criterion has more relevance than it would to structural steel on, say, a silo in Kansas.[5]

Test methods that introduce a cyclic environment (wet/dry or hot/cold or both) afford enhanced relevance for most applications. Cyclic tests such as ASTM G85, ISO 20340, ASTM D5894, and NACE TM0304 are routinely employed but the story remains the same: it is still important to obtain better correlation of the test and the intended exposure environment.

Despite unprecedented technological progress, we still find ourselves in the realm of corrosion testing that differentiates coating systems by the degree of rust creep at the scribe of a test panel. And the subjectivity involved in panel preparation, the removal of loose paint from the scribe, and subsequent corrosion ratings stems from the variability in the operator doing the work. As a result, the adhesion data generated in terms of scribe creep values is best used comparatively rather than to generate an absolute "number." Although round robin studies of the same systems in different laboratories, or in different test regimes, may give fairly consistent performance rankings, the absolute scribe creep values may vary widely.

Atlas Cell Testing and the Canadian Oil Patch

A cold dose of Canadian oil patch reality is a good thing.

When an internal coating or lining fails prematurely in the Canadian oil patch, a facility owner can lose revenues of hundreds of thousands of dollars per day while the facility is out of service. For cost reasons alone, proper selection of the high-performance coating and the coating supplier cannot be overemphasized.

To judiciously select coating systems in the oil patch, third-party independent testing is needed to evaluate the effects of chemical and physical stresses on candidate coating systems. Several laboratory test methods are typically used to determine whether or not coatings meet pre-qualification criteria for tanks and vessels.[10]

- Autoclave testing (NACE TMO185-02)
- Electrochemical impedance spectroscopy (EIS) (ISO 16773)
- Cathodic disbondment (ASTM G8, G95 or CAN/CSA Z245.20/21-02)
- Standard Atlas Cell test (NACE TM-O174-02)
- Pressurized Atlas Cell test (modified field NACE TMO174-02)
- Chemical cycle tests at elevated temperatures
- Adhesion (parallel scribe method)
- Impact test (modified ASTM G14 or CAN/CSA Z245.20/21-02)

Of interest here is Atlas Cell testing, its use to try to correlate real world service, and the specifier's recognition and interpretation of the testing to qualify or disqualify coatings for tanks and vessels in the oil patch.

For several decades, coatings and linings subject to the cold wall effect[11] have been studied using Atlas Cell and pressurized Atlas Cell tests. Such tests have been used to compare the performance of internal linings for high-temperature, high-pressure, and chemically aggressive oil patch applications (where external temperatures are at ambient) to rank and pre-screen linings for particular service environments. For determining suitable pipeline coatings, the predictive capability and usefulness of Atlas Cell tests have been well established.[12]

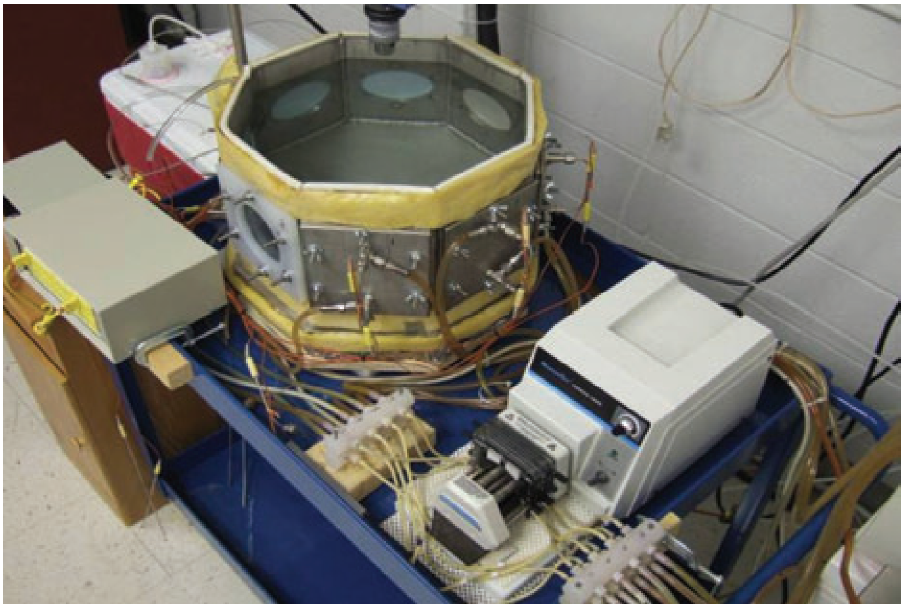

Fig. 2: Multi-Port Atlas Cell (ref. 13). This Atlas Cell apparatus was designed and constructed whereby eight coatings can be evaluated simultaneously, and in which hot and cold side temperatures can be significantly better controlled and measured. Cold wall conditions were created with either cooling water or air.

Many people contend that Atlas Cell tests are invaluable for ranking and pre-screening linings for tanks and vessels.

Testing initiated by facility owners has shown that some high-performance epoxies with the longest, most successful track records in oil patch service actually fare miserably in standard Atlas Cell tests compared to many other coatings. As a result, specifiers may reject the epoxies out of hand.

So what's the problem? First, based on

the Atlas Cell test, a lining ostensibly most fit for purpose is mistakenly deemed inferior and, therefore, unsuitable for real life service compared to another lining that performs well in the test. Second, and most importantly, the facility owner's desire for optimum life cycle costs can be thwarted by over-reliance or over-interpretation of an Atlas Cell Test. Third, from a technical perspective, tanks exposed to the chilling temperatures of Canadian winters might erroneously be thought to be subject to a much stronger cold wall effect than is actually present.

Against this backdrop, and to test cold wall hypotheses, a custom-built Atlas Cell was used (Fig. 2). The "multi-port" Atlas Cell was designed to evaluate eight coatings simultaneously, and temperatures on the hot and cold sides were far better controlled than with the standard test model.[13] The procedure revealed a pronounced difference between chilling with air and chilling with water (or glycol) in the Atlas Cell test. When an Atlas Cell test is run with a given temperature gradient between the hot and cold side, the actual temperature gradient will be considerably higher when the chilling is done with water compared to air. This factor is never taken into account when reporting Atlas Cell test results.

Certain tightly cross-linked epoxy novolac coating systems perform poorly and blister relatively quickly when the Atlas Cell is chilled by *water*—i.e., how the standard test is normally run (Fig. 3). Although many specification authorities like the Atlas test, the difficulty is in correlating the test results with real world coating performance in hot process fluids. In real life, the tanks in the freezing winters in the Canadian oil patch are chilled by *air*. Guess what? The coatings on the inside perform for decades when the tank externals are chilled by *air* (Fig. 4).

Paradoxically, the better the coating performed in real life, the worse the coating performed in the Atlas Cell test. Why? The difference between the heat capacity and thermal conductivity of air and water accounted for the discrepancy between Atlas Cell test results and field observations for the coating. Air has a low heat capacity and a low thermal conductivity, whereas water has a high heat capacity and good thermal conductivity. Therefore, when it contacts steel, chilled water can draw out a significant amount of heat, exerting a strong chilling effect and producing a substantial cold wall effect.

In marked contrast, air has little capability to produce a cold wall effect in the real-life freezing conditions in the Canadian oil patch. The actual temperature gradient in the tank walls is significantly lower than that produced in the Atlas Cell chilled with water, given the same difference between inside and outside temperature. It has been shown that if the temperature gradient is controlled rather than the temperature of the hot and cold media, on the hot and cold sides of the Atlas Cell respectively, laboratory results match field results very well.[13]

Coatings with high chemical resistance appear to be associated with low permeability and low tolerance to a cold

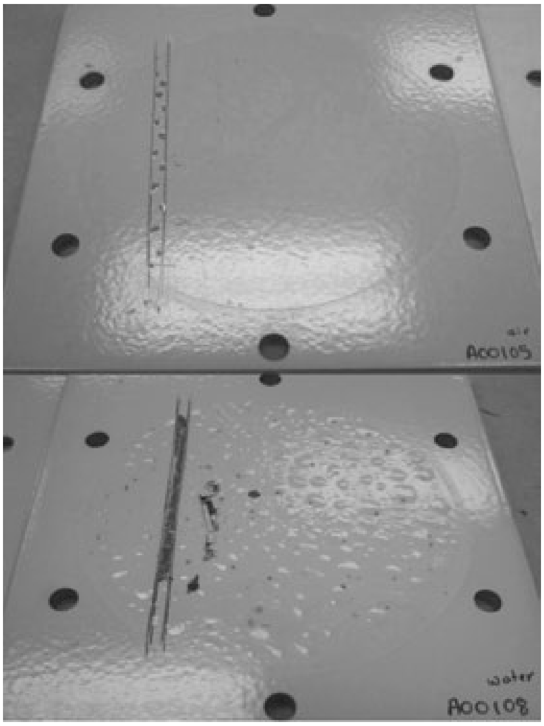

Fig. 3: Results from Multi-Port Atlas Cell test (ref.13) Top: Coating A: (a two-coat epoxy novolac) ΔT=7 C, cooled with 23 C air. Note lack of blisters and excellent adhesion from parallel scribe adhesion test. Bottom: Coating A: ΔT=45 C, cooled with 23 C water. Note high density of large blisters and poor adhesion from parallel scribe adhesion test.

Fig. 4: Un-insulated tanks in Canadian oil patch—hot cargo with a large cold wall effect in winter. Lined with Coating A (a two-coat epoxy novolac) at 12-18 mils total DFT. No coating breakdown in real life performance after 15 years.

wall effect, whereas coatings with high cold wall resistance appear associated with moderate permeability. Field performance was also shown to correlate poorly to Atlas Cell results when unrealistically high temperature gradients were used in testing.

To add insult to injury: what good is it if certain test data for the best-in-test performer, (even if erroneous) indicates success for the facility owner but, in reality, the coating application characteristics were not hitherto assessed and were later found difficult on the job site. Linings that can neither be applied well under field conditions nor equal the applied finish of laboratory test panels are hardly conducive to successful projects.

In the final analysis, the Atlas Cell test as it is normally run with water cooling is *not* a good indicator of in-service coating performance for some highly cross-linked epoxy novolacs used for tank linings.

Ironically, specification authorities may continue to screen out such proven "field performers," preferring instead Atlas Cell test's "good-performers." Meanwhile, facility owners can lose out, while poorer performance coatings squeak through to the job site.

Adhesion Testing

Eng's Principle—The easier it is to do, the harder it is to change.

Lo and behold, do we want, or need, high adhesion values to be stipulated in coating specifications? Should arbitrary adhesion numbers serve as pass-fail criteria? Does the magnitude of adhesion numbers correlate in real life with how long coating systems actually last?

These questions, though by no means all-encompassing, underscore a need to assess the implications of adhesion where intermolecular forces such as Lewis acid/base interactions (including hydrogen bonding) and Van der Waals forces operate.[14]

Adhesion Tests—Structural Steel

Let's take a hypothetical but typical situation. Measuring adhesion of Coating Systems A and B for structural steel is a relatively straightforward process for the coating manufacturer when ASTM D4541 is used. The results are given to a coating specifier. At first glance, the temptation for our specifier is to say that if Coating System A gave a 2,500 psi adhesion value, it is markedly better than the 1,800 psi value measured for Coating system B. Not so fast. If the method of measurement has an accuracy (Coefficient of variation) of ±20%, then the result for System A is actually between 2,000 and 3,000 psi, and the result for System B is between 1,440 and 2,160 psi. Because the ranges overlap, you cannot state conclusively that one is better than the other. The significance of the differences in results depends on the number of data points and the accuracy of the measuring system. Beware the one data point comparison!

So there is little, if any, significance in the difference between 1,500 and 2,500 psi adhesion numbers. Simply put, based on these adhesion numbers, no meaningful argument exists for the specifier to differentiate between either coating system. But the specifier is in the dark; no one told him about coefficients of variation. He screens out Coating B, and Coating A becomes the standard of quality. Difficulties do not end there. Porous thin films, for example, where the glue penetrates more extensively, might give superior adhesion values.

The consensus from an SSPC survey of coating manufacturers revealed that "tenacious adhesion" was cited most often as a primary factor to ensure successful bridge overcoating projects.[15] And how was "tenacious adhesion" thought to be most likely assured? In essence, by obtaining high numerical adhesion values for the coating system.

No one would dispute the importance of good adhesion as a criterion for the success of a coating project, but what defines the breadth or narrowness of "good"? For example, good adhesion may have far more to do with an ability to withstand the rigors of hygrothermal stress from inclement weather conditions *and* the rigors of internal coating stresses than what is inferred by a large adhesion value. Counter-intuitively, when it comes to overcoating lead-based alkyd paints, the chemistry behind single-component coatings with low adhesion values (approximately 200–300 psi) can provide far better coating test results and longevity than coating systems based on two-component technology with very high adhesion values.[16,17]

Accelerated laboratory tests routinely include ASTM D4541 pull-off adhesion tests. Although pneumatic testers have precision superior to that of mechanical ones, the accuracy and relevance of the adhesion data may be questionable and over-interpreted, and may lead to erroneous conclusions.

No significance whatsoever can be attached to a test failure value reported without an accompanying description of the failure mode. For example, a coating system that fails cohesively at 750 psi is arguably less prone to catastrophic field failure than another coating system that has intercoat or substrate adhesion failure at 1,000 psi. Once again, a higher adhesion value is not indicative of a better coating system.

Different opinions also abound on the comparative merit of adhesion measurements where cutting around the adhesion dolly before the pull is advocated (as in the ASTM procedure) versus cutting around the dolly (as in the ISO procedure).[18] Testing authorities who advocate the ISO test method contend that the ASTM procedure does not strictly measure adhesion but also measures the tensile properties of the coating. Granted, this is the case. However, what coating system is subjected to a force that essentially "sucks" it off the substrate? Conversely, testing authorities who favor ASTM counter that cutting the coating may cause a micro-crack flaw around the cut edge, where cracks propagate into the coating, thereby making the adhesion test area vulnerable to a differ-

Fig 5: Example of a polyurethane finish coat applied beyond the recoat window of an epoxy mid-coat. Intercoat adhesion between the polyurethane and epoxy mid-coat is best determined by wet adhesion testing as opposed to dry adhesion testing.

ent failure mechanism.

Certainly we should seek to better understand the intended service environment for a given coating system, where the rates of stress change in real life are probably substantially different from the rate in a specific adhesion test. In that light we should ask what the adhesion test really tells us, and examine total test data accumulated, including adhesion data possibly from simple knife X cuts. A coating system on structural steel in a high abrasion service in a pulp mill will necessarily require better adhesion than a system in the less demanding, benign atmosphere of a sports stadium.

When it boils down to coating specifications, those much prized adhesion values are often widely cited as though they possess intrinsic significance. Other things being equal, you could argue this: simply meet or exceed the prescribed benchmark adhesion values and perhaps your coating system can be on the road to "generic equal" status. Pass or fail in an adhesion test and thus be accepted or rejected in a coating specification. An arbitrary value such as 1,000 psi can be the deciding factor. That argument is not good.

It is important to evaluate both dry *and wet* adhesion (adhesion after immersion in water). Recoat times touted as 30 days, 60 days, indefinite, and so on, are often based on *dry* adhesion data, which then finds its way to specification authorities. The rest is history. If the wet adhesion values had been obtained, the conservative and true recoat times would have been much shorter and premature failures avoided.

What are some of the dire consequences of coating selection choices based on poor adhesion data? One particular case is noteworthy. A bridge coating contractor was told by a coating manufacturer that the recoat time for the field-applied epoxy was several months. All would be fine. The contractor was to simply wash and clean the aged epoxy and spray apply the polyurethane finish. The adhesion data apparently supported this procedure. Months later, in bitterly cold weather, the temperature plummeted rapidly, and the polyurethane finish coat could be heard coming off the bridge structure as the coat delaminated from the epoxy.

Proactively, several coating manufacturers now age coated panels used for recoatability (intercoat adhesion) studies both in the laboratory *and* in different real world conditions, such as those found in California, Florida, and Texas. In one test regimen, after application of a polyurethane refreshment finish coat to samples from laboratory and field sets of aged panels, the new coating system was exposed to high humidity for 2–3 weeks, and the resultant *wet* adhesion was measured. When compared to dry adhesion data from the remaining set of panels, the wet adhesion test yielded far shorter recoat times than those from dry adhesion tests. But the manufacturer's data sheets often give the longer and riskier recoat times based on dry adhesion times.

Thus, an all-too-familiar problem can be avoided, namely, a polyurethane applied per a dry adhesion recoat test that looked fine on a mid-coat of epoxy for six months but that later delaminated in a patchwork quilt pattern. Interestingly, wet adhesion tests of aged and water-washed epoxy coatings with the same epoxy reveal a dependence on where the epoxy was aged. In one in-house study, the wet adhesion measured on panels aged in California after six months was excellent. However, the wet adhesion on panels prepared in Texas and Florida was virtually zero, which suggested contaminants might have been a major factor for de-adhesion. The same coated panels aged in the laboratory, however, gave excellent wet adhesion values.

Ultimately, wet adhesion results are deemed best to establish recoat times for aged coatings, more meaningful adhesion values for coating systems, and a more appropriate foundation for good specifications. Reliance on dry adhesion testing may prove to be problematic, and we might suffer the consequences (Fig. 5).

Adhesion—Tanks and Vessels in the Oil Patch

Unlike coated structural steel, coated tank and vessel steel invariably receive adhesion testing by an altogether different method. In the Canadian oil patch, the aggressive chemical, temperature, and pressure environments are simulated in an autoclave in which coated steel panels are placed for a 96-hour test. Part of the test regimen consists of rating the adhesion of the coatings before and after the test using the parallel scribe method.[13] Two cuts, 1/8 inch apart, are cut through the coating on steel panels down to the base metal with an abrasive disc on a Dremel tool, whereupon coating adhesion between the scribe marks is evaluated by prying with a utility knife (Fig. 3). In an autoclave test, the adhesion is evaluated within an hour after the panels are removed from the autoclave so that wet adhesion is measured. Adhesion ratings are shown in Fig. 6.

Autoclave Adhesion Test

Rating Code and Description

A No change/no disbondment

B Slight change of adhesion (>50% still attached)

C Moderate loss of adhesion (<50% still attached)

D Severe loss of adhesion

E Disbondment

Fig. 6

Another test to evaluate wet adhesion is CAN/CSA Z245.20-98 (Section 12.14).[19] Coated test panels are immersed in tap water at a specified temperature and duration. The panels are subsequently removed, and the adhesion of the coating is assessed by cutting a rectangle into the coating, followed by prying it with a utility knife to determine if the coating within the rectangle can be lifted from the metal surface.

The CSA test conditions are 75 C for 24 hrs and 28 days. However, many other test temperatures and exposure times are commonly used.

The rating schedule used in the CSA standard is as follows. Ratings of 1 to 3 are specified as a pass in coating prequalification, Table 2, under the CSA specified test conditions. Adhesion ratings are shown below.

1. Coating cannot be removed cleanly.
2. Less than 50% of the coating can be removed.
3. More than 50% of the coating can be removed, but the coating demonstrates a definite resistance to levering.
4. The coating can be easily removed in strips or large chips.
5. The coating comes off as a single piece.

Unfortunately, adhesion test methods incorporating a knife to pry the coating are highly subjective (knife adhesion is best

used comparatively in the same laboratory by the same operator as discussed earlier). The generic type, flexibility, hardness of the coating (e.g., high-build polyurethane or epoxy linings), and the tensile strengths render a knife adhesion test lacking in objectivity. A compounding variable is the degree of force used by the individual carrying out the test to pry the coating. On the downside, adhesion tests such as these help to decide which coatings are specified and used in the oil patch and which are not. On the upside, specifiers invariably demand coatings with Ratings A, B, and C for pre- and post-autoclave testing. And while a more objective adhesion test has yet to be developed, there have been few instances where specified coatings have failed because of inadequate coating adhesion stipulations. This is a far cry from the world of structural steel coatings.

Toward a Better Way

Herodotus's Law—circumstances rule men; men do not rule circumstances.

The bottom line is that the coating industry has a vast repository of test data, but putting it all together in some meaningful way has proven elusive. Test data and observations provide an anecdotal view of how coatings will work in specific situations. But we need a predictive power based on actual performance testing, a move beyond general assessments to correlations between tests and real-world performance correlations.

In the authors' view, the protective coatings industry has put in place two fundamental barriers that largely prevent meaningful testing of products and systems. These barriers are the use of testing protocols that are not relevant and the establishment of arbitrary acceptance values resulting from the testing.

Fundamental Barrier 1

The use of test protocols that lack relevance has many sources, including well-meaning but misguided specifiers and apparently smart coating folks who find ways to manipulate specifications to freeze out the competition.

Repeatedly, specification writers include test protocols that are not relevant to real world conditions to which the coatings will be subjected. Three brief examples serve to illustrate the point.

- First, 6,000 hours of ASTM B117 salt spray was required for the externals of wind towers slated for erection in the desert region of West Texas. How much of a salt spray environment is there in West Texas?
- Second, a coating system had to pass the requirements of ISO 20340 for an application in industrial China subject to acid rain conditions.[20] ISO 20340 is a test protocol designed for the harsh environment of North Sea off-shore structures. Far better, and arguably more relevant, would be the selection of the ASTM D5894 cyclic prohesion test.
- Third, a Taber Abrasion test was specified for an abrasive slurry conveyed in a pipe. The Taber test is not used for liquid environments.

Fundamental Barrier 2

The second barrier is the establishment of arbitrary acceptance values resulting from testing. What is the true significance of testing to ISO 12944 C-5 corrosion test for 1440 hours and requiring 1 mm maximum of scribe creep? Likewise, what is the true significance of a 725 psi pass value for pull-off adhesion required in ISO 12944 (Fig. 7)?[21] Or what is the true significance of establishing a scribe creep value of 3 mm in ISO 20340 (Fig. 8)? Does that mean 3.1 mm is automatically, intrinsically bad? In standards and specifications alike, it is common to set an essentially arbitrary test duration and result requirement. Indeed, there may be some value in testing a product against a standard product at some arbitrary duration to see how they compare. Nevertheless, standards such as ISO 12944 and ISO 20340 as well

Fig. 7: Three adhesion panels that failed the cross-cut adhesion test for ISO 12944 but passed the pull-off adhesion testing for ISO 12944.

Fig. 8: Three panels tested per ISO 20340 for scribe cutting. The left and middle panels passed; the panel on the right failed: hence, the problem with assigning arbitrary pass-fail values.

as customer-specific specifications are not really about comparisons; they are about absolute pass or fail criteria for coating systems. Arbitrary values so gleaned arguably have no real-world basis. Rather, using these arbitrary values gives a distorted view of the real-world performance of a coating system.

What are we to do? How do specifiers handle testing relevancy and arbitrary test result requirements? Lamentably, there is no easy answer, although the industry would like a better way. Presently, the sequence is that hypothesis leads to perceived reality, which in turn leads to method establishment and thus to problems of relevance and arbitrariness. Time, ingenuity, and energy spent in laboratory work are necessary to throw meaningful light on the issue.

Thinking Outside the Proverbial Box

Problem solving has many guises. A fairly simple idea would prove invaluable to provide meaningful tests for facility owners: work initially with a few of them to really understand their needs, delve into their processes, fully comprehend the type of environment to which the coating/system will be exposed, and develop a clear understanding of performance expectations for the coating system. Here are some details.

1. Establish with the owner what constitutes a failure to a system for a given application. What degree of coating system deterioration would trigger a substantial investment to correct the deteriorating conditions (such as removing the old coating and recoating the structure). Properly understanding this element of deterioration is pivotal because there is no one definition of failure.
2. Develop test protocols and test the coating system to the point of failure established above.
3. After studying and understanding the application history, develop some correlation between the real world and laboratory testing as to how long a particular coating or coating system will last.
4. Knowing the capability of the coating system from its track record and a broad spectrum of tests already in the coating's library, so-to-speak, you will take a powerful step forward to meet the owner's real requirements. From this combined data, meaningful real world specifications can be established.

So, for example, in the past, where a specification would have required a maximum of 3 mm scribe creep resistance after 5,000 hours of ASTM B117 salt spray, a new specification might state a minimum of 5,000 hours of salt spray exposure without scribe creep exceeding 3 mm. Hence, a coating system that displays a scribe creep of 3 mm after 4,000 hours would fail; if the coating system displayed a scribe creep of 3 mm after 7,500 hours, it would pass. Systems would then be categorized not by the degree of scribe creep, but by the hours necessary to reach that degree of scribe creep. On the positive side, this approach would allow the customer to choose the coating or coating system that provides value based on real performance-related testing.

Of course, this view has a couple of downsides. The first is the many variables, known and unknown, that may make it difficult (but not impossible) to give accurate predictions over the full range of possibilities. One way to deal with the variability is the approach weather forecasters take: they assign the likelihood of a precipitation event. For coatings, we could assign probabilities that the system will provide the necessary performance over a duration for a given test, or series of tests.

Conceptually, it appears reasonable to provide a customer a "performance probability" based on both laboratory testing and real world results that would help them choose an appropriate system for their application.

The second downside to categorizing coatings by time to failure is that the testing takes more time than testing to duration. But we need to start somewhere, and testing to failure yields far more useful data.

Another idea with merit has worked well in lining applications for field tanks in the Canadian oil patch. Accelerated laboratory tests were carried out on prospective linings applied to test panels made from virgin steel and field-retrieved steel (from the tank itself). First, the coatings on the differently prepared panels were "benchmark" tested in the laboratory before being placed in the tank. Second, the coated steel panels were immersed in the process fluids of the tank. Third, after a prescribed time in this real-world environment, the panels were withdrawn and the coatings re-evaluated side by side with those not subjected to field exposure.[3] In this way, the particular tests carried out had a more meaningful correlation with real world service environments.

"Hubble, bubble, tests and trouble" suggests a brighter side for the future of coating testing with an improved correlation with real life coating performance. Yet the future, as we all know was not so good for Macbeth as the famous, and correctly quoted witches' incantation prophesied, "Double, double, toil and trouble."

So let's finish where we began with the witches of Macbeth and one more omen: "By the pricking of my thumbs something wicked this way comes." With all our good science let us not ignore our own portents of possible disaster in the world of protective coatings.

Conclusions

Caveat emptor: Buyer, or in this case, "Specifier" beware.

- Avoid over-reliance on big adhesion numbers, or hours of duration in salt fog tests. The "values" have little to commend themselves.
- The field performance in the Canadian oil patch shows that the longest lasting, chemical-resistant epoxy novolac tank linings gave some of the poorest results in an Atlas Cell Test when unrealistically high temperature gradients were used in the testing regimen. The result reflects chilling with water versus chilling with air in the test.
- The genesis of a new paradigm has been offered to improve the correlation between laboratory testing and real-life coating performance.

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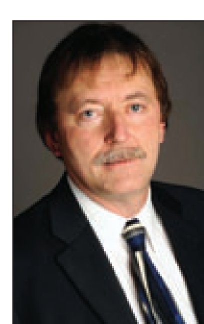

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Fig. 1: Caruthersville Bridge–original coating system. Photos courtesy of the authors

Overcoating the Caruthersville Bridge

How the Owners, Inspector, and Contractor Met the Challenges from System Selection to Application and Protection

By Ernst Toussaint, EIT, (formerly with Greenman-Pedersen, Inc., Round Rock, TX); Ross Sherwood, EIT, Project Manager, Tennessee Department of Transportation; and Scott Stotlemeyer, PE, Project Manager, Missouri Department of Transportation

Several thousand state bridges are scheduled for maintenance painting in both Tennessee and Missouri. On the Caruthersville Bridge (I-155 Mississippi River Bridge), the northernmost bridge over the Lower Mississippi River, overcoating with a calcium sulfonate alkyd is an ongoing project. Although overcoating increases the risk of coating incompatibility (stress, premature failure, etc.), use of a calcium sulfonate system on this unique asymmetrical structure was a viable option that the Tennessee Department of Transportation (TDOT) spearheaded and the Missouri Department of Transportation (MoDOT) supported. This option provided both DOTs with an initial low cost and extended the coating life of the bridge, thus extending corrosion protection.

Editor's Note: This article is based on a paper presented at PACE 2010, the joint conference of SSPC: The Society for Protective Coatings and the Painting and Decorating Contractors of America, held February 7–10 in Phoenix, AZ. At the time of the presentation, Toussaint was with Greenman-Pedersen.

Every type of generic coating system has its requirements for surface preparation and application as well as its advantages and disadvantages in terms of performance and life-expectancy. Meeting the application and inspection challenges of a calcium sulfonate on this project has provided invaluable experience and knowledge of this system. The project-specific challenges have been evaluated, researched and successfully solved to the satisfaction of the respective DOTs. This article discusses the requirements of a calcium sulfonate system as learned from its use on the Caruthersville Bridge. The interaction among the DOTs, inspection firm and painting contractor is presented to assist in future design and construction contracts that specify a calcium sulfonate alkyd system.

Background

The Caruthersville Bridge is a steel through-truss deck bridge that spans the lower Mississippi River from the outskirts of Dyersburg, Tennessee to Caruthersville, Missouri. Construction of the bridge began in 1971 and was completed, including coating application, in 1976. The four-lane bridge is 78 feet wide and is approximately 7,102 feet long. The total length of the bridge consists of 1,030 feet of Missouri approach spans; a 2,150-foot main structure; 920-foot and 520-foot main spans; and 2,480 feet of Tennessee approach spans. The bridge has approximately 1,324,000 square feet of painted structural steel. The original coating system remained largely intact for over 30 years.

The bridge is not symmetrical. The Tennessee side structure is much longer than the Missouri side structure due to the natural curve in the river. Rip-rap (rock or other material) was placed on the outside bank to keep it from eroding further and bypassing the bridge.

The bridge consists of inspection ladders, a catwalk underneath the bridge, and 12 steel spans flanked by prestressed concrete approach spans. The structure is supported by reinforced concrete piers and abutments that rest about 6 miles from the New Madrid Fault. A 1993/1994 study found that the bedrock was 2,700 feet under the ground surface. The bridge also has two truss spans, eight plate girder spans, and two multi-girder spans. The bridge deck is approximately 99 feet above the Mississippi River. It is understood that the structure was abrasive blast cleaned before application of the original coating system. The Caruthersville Bridge had an original coating system consisting of a three- and sometimes four-coat alkyd system. A shop-applied alkyd primer was applied to all of the structural steel. An additional two coats were applied in the field to floor beams and lateral braces, while an additional three coats were applied to members at the bridge deck level. Figures 1 and 2 depict the original coatings of the bridge.

Fig. 2: General side view of Caruthersville Bridge.

Investigation of Existing Coating Condition and Content

An initial field investigation of both approaches of the bridge revealed coating breakdown and minor surface corrosion on approximately 3% of the painted surfaces. Pinpoint corrosion was also found on the underside of the bottom flanges of lateral bracing as well as the underside of the girder bottom flanges (Fig. 3). Corrosion along the edges of box beams and minor areas of coating breakdown were found on edges of the supporting members of the inspection walkway (Fig. 4). The webs, stiffeners, and top flanges of both girders and floor beams exhibited very little corrosion. Chalking was evident throughout the structure.

Coating adhesion was assessed in accordance to ASTM D 3359, "Adhesion by Tape Test," using Method A (X-Cut), and Method B (Cross-Cut). No adhesion results were below 3A and 3B, indicating that the majority of the original coating system still adhered well to the bridge. The original coating system along the floor beams and lateral bracing is a three-coat alkyd, with an orange primer and intermediate coat and a green topcoat. Based on the original report and the condition survey, its average dry film thickness ranges from 3.6 mils to 17.4 mils, with the low millage on the stiffeners.

Thus, the initial investigation revealed that the majority of the painted structural steel is in excellent condition after more than 30 years of service, with some isolated areas of coating breakdown. The coating is in the beginning life cycle segment of coating degradation. Considering that there is approximately 1% to 3% of coating breakdown of the total surface area of the steel, both DOTs have agreed that this is the optimal time to perform an over-coat maintenance painting repair to extend the life of the existing coatings for many years, thus reducing the bridge's total life cycle maintenance costs.

Fig. 3: Corrosion on bottom flange

Fig. 4: Edge corrosion

Coating samples were removed and sent to an independent laboratory to test for heavy metals. The laboratory test revealed that part of the alkyd system, presumably the red lead primer, has heavy metal content of 16% lead, 0.2% chromium, and less than 0.01% cadmium. Although the primer was not expected to be disturbed during cleaning and preparation, appropriate worker and environmental protection measures were taken in case of accidental disturbance of any heavy metals.[1]

Containment

In accordance with the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction*, 2006 edition, Section

Fig. 5: Containment chain link system

Fig. 6: Containment with tarpaulin

603.13 b-"Containment,"[2] before beginning surface preparation, the contractor submitted drawings of the containment system to the engineer for review. The contractor also obtained all permits required for the project. The additional requirements for containment were given in the project site plans. To protect the traveling public and the environment from loose paint chips, wastewater, solvent, coating drips and overspray, the containment was designed in accordance with SSPC Technology Guide No. 6, "Guide for Containing Surface Debris Generated During Paint Removal Operations."[3]

The containment system was thus designed to contain debris generated from SSPC-SP 3, "Power Tool Cleaning,"[3] and SSPC-SP 12, "Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating."[3] That is, the framework was constructed with a chain link support system and a tarp impermeable to air and water. Following the design of an SSPC Class 2P containment,[3] the system included these components: A2-Flexible, B1-Air Impermeable, Support Structure C2 —Flexible, D1-Full Seal Joints, Entryway E4-Open Seam, Air Make Up F2-Open and Input Air Flow G2 Natural. The containment system also followed the design of a Class 2W containment, with these components: A2-Flexible, B3a-Water Impermeable, Support Structure C2 —Flexible, D1-Full Seal Joints, Entryway E3-Overlap, Air Make Up F2-Open, and Input Air Flow G2 Natural (Figs. 5 and 6).

Protecting Workers from Exposure to Heavy Metals

In accordance with 29 CFR 1926.62, "Lead," the contractor and inspection personnel took precautions to prevent overexposure to lead dust in case it was accidentally generated from power tool cleaning methods. SSPC-SP 12,"Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating," was also specified to remove loose coating, dirt, and debris from the surface of the steel; it was determined that the SP 12 method posed no significant risk of elevated lead exposures, as described by OSHA in the preamble to the lead in construction standard.

Before beginning cleaning operations, workers had their blood samples tested by an independent laboratory for lead and zinc protoporphyrin (ZPP). All of the workers used proper personal protective equipments (PPE) to ensure a minimal risk to lead. The workers used half mask respirators with high efficiency particulate air (HEPA) filters with appropriate cartridges, gloves, goggles with side shield protectors, protective suits, steel toe boots and ear plugs to reduce the levels of noise below 90 decibels. The power tools were equipped with HEPA filters to collect debris generated from removing loose coating on the surface of the steel bridge. Wash and change stations were positioned inside of the contractor's regulated area to promote worker hygiene and to keep all contaminated articles of clothing at the jobsite for proper removal and cleaning.

Coating Selection and Inspection Concerns

Overcoating maintenance painting and repair with 1% to 3% breakdown of the original system to extend its service life expected to save the DOTs well over $15 million over the bridge's total life cycle maintenance costs. When a coating starts to deteriorate, it tends to break down exponentially rather than linearly (Fig. 7), so the DOTs considered overcoating optimal at the 1% to 3% point of breakdown.

While overcoating is a viable alternative to a costly complete removal and recoating of the bridge, both DOTs understood that overcoating presents challenges. Alkyds are susceptible to attack from coatings blended with a strong solvent or with a high solvent content. The best way to minimize the stress on the existing coating was to overcoat the existing structure with another alkyd, and the DOTs selected a two-coat calcium sulfonate alkyd system, with the primer and topcoat differing only in tint base (red primer and beige topcoat).

Prior to surface preparation of the areas showing some breakdown, the entire structure was cleaned in accordance with SSPC-SP 12, "Low Pressure Water Cleaned," with maximum pressures of 3,000 psi. Areas with loose coatings and rust were power tool cleaned in accordance with SSPC-SP 3, "Power Tool Cleaning." There was no bare steel after surface preparation. A penetrating sealer was applied to areas of back-to-back angles. Bolts and crevices were stripe coated, followed by two coats of the alkyd on the entire structure, which exhibited at least a 3A adhesion rating.

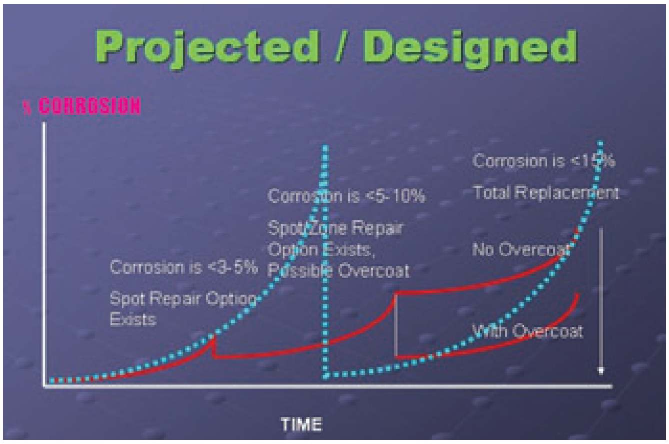

Fig. 7: Corrosion curve

There are certain advantages to a calcium sulfonate alkyd, including easy mixing (single package), easy application, available with relatively low volatile organic compound (VOC) content, low cost, relatively good corrosion resistance, and tolerant of many surface conditions as described in SSPC and NACE standards. This coating is typically used in mild service environments.

However, because alkyd systems are flexible, dry slowly, and cure by reaction with oxygen from the air (oxidation), they present several inspection concerns: foreign particles can be embedded into the soft surface and the soft surface can accidentally be damaged during quality assurance measures. And unless the (relatively slow) curing mechanism is modified to prevent residual tackiness, the mechanism allows the ambient (humidity, temperature, etc.) conditions to play a major role during the curing process.

In accordance with ASTM D3363, "Pencil Hardness Scale," which determines the hardness of a coating on a scale from 6B to 6H, soft to hard respectively, the alkyd selected is a 5B, indicating that the system is soft. This is a point of concern because if a coating is soft and slow drying, its abrasion resistance is poor. Bleeding or color migration can occur if the prime coat's color drastically contrasts that of the topcoat once the topcoat has been compromised by abrasion. A bleeding effect can also occur in isolated areas of the bridge that do not have an adequate amount of sunlight. In such areas, at high pressures (3,600 psi), the airless spray gun partially impregnates the finish into the soft, tacky red primer and allows the primer to slowly show through the topcoat over several days. In these areas, it is understood that

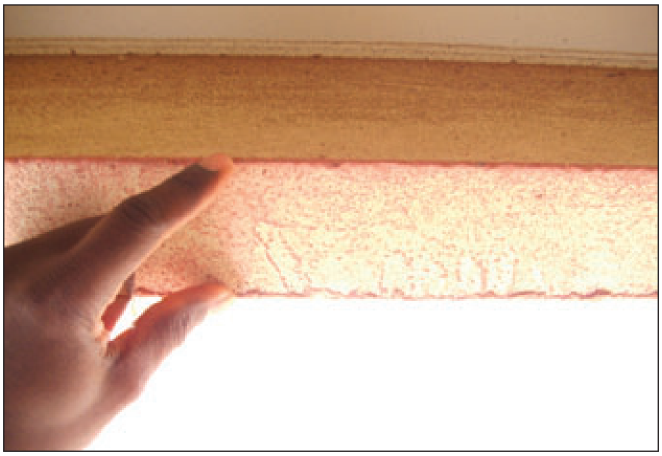

Fig. 8: Bleeding and color migration of the primer along the entire bottom flange.

Fig. 9: Bleeding and color migration of the primer through the topcoat during striping of the topcoat.

the red primer, which is still tacky, has interface layers that show through the topcoat even with adequate topcoat thickness of 4 to 6 mils, for example. This bleeding phenomenon occurred on the project (Fig. 8).

Color migration and bleeding of the primer also occurred due to an under-cured primer and low mils around the nuts and bolts of the structure while striping between coats (Fig. 9). The soft film also allows foreign particles (e.g., dirt) to become imbedded onto the surface and to a certain degree into the coating before it dries to touch (Fig. 10). Industry experience has shown that this coating can remain soft for several months at a time. The amount of dirt that imbeds into the coating before its full cure can greatly affect its color and gloss retention. Although the surface contaminants affect the coating's aesthetic appearance, its corrosion protection properties are not compromised and the expected life of the system should be achieved.

To eliminate the bleeding effect from striping the nuts and bolts, the coating manufacturer recommended that the striping be performed with the topcoat instead of the red prime coat. The coating manufacturer also recommended that the contractor stop applying the red prime coat (over the existing coating) approximately two feet from all striped areas to prevent overspray to those areas. The contractor was then to apply a final (beige) topcoat to all the areas to provide adequate coverage and film build and avoid color migration. Replacing the red primer with the beige topcoat during striping procedures would eliminate migration of the red to the beige coat, thus providing a uniform appearance to the bridge.

Fig. 10: Foreign particles on the surface of the coating.

The soft, flexible, surface tolerant calcium sulfonate allows a steel substrate to contract and expand without causing the coating to crack. However, due to the slow curing and drying nature of this alkyd system, measuring the film thickness with a dry film thickness gauge proved to be unreliable. Therefore, the inspection staff monitored the average film thickness with a wet film thickness notch gage. The film thickness of the final coat was also calculated daily with a notch gage, supported with square footage calculations and deductions of approximately 20% for overspray and waste.

Project Completion

The Caruthersville Bridge Project was scheduled to be completed by the end of painting season 2010. The first phase in painting season 2009 consisted of preparing the surfaces of the Tennessee and Missouri approaches to be primed and topcoated with the calcium sulfonate system. The second phase of the project was scheduled to begin early 2010 and to be completed by November 2010.

At the time of this writing, the project is on schedule, with SSPC-QP 1- and QP 2-certified VHP Enterprises performing the surface preparation and coating work.

Challenges of Overcoating

References

1. Tennessee Department of Transportation: "Coating Condition Evaluation of the Interstate 155 Bridge Over the Mississippi River."
2. *Tennessee Department of Transportation Standard Specification for Road and Bridge Construction,* March 1, 2006.
3. SSPC-SP 3, "Power Tool Cleaning," and SSPC-SP 12, "Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating"; SSPC Technology Guide No. 6, "Guide for Containing Surface Debris Generated During Paint Removal Operations," Pittsburgh, PA: SSPC: The Society for Protective Coatings.

Ernst Toussaint, EIT, has managed bridge coating projects, including several for the Florida and Tennessee departments of transportation. Currently self-employed as a consultant to the industry, he previously worked for Greenman-Pedersen, Inc. and KTA-Tator, Inc. He also has worked as a chemical engineer for manufacturing industrial process facility components. He is a member of SSPC: The Society for Protective Coatings. He holds a B.S. in Chemical Engineering.

Steven Ross Sherwood, Jr., EIT, has been with the Tennessee Department of Transportation for 11 years, working in the Construction Division. Currently an Operations Specialist Supervisor I at the Brownsville Construction Office, he manages projects in Dyer, Lake and Obion counties. He has a B.S. in Civil Engineering.

Scott B. Stotlemeyer, PE, is the State Bridge Maintenance Engineer for the Missouri Department of Transportation. He develops and coordinates guidance for inspecting and maintaining more than 10,200 state bridges. In 19 years, Stotlemeyer has held positions in the Design, Maintenance, and Traffic Divisions. He has a B.S. in Civil Engineering and is a registered Professional Engineer in Missouri.

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SSPC Holds Floor Coating Course

SSPC held its Floor Coating Basics Course (C-10) on February 22-23 at the Sherwin-Williams Company in Cincinnati, OH. The instructor was Larry Pack, technical service manager for the Sherwin-Williams Company.

Larry Pack said of the C-10 course: "We consider this training vitally important in the advancement of coating concrete properly and profitably. Our industry is ever changing with new product development and government regulations. If we provide this training on a continuing basis, the contractors will remain on the leading edge of technology, information, profitability, and limited loss prevention. In providing this service, Sherwin-Williams recognizes that this will lead to a profound advancement of our industry. We are pleased to be a member of the SSPC team."

Students of the C-10 Floor Coating Basics Course in Cincinnati, OH
Photos courtesy of SSPC

SSPC 2011 Call for Papers

SSPC is currently accepting abstracts for SSPC 2011 featuring GreenCOAT. Speakers can choose from subjects ranging from surface preparation to inspection to coating formulation. The SSPC 2011 protective coatings show will be held January 31–February 3, 2011, in Las Vegas, NV. Contact Jennifer Merck at merck@sspc.org for more information.

Hampton Rds. Hosts Abrasive Blasting Class

Examining some of the equipment at the SSPC's C-7 class on abrasive blasting

The SSPC Hampton Roads Chapter hosted the SSPC Abrasive Blasting (C-7) course on March 27 at Vanwin Coatings. The class was instructed by Joyce Wright, and ten students participated.

Continued

SSPC Offers New Flash Rust Guide

SSPC is now offering a non-mandatory guide developed by the National Shipbuilding Research Program Surface Preparation and Coatings Panel (NSRP SP-3) for determining flash rust on steel. The guide includes text and reference photographs describing how to perform a field assessment of the amount of flash rust on a steel surface by brushing the surface with a paint brush wrapped with a white cotton cloth and evaluating the color and amount of rust that transfers to the cloth.

The guide can be ordered through the SSPC marketplace at www.sspc.org.

Upcoming SSPC Courses

- May 17-22 PCI Protective Coatings Inspector, Port Orchard, WA
- May 17-18 CCB Concrete Coatings Basics, Houston, TX
- May 19-22 CCI Concrete Coating Inspector, Houston, TX
- May 22 PCS Protective Coatings Specialist, Norfolk, VA
- May 24-25 C12 Airless Spray, Lakewood, WA
- June 5-6 C13 Water Jetting, Hampton Roads, VA
- June 7-11 C1 Fundamentals of Coatings, Henderson, WV
- June 7-11 NBPI NAVSEA, Seattle, WA
- June 7-12 PCI Protective Coatings Inspector, Shanghai, China
- June 12-13 C12 Airless Spray Basics, Hampton Roads, VA
- June 14-15 Floor Coatings, Cincinnati, OH
- June 14-18 C2 Planning & Specifying, Hammond, IN
- June 14-18 C1 Fundamentals of Coatings, Garland, TX
- June 17 Northern California/Nevada Chapter Event, Vallejo, CA

industry

FHWA Issues Advisory on NDE for Gusset Plate Corrosion

The Federal Highway Administration (FHWA) has developed a new technical advisory on Inspection of Gusset Plates Using Non-Destructive Evaluation Technologies. The advisory was formed after the National Transportation Safety Board (NTSB) concluded the I-35W highway bridge in Minneapolis, MN, collapsed due to design error of the gusset plates, and that visual inspection is not always capable of determining the condition of gusset plates.

On August 1, 2007, the eight-lane, 1,907-foot-long I-35W highway bridge over the Mississippi River in Minneapolis, MN, collapsed into the river. A total of 111 vehicles were on the portion of the bridge that collapsed, resulting in 145 injuries and 13 deaths. An NTSB investigation determined that the probable cause of the collapse was the inadequate load capacity of the U10 nodes due to a design error of the gusset plates. The gusset plates are thought to have failed due to increased weight and the traffic and concentrated construction loads on the bridge that day. Also, corrosion documented on the gusset plates at the L11 nodes had been overlooked or underestimated by bridge inspectors using visual methods.

Underestimates of corrosion loss using visual inspection on primary truss gusset plates were identified in other states. As a result, the NTSB concluded that visual methods were not always capable of evaluating the condition of gusset plates with section loss due to corrosion. Based on this conclusion, NTSB recommended H-08-18, which asked FHWA to require that bridge owners assess the truss bridges in their inventories to identify locations where visual inspections may not detect corrosion and non-destructive evaluation (NDE) technologies should be used.

The following recommendations are consistent with revisions to Section C4.8.3.6 of the AASHTO Manual for Bridge Evaluation (MBE), approved during the 2009 Annual Meeting of the

Highway Subcommittee on Bridges and Structures:

- Bridge owners should identify primary truss gusset plates where corrosion is evident and visual inspections may not detect or adequately quantify section loss due to corrosion. This should be done prior to or during the next scheduled inspection, but not later than 36 months from the issuance date of the advisory (January 29, 2010).
- NDE technology should be used for all future inspections to assess gusset plates at all locations identified with evident corrosion. All measurement locations and dimensions from when NDE is employed should be documented.
- The advisory recommends ultrasonic testing (UT) methods for thickness measurement because it is a proven, field-ready technology suitable for measuring thickness in single-plate gusseted connections.
- Until suitable technology is available, the advisory recommends a combination of visual and UT inspection to best evaluate multi-plate gusset connections.
- The advisory recommends that UT inspections be performed by trained technicians concurrently with or soon after visual inspection. The level of training is to be commensurate with the complexity of the connection, ease of use of the equipment, and acceptance by the owner.

Thomas Langill to Head ASTM Panel

Thomas Langill, Ph.D., technical director at the American Galvanizers Association in Centennial, Colo., has been elected chairman of ASTM International Committee A05 on Metallic-Coated Iron and Steel Products.

Thomas Langill

Committee A05 includes more than 270 members who oversee 74 ASTM standards on the protection of iron and steel products

Continued

against corrosion by use of metallic coatings and non-metallic coatings.

A member of ASTM International since 1994, Langill also is chairman of Subcommittee A05.13 on Structural Shapes and Hardware Specifications. He is an active member of several other ASTM committees related to metals and coatings. In 2009, he was honored with the ASTM Award of Merit, the organization's highest honor for individuals.

Langill's professional career has focused on materials engineering and failure analysis, ASTM said. At the American Galvanizers Association, he concentrates on training, specification writing, and materials analysis. Langill is also a member of SSPC, NACE, the American Society of Civil Engineers, ASM International, the American Welding Society, and the Association for Iron and Steel Technology. He holds a Ph.D. in materials science and engineering from Northwestern University.

BASF Wins Best Paper Award for Waterborne Anticorrosion Coatings

Oihana Elizalde and Collin Moore of BASF.
Photo courtesy of Helko Stahl.

Three BASF researchers received the outstanding paper award at the American Coatings Show in Charlotte, N.C., for their work on the development of high-performance waterborne anticorrosion coatings.

Oihana Elizalde, Stephan Amthor, and Collin Moore received the American Coatings Award for their paper, "Closing the Gap Between Water and Solvent-borne Anti-corrosion Coatings via New Binder Concepts." The award was presented during ceremonies held on the opening day of the conference, at the Charlotte Convention Center. The conference began April 12 and was held in conjunction with the American Coatings Show, which ran April 13–15.

The events were presented by the American Coatings Association (formerly the National Paint & Coatings Association and Federation of Societies for Coatings Technology) and Vincentz Network, with show management by NurnbergMesse North America Inc.

For details about the conference, visit www.american-coatings-show.com.

Special BidTracker Update on 5 Bridge Jobs

By Brian Churray and Julie Birch, Paint BidTracker

In honor of the International Bridge Conference, scheduled for June 6–9, 2010 in Pittsburgh, PA, *JPCL's* Project Preview is taking a look back at five projects that appeared in this space in the past twelve months. Project Preview typically delivers a brief synopsis of contract awards before the work begins, using details from the Paint BidTracker construction information service. This month, we asked five contractors to give us a closer look at their projects and the progress that they have made since we originally detailed the jobs. Their accounts provide a telling cross section of the numerous decisions and challenges that comprise large-scale bridge painting projects.

SCR Teams with Intech Contracting on Corpus Christi Bridge

SCR Construction Company, Inc. (Richmond, TX) was awarded a contract of $23,165,710 by the Texas Department of Transportation to perform steel repairs and coatings application on the Corpus Christi Harbor Bridge, a 5,818-foot-long bridge that features a 3-span, 1,240-foot-long cantilever steel truss unit rising 138 feet above the shipping channel below. The project, which began in the closing days of March 2010, is scheduled for completion by September 2012, with the coatings work included in the initial phases that are currently underway.

Courtesy of Randy Roberts, SCR

SCR signed a subcontract of $16,880,800 with Intech Contracting, LLC (Lexington, KY), SSPC-QP 1- and QP 2- certified, for the surface cleaning and coatings application. Intech's portion of the work includes pressure-washing the entire structure; water blasting, spot-cleaning, and overcoating girder approaches with an epoxy penetrating sealer, an epoxy stripe coat, and a polyurethane finish; Near-White (SSPC-SP 10) abrasive blast cleaning and recoating truss surfaces with an organic zinc-epoxy-polyurethane system; and treating pack rust with penetrating sealer.

Brad Wilder, Intech's construction coordinator, indicated that the humidity, high winds, and soluble salt-heavy atmosphere of the Gulf Coast, as well as the heavy traffic over the bridge, present the most pervasive challenges, which will be met by using containment and dehumidification designs that exceed TxDOT Standards. The contract stipulates that the required full containment systems be limited to within one foot of the bottom member, which will be facilitated through the use of steel platforms provided by SafeSpan.

SCR also subcontracted Highway Barricades and Services, Inc. (Corpus Christi, TX) and TCOPS (Dallas, TX) to assist in the safety and traffic control portions of the project.

Ahern Painting Juggles Right-of-Way Challenges on Passaic River Bridge

Ahern Painting Contractors, Inc. (Woodside, NY), SSPC-QP 1- and QP 2-certified, was awarded a contract of $30,857,890 by the New Jersey Turnpike Authority to recoat existing steel surfaces on the 6,948-foot-long Washington Memorial Passaic River Bridge.

The project, which is fully underway and slated for completion by the end of 2010, includes lead-based paint abatement with full containment; coatings application on 1,600,000 square feet of carbon steel surfaces and 220,000 square feet of weathering steel surfaces; and waterproofing membrane installation on 11,310 square feet of substructure surfaces.

Ahern Painting enlisted the help of Anka Painting Company (Palisades Park, NJ), SSPC-QP 1- and QP 2-certified, who will recoat ten sections on the south side

Courtesy of Joe Steele, Ahern Contractors

of the bridge under a $5.9 million subcontract. The contractors will apply an Ameron (PPG) brand zinc-epoxy-aliphatic urethane system to the steel. Ahern's approach to the project includes the use of SafeSpan platforms, Graco pumps, and Ingersoll compressors.

The biggest challenge to date, according to Joe Steele, Ahern's project manager, is working with the four separate railroad companies that operate tracks beneath the bridge, each with different right-of-way restrictions. "It's just been a matter of reaching out to the different agencies to let them know what we're doing." While the project does not require full closures, each agency sends its own group of flagmen and, Steele said, "before you know it, you have 12 or 13 flagmen down there."

The Gateway Company Feasts on Starvation Reservoir Contract

The Gateway Company of Utah, LLC (Salt Lake City, UT), SSPC-QP 1- and QP 2- certified, recently completed work on a bridge painting contract of $1,081,215.50 from the Utah Department of Transportation. The project involved coating steel and concrete surfaces on an 8-span, 1,674.25-foot-long bridge over Starvation Reservoir. The project included abrasive blast removal of the existing finish on 235,691 square feet of steel down to the red primer, followed by overcoating

Continued

Courtesy of Andres Pack, The Gateway Company with a 100%-solids epoxy primer and intermediate and a silicone alkyd finish manufactured by Carboline. The project also included applying a Hydrozo (BASF) silane penetrating sealer to 3,350 square feet of existing concrete surfaces.

The largest challenge of the job was that the entire bridge is over water, which was overcome by dividing the work into three 600 linear foot sections and transferring 25,000 square feet of SafeSpan decking under the sections. To meet OSHA guidelines, the contractor provided its workers with 100% tie-off protection and a rescue boat. Gateway also obtained permission from the director of Utah State Parks to close off the waterway under the bridge using water buoys and signs to ensure the safety of boaters.

Gateway secured equipment from Ahern Rentals (Las Vegas, NV) and employed Riley Traffic Consultants, LLC (Salt Lake City, UT) to design the traffic control plan and Peck Striping (Kearns, UT) to provide traffic control equipment.

Blastech Tackles Cheat Lake Painting Project

Blastech Enterprises, Inc. (Baltimore, MD), SSPC-QP 1- and QP 2-certified, secured a Recovery Act-funded contract of $5,595,373 from the West Virginia Department of Transportation to recoat a 7-span, 1,964-foot-long cantilevered Warren deck truss bridge over the Cheat Lake.

Blastech began rigging during April, with completion expected by October 15, 2010. Blastech worked with Atlantic Design, Inc. (ADI) to design a custom recycling unit for the project, which is “one of the largest units that [ADI has] ever built,” according to John Korfiatis, president, Blastech Enterprises. The contractor is installing two levels of platforms, one under the deck and one under the steel truss, with


Courtesy of John Korfiatis, Blastech Enterprises

chain-link fencing to enable safer, more efficient production. The platforms will allow easier walking throughout the full containment structure, which is required as part of the lead control plan.

Blastech will abrasive blast clean the steel to a Near-White finish (SSPC-SP 10) prior to applying a Sherwin-Williams organic zinc primer and acrylic intermediate and finish coats using Graco spray equipment. The biggest challenges to date have been wind coming across the lake and heavy traffic, which have required a considerable degree of caution.

S&K Painting Wrapping Up Union Street RR Bridge Job

S&K Painting, Inc. (Clackamas, OR) is putting the finishing touches on a contract of $1,612,895 from the Oregon Department of Transportation to recoat structural steel surfaces on the Union Street Railroad Bridge. The 5-span, 722-foot-long Pratt through-truss vertical lift bridge over the Willamette River, which was built in 1912, was recently converted to a pedestrian and bicycle crossing between two parks.

According to Steve Smith of S&K, the project presented the usual challenges


Courtesy of Doug Eakin, OBEC Consulting Engineers

of coating a bridge over water during spring in the Northwest—containing the paint on a complex structure and working against the wet weather. The steel, which was previously coated with lead-bearing paint, was overcoated with a moisture-cured urethane system manufactured by Wasser.

The contractor employed Signal Electric (Kent, WA) as a subcontractor and elected to use Ingersoll air compressors, Detroit Tarp containment materials, a Gapvax vacuum truck, and Graco spray equipment.