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The Voice of SSPC: The Society for Protective Coatings

FEATURES

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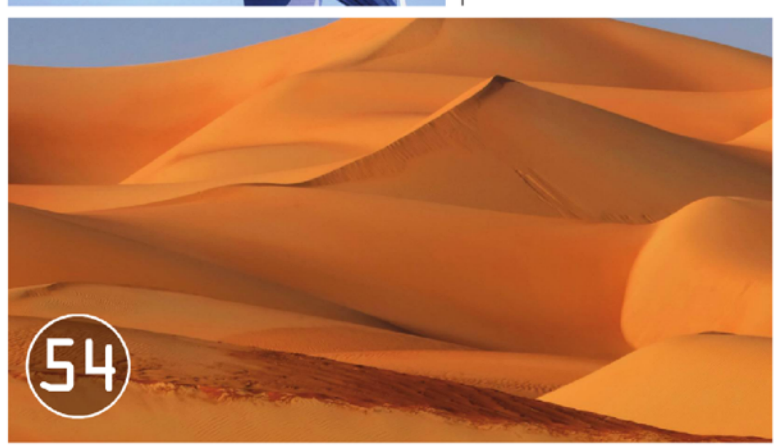
Please see pp. 20–30 for photo credits.

DEPARTMENTS



Also This Month

From the Offices of

SSPC The Society For Protective Coatings

Staff

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The Importance of Conferences

As you may know, SSPC just completed a very successful international conference in San Antonio, Texas. I want to relay a story that I heard from a member named Nancy at the Grand Hyatt's "watering hole" one evening during this year's conference.

Nancy mentioned to me that she really enjoys the SSPC show for one very important reason: she becomes reacquainted with old friends and meets new ones. She told me the relationships she has made at the show over the years have been rewarding not only professionally, but, even more importantly, on a personal level. At the conference, she gets to catch up on how each person is doing and talk about the events in each of their lives. Nancy said that over the years, her priorities at the conferences have shifted, and the relationship building means so much more to her now.

This conversation was very appropriate, as earlier in the day I had a talk with another member, Bob, about the problems that face this association and other groups in attracting new members to participate in committees, task groups, and other initiatives.

Bob had owned a major coatings contracting firm before selling the firm to a relatively young new owner. Bob told me that the new owner did not believe in going to meetings and conferences to build relationships through a network of knowledgeable peers. The new owner believed that any information that one might need would be available on the internet.

I would like to share a story of a relationship I have built over the years with one of our conference attendees named Ron. At an SSPC conference years ago, I was in a DOT Peer forum, and Ron made a disparaging remark about a certified contractor whom he had to deal with. Even though I later found out that the incident had occurred years before, I sought Ron out after the forum and had a great discussion with him. I told him we had modified the program because of those types of problems and hopefully that corrected the situation. After that conversation, I think we each had a better appreciation for one another. We have established a relationship in which I always seek him out at the conference, just to see how he is doing. If I needed some information from the Idaho DOT, or even contacts in some of our western states' DOTs, Ron is the first person I would call.

How do you get to know your colleagues in this industry if you don't attend conferences or meetings? Business is still about relationships. A recent CBS Sunday Morning program had a piece about what made a great President. It mentioned that, as President Obama starts his second term, he has to be the great "Healer in Chief," and that the key to his success will be building relationships. In the program, one of the historians mentioned that Thomas Jefferson even brought the opposing party in Congress to the dinner table because he found that it was far harder to say "no" to someone you know. That's why conferences and meetings are so important—because where else can you meet and really get to know the people that you have to interact with in business, and begin to build those long-term relationships?

I want to thank all the people that attended our conference, as well as the exhibitors, presenters, and instructors. I would also like to congratulate all of the award winners. A special acknowledgement goes out to David Boyd, the Honorary Life Member, and Doni Riddle, winner of the John Keane Award. And for next year, I ask that you heed the challenge of the current SSPC President, Steve Collins, by bringing at least one young person to the conference with you.

Bill Shoup

Bill Shoup
Executive Director, SSPC

Webinars Examine Effective Waterjetting and Blasting Safety

The 2013 SSPC/*JPCL* Education Series Webinars continue through March with two free presentations: "Steps to a More Effective Waterjetting Standard" and "Safety in Abrasive Blasting."

"Steps to a More Effective Waterjetting Standard" will be presented on Wednesday, March 20, 2013, 11:00 a.m. to noon, EST. It will explain the steps to effectively preparing a steel substrate by waterjetting. Discussion will include the importance of surface preparation, types of waterjetting equipment, waterjetting productivity, and a review of the recently-updated waterjetting cleaning SSPC/NACE industry standards.

The presenter of this material will be Richard Dupuy, founder and president of UHP Projects, Inc. since its inception in 1993. Dupuy founded the company to supply state-of-the-art surface preparation and recoating services to the marine and industrial industries. This webinar is sponsored by NLB Corp.

Richard Dupuy

"Safety in Abrasive Blasting" will be presented on Wednesday, March 27, 2013, 11:00 a.m. to noon, EST. This webinar will explore potential respiratory hazards that can occur from abrasive blasting, with a brief review of applicable OSHA standards. The discussion will examine how limits are measured, how to understand the results of respiratory exposure testing, and how often testing should occur. The next section will focus on selection, use, and care of personal protective equipment (PPE).

Dr. William J. Mills, III, president of Mills Consulting Inc., will be the presenter of this webinar. Dr. Mills has over 25 years of experience in environmental, health, and safety issues, chemical processes, and advanced technologies. This webinar is sponsored by Harsco.

Registration, CEU Credits

This program is part of the SSPC/*JPCL* Webinar Education Series, which provides continuing education for SSPC re-certifications and technology updates on important topics.

SSPC is an accredited training provider for the Florida Board of Professional Engineers (FBPE), and Professional Engineers in Florida may submit SSPC Webinar Continuing Education Units to the board. To do so, applicants must download the FBPE CEU form and pass the Webinar Exam, which costs $25.

Register for these online presentations at www.paintsquare.com/webinars.

Most of the stories on pp. 6 and 7 and more news can be found on *PaintSquare News*, *JPCL*'s sister publication, a free daily e-newsletter. To sign up for the newsletter, go to paintsquare.com/psn.

SSPC Board Continues College Scholarship Program

SSPC is pleased to announce that the Board of Governors has approved the continuation of the college scholarship program for the 2013-2014 school year. Beginning in January 2013, college students will be able to apply for one of four $2,500 scholarships.

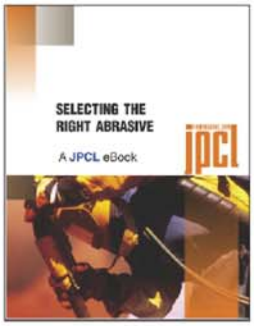
All students who are beginning or continuing their education in an institution of higher learning can apply for a scholarship. All educational institutions in the United States or Canada are now acceptable for students to receive these scholarships.

The deadline for application submission is April 30, 2013. For more information, please visit www.sspc.org/college-scholarship-program.

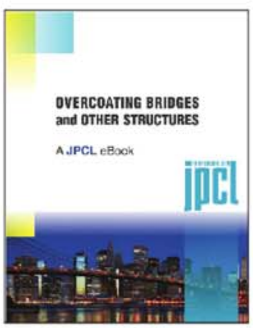
JPCL Offers New eBooks on Abrasives and Overcoating

JPCL has released two new, free eBooks, one covering abrasive selection and the other covering overcoating industrial structures. Both are available for a free download exclusively through paintsquare.com, the online home of *JPCL*.

Selecting the Right Abrasive is a combination of seven in-depth, technical articles by leading experts



that serves as a guide to determining the appropriate abrasive material for surface preparation in various applications. This eBook is co-sponsored by GMA Garnet Group and Van Air Systems.



Overcoating Bridges and Other Structures is also comprised of seven in-depth, technical articles, this time covering different lead paint overcoating methods employed in past bridge and penstock rehab projects. This eBook is sponsored by Termarust Technologies.

All of the articles in these new eBooks were published in *JPCL*. Copies of both eBooks are available for free download at paintsquare.com/store.

SSPC Board Seeks Nominees

SSPC is now seeking nominations for two seats on its Board of Governors in the categories of Coatings Contractors, where there is one opening, and Other Product Suppliers, where there is one opening.

The Coatings Contractors category is defined in the bylaws as "individuals who own or are employed by industrial contracting firms specializing in the removal or application of coatings and linings, either in the field or shop."

The Other Product Suppliers category is defined in the bylaws as "individuals who own, are employed by, or represent firms that manufacture or distribute equipment, abrasive or peripheral products for use in the protective coatings industry."

All nominees must be SSPC members and meet the requirements on page 5 of the SSPC bylaws, located at http://www.sspc.org/media//January2012a_Bylaws.pdf. Self-nominations are not accepted. To nominate a candidate, SSPC asks that members submit a brief statement detailing the nominee's qualifications by March 1, 2013, to SSPC, Attn. Bill Shoup, Executive Director, 40 24th St., 6th Floor, Pittsburgh, PA 15222-4656; fax 412-281-9992; email: shoup@sspc.org.

"Ace" Bean Led Tnemec for Decades

Albert C. "Ace" Bean, Jr., former president, chairman of the board, and Chairman Emeritus of Tnemec Company, Inc., died at the age of 91 on January 23 at his home in Kansas City, MO.

"Ace Bean guided our company during a career that spanned more than 66 years, during which time he instilled the Tnemec spirit in several generations of employees and sales representatives," acknowledged company President and CEO Pete Cortelyou. "To all, he was a gentleman, known for his integrity and compassion."

A lifelong resident of Kansas City, Bean was born on July 12, 1921, the same year that his father, Albert C. Bean, Sr., incorporated Tnemec Company. After graduating from college and serving as a communication officer in the U.S. Navy, Bean joined Tnemec in 1946 as a full-time sales manager for all of the country's major oil-producing states.

In 1956, Bean was named company president, and in 1964 he became chairman of the board, remaining active in that position until he became Chairman Emeritus in 2006. He was a past member of the board of directors of the National Paint & Coatings Association. In 1998, he won the NPCA Industry Statesman Award.

Throughout his career, Bean held a firm commitment to providing customers with innovative high-performance coatings and outstanding technical support.

Bean is survived by his wife, his son, his two daughters, his eight grandchildren, and his four great-grandchildren.

Established in 1921 and headquartered in Kansas City, Tnemec Company, Inc. specializes in industrial coatings for steel, concrete, and other substrates for new construction and maintenance.

JPCL

Problem Solving Forum

On Smart Coatings

What Are Smart Coatings?

From Brian Goldie
JPCL

"Smart" coatings are coatings that are able to respond to changes in their environment. They are designed to sense an external stimulus and react to it, giving a visual warning or "switching on" a certain property.

Smart coatings are not new. For many years, we have had temperature indicating paints. These coatings change color at a defined temperature and thus give a visual indication of the new condition.

However, although smart coatings are not new, the rise in the knowledge of and research into the use of nanotechnology in particular has opened the way for a range of smart coatings that can react in a planned and predictable manner to external stimuli such as stress, pressure, radiation, corrosion, and biological triggers.

There are coatings that can detect application problems such as low film thicknesses or holidays. These paints contain special fluorescent pigments that respond to UV light. Under ordinary light it can be very difficult to easily pick up non-conforming areas, but when inspected under UV, or other wavelengths of light, then these defects can be seen clearly and repaired. This type of technology is common now in marine ballast tank coatings, where its use has speeded-up the inspection process and reduced premature failure rates.

Other types of smart coatings have been developed. Just as some natural systems, when damaged, can initiate automatic healing, coatings have been developed based on polymeric materials that possess the ability to self-heal. They can, for example, self-detect and repair micro-cracks or other defects caused by the natural weathering of the polymeric binders before this damage can get to a macro-scale and cause total coating breakdown. The "smart" additives that detect these micro-cracks release a substance which can polymerize to seal them and other defects, thus maintaining the coating integrity.

Brian Goldie is the technical editor for JPCL.

Problem Solving Forum questions and answers are published in *JPCL* and its sister daily electronic publication, *PaintSquare News*. Upcoming questions in *JPCL* include the following.

- What is the most effective practice for crack sealing in concrete to prevent water intrusion in wastewater collection systems?
- Is the MEK (methyl ethyl ketone) rub test a conclusive test to check the cure of IOZ coatings?
- Whose responsibility is safety on a bridge coating site?
- If an inorganic zinc (IOZ) coating has not fully cured because of low humidity, can water be sprayed onto the IOZ-coated surface to accelerate the cure?
- What action should be taken if an inorganic zinc coating fails the MEK (methyl ethyl ketone) rub test?
- What causes "amine blush" in epoxy topcoats?
- Do water treatment processes to stop the transfer of invasive marine species in ballast water affect the performance of ballast tank coatings?
- How soon does metallizing need to be sealed after it is applied to concrete on bridges?

Responses to *JPCL* questions can be submitted to kkapsanis@paintsquare.com. Readers may also propose questions.

Readers can respond to PSF questions on *PaintSquare News* and can propose questions on *PaintSquare News* at paintsquare.com/psf.

Q&A with David Hunter

By Charles Lange, JPCL

This month's SSPC PCS is David Hunter, Managing Director in Southeast Asia for Mascoat, a company that produces thermal insulating coatings for industrial and commercial applications. Recently promoted to handle all distribution company-wide, Hunter identifies, interviews, sets up, and trains new distributors of Mascoat products, as well as provides technical support and project assistance to clients.

A 19-year veteran of the coatings industry, Hunter is an SSPC Lead Instructor and a NACE-certified inspector and instructor. He lives in the Atlanta area, but spends much of his time abroad, traveling to and working in more than 18 countries around the world.

JPCL: How did you get your start in the protective coatings industry?

DH: I don't think I ever decided to get into the coatings industry—it sort of found me. I actually have a degree in Civil Engineering, and when you get out of college with that kind of degree, you either get to build new things, or you end up, what I call, "fixing someone else's design." I got in on the second part, so I was inspecting bridges, water tanks, piers, lighthouses, and other commercial structures, and the problems often were with coatings and corrosion issues.

Since there isn't a great way to get experience in the coatings business other than learning on the job, I learned by asking *lots* of questions. The problems were always different, and I also realized that many of the engineers I was talking to knew almost nothing about coatings. So I had to teach them as well, and my experience explaining or "translating" technical concepts to technical and non-technical people led me to opportunities to teach for SSPC and NACE. I have taught classes with translation in Kazakhstan, Korea, Singapore, Brunei, Peru, Thailand, Indonesia, China, and Hong Kong.

JPCL: What kinds of courses do you instruct?

DH: For SSPC, I teach C-1, Coating Fundamentals; C-2, Specifying & Managing Coatings Projects; PCI, Protective Coating Inspector Course; and Navy Basic Paint Inspector Course (NBPI). Also, for NACE, I teach CIP Levels 1 & 2 Full Courses; CIP Exam Course 1; CIP Exam Course 2; Nuclear Power Plant Training for Coating Inspectors; and Offshore Corrosion Assessment Training (O-CAT).

JPCL: Have you lived in any of the other countries that you've worked in, or do you just travel to and from for business?

DH: So far, I've only traveled. I would do almost anything to get an opportunity to live and work overseas.

JPCL: What has been your favorite country or part of the world to travel to?

DH: I like Asia and South America the most. Thailand, Indonesia, Australia, and China are some of my favorites. For me, Shanghai is way more fun than New York City. Peru and Colombia are also nice.

JPCL: What are some of the challenges that you might face when working with international clients?

DH: Language barriers and time zones are difficult, but differences in cultural and business practices are the most important. One of my best skills is determining, in other cultures, if the person I am talking to can actually accomplish what he or she says that they can do. In some cultures, it is not appropriate to just say, "no," even if that is the answer. I need to evaluate business partners, and that selection affects whether or not I am successful. I have to read all clues about that person, which is a hard skill to teach someone else.

JPCL: What do you enjoy most about what you do?

DH: I enjoy the travel and the food, but mostly the people. You cannot enjoy my job without enjoying the people that you work with. For me, the places always change, but the people are what make the job fun.

JPCL: With such a busy schedule and so much traveling, what kinds of things do you do in your free time for leisure?

DH: I got very lucky in that working is kind of my hobby. Sure, there are days when it feels like all work and no fun—ask me after a wicked bout of jet lag!—but most of the time, I have fun with my work. Ask anyone that has seen me teach. How do you make paint fun? You can't fake enthusiasm—you either have it or you don't.

It's an amazing life, and a gift, and all of my friends look at me ask, "how do you do that?" I look at them and say, "how do you go to the same office every day? That would kill me!" I do things that others dream of, or at least I think I do.

I love sports, especially golf and college football, which I cannot get enough of. In the end, though, I get very little of either.

JPCL

The Case of the Mysterious Hailstones

By E. Bud Senkowski, PE, KTA-Tator, Inc.
Richard Burgess, KTA-Tator, Inc., Series Editor

Specification writers, contractors, and coating manufacturers, at one time or another, have been blamed when installed coatings fail to meet service life expectations. However, rarely does the wrath of Mother Nature receive the blame for premature coating failure. In this Cases from the F-Files, an interior roof coating system reportedly failed because of localized impact on the roof exterior from large hailstones during a severe thunderstorm. Can this really happen, at least in this case? Let's find out.

Background

The facility was a 100,000-square-foot aircraft hangar supported by a steel framework and covered with steel panels. Shortly after erection, the interior roof panels and associated supporting steel were painted with an alkyd-based coating system. The original alkyd coating was reportedly applied at a dry film thickness (DFT) of 3.0–3.5 mils. After approximately 10–15 years of operation, the roof panels and support steel were power washed with water to remove surface dirt, then overcoated with a waterborne acrylic dry fall coating (also called dry fog coatings or sweep-up coatings). The dry fall overcoat was reportedly applied in a DFT range of 3.0–4.5 mils.

Approximately three years after the application of the dry fall waterborne acrylic overcoat, the dry fall coating system began to delaminate from the original alkyd coating. The falling paint chips contaminated the hangar workspace. Aircraft maintenance operations had to be suspended until the problem was resolved. The peeling paint was blamed on a recent severe thunderstorm during which large hailstones struck the exterior of the painted roof panels and reportedly caused delamination of the coating applied to the underside of the roof panels. The owner called in a third-party consultant to analyze the failure.

Fig. 1: Extreme delamination of the dry fall coating from the original alkyd on the interior roof panel
Photos courtesy of the author.

Site Investigation

A visual inspection within the hangar revealed obvious areas of distressed coating on the inner roof and associated network of supporting roof trusses. Both locations contained areas where the gray acrylic topcoat had spontaneously delaminated from a buff-colored alkyd layer. The areas of coating failure were distributed throughout the hangar. The exposed alkyd layer was covered with many small areas of rust that had developed at the steel substrate beneath the alkyd. Figure 1 shows extreme delamination of the gray waterborne acrylic dry fall coating off the pre-existing buff alkyd layer applied to a corrugated roof panel. Figure 2 shows the same type of delamination of the light gray acrylic overcoat from the buff alkyd layer on a supporting steel member.

Physical probing with the point of a knife blade was used to explore the degree of coating adhesion at failing and non-failing areas of the applied roof coating system. At failing areas where the acrylic was already delaminating from the alkyd layer, probing extended the coating loss to a point at least 6–8" beyond the original damage. At most areas tested, the acrylic topcoat could be cleanly separated from the underlying alkyd layer using only a moderate degree of physical probing.

In contrast, the adhesion of the alkyd

Fig. 2: Extreme delamination of the dry fall coating from the original alkyd on supporting steel

Fig. 3: Adhesion of the original alkyd to the steel was excellent. Aggressive scraping was needed to remove the alkyd.

layer to the underlying steel substrate was excellent. Aggressive scraping was required to remove the alkyd from the steel at all tested locations. Although pinpoint rusting had penetrated the alkyd layer, the overall bond to the steel remained strong. Figure 3 shows that the original alkyd layer was removed only after aggressive scraping with a knife blade.

An electronic gage was used to measure the thickness of the applied coatings. The thickness of the original alkyd layer on the roof panels and supporting steel ranged from 3.5 to 6.5 mils, with an average value of 5.0 mils. The thickness of the waterborne acrylic dry fall overcoat ranged from 7.8 to 12.0 mils, with an average of 9.3 mils.

The field investigation revealed the following significant factors that caused the coating failure:

Excessive Coating Thickness

The DFT of the waterborne acrylic dry fall coating on the interior surface of the roof panels exceeded the manufacturer's recommended DFT. According to the product data sheet, the recommended DFT for the coating was 3.0 to 4.5 mils, with an average of 3.8 mils. Measurements at the site revealed an average of 9.3 mils and a range of 7.8 to 12.0 mils. The average thickness of the acrylic topcoat was approximately 2½ times greater than recommended by the coating manufacturer.

Flexibility Losses

Dry fall coatings are formulated so that when they are sprayed onto a substrate, the overspray droplets dry before they contact the floor or other surfaces. The coatings are designed to dry after falling 8 to 10 feet, depending on the formulation and the environmental conditions. The use of dry fall coatings minimizes the amount of masking and covering of surfaces below that are not to be coated, and the dried coating can easily be cleaned up simply by sweeping. The characteristics of the coatings require application by spraying because the quick-drying characteristics of dry fall coatings would not be realized with non-spray application techniques.

Dry fall coatings are typically formulated with a high pigment-to-binder ratio to facilitate the formation of dry particles and rapid cure. These properties also result in a reduced cohesive strength, leading to a loss in flexibility at high film builds. The waterborne acrylic dry fall coating applied within the hangar probably has an acceptable degree of flexibility when applied in the recommended thickness range of 3.0 to 4.5 mils. Exceeding these limits caused a corresponding loss of flexibility within the cured coating film.

Internal Coating Stress

Coating films also develop internal stress as they cure from a liquid coating to a protective film. When coatings are applied at a normal (recommended) thickness, the stress levels are uniformly distributed during the curing process. When recommended thickness levels are exceeded, the concentrations of resulting stress can lead to adhesion loss. The high pigmentation levels of dry fall coatings also produce lower cohesive forces between molecules, contributing to cracking and splitting of the cured film.

The excessive thickness of the waterborne acrylic overcoat led to the development of longitudinal cracks in the panel coating and the spontaneous delamination of the acrylic topcoat from the aged alkyd.

Lack of Adhesive Bond

In addition to the internal stress developed within the thick layer of the acrylic dry fall overcoat, poor adhesion between the acrylic topcoat and the pre-existing alkyd was the most significant factor that led to the coating failure. Because the acrylic topcoat is waterborne, it had no aggressive solvents to soften the surface of the pre-existing alkyd and create chemical adhesion. Further, with dry fall products, any co-solvents would have very limited contact time with the alkyd film.

Alkyds dry by solvent evaporation followed by curing through slow oxidation from a reaction with oxygen in the air. The air oxidation is continuous over the life of the coating. Over its 10–15 years of service life, the alkyd coating became hard through aging and air oxidation. The aged, smooth alkyd surface thus did not present any significant surface texture to enhance the mechanical bond of the acrylic topcoat. White alkyd films also turn yellow when exposed to the air without weathering forces (e.g., sunlight), and the yellowing chalks the surface. It seems reasonable to speculate that the yellowed surface layer oxidation would be more advanced, further reducing the chance of intercoat adhesion. This surface layer oxidation then would make some form of mechanical surface preparation important before applying the dry fall coating to enhance mechanical bonding of the dry fall coating to the aged alkyd.

Before applying the overcoat, the contractor did not attempt to either roughen the surface of the pre-existing alkyd or apply a bonding primer. The contractor prepared the alkyd only by power washing with water to remove surface dirt and grime.

Other Factors Affecting Coating Adhesion

The roof was assembled by fastening the interlocking steel panels to a supporting system of metal trusses. Adjacent roof panels were overlapped and fastened to each other with self-tapping screws. Layers of board insulation and a waterproof membrane were added to the exterior panel surface to complete the roof. The built-up roof was somewhat rigid but was affected by external forces from snow, ice, and wind loading. Foot traffic can also transmit loads to a corrugated roof system. Although the exterior of the roof was insulated, seasonal temperature changes could also cause expansion and contraction of the corrugated metal panels. The movement could contribute to intercoat delamination of the acrylic dry fall coating from the aged alkyd.

Effect of Hailstone Damage

So was Mother Nature to blame? No evidence suggested that the impact of hailstones on the exterior of the roof caused the delamination of the waterborne acrylic topcoat from the interior of the roof. Rather, the delamination of the coating was the result of weak adhesion between the pre-existing aged alkyd and the dry fall coating. The lack of an adhesion bond resulted from the following factors:

(1) the lack of roughness on the surface of the pre-existing alkyd;

(2) the absence of any chemical reaction (that would have created a chemical bond) between the existing alkyd and the waterborne acrylic overcoat; and

(3) the excessive thickness of the acrylic overcoat (at 2.5 times greater than the recommended average thickness) that may have contributed to the problem by causing internal coating stress during the curing (drying) process.

In support of these conclusions, the same kind of delamination failure was evident on supporting trusses and girders throughout the hangar. These supporting surfaces were not exposed to hailstone impact.

Recommendations for Repair

The overall appearance of the coating and the results of the physical testing revealed a chronic and widespread problem manifested by the lack of adhesion between the pre-existing alkyd layer and the waterborne acrylic dry fall overcoat on the interior roof and the supporting steel members. The problem could not be remediated by simply overcoating the existing alkyd and dry fall coatings. The added weight of a new layer of coating would only further exacerbate the delamination problem.

Rather, all loose coating needed to be located and removed before any overcoating operations were undertaken. This was accomplished by a combination of hand scraping and pressure washing using 1,000–3,000 psi pressurized water and a 0° oscillating tip. Following removal of loose coating, the surfaces containing intact coating were lightly abraded and a bonding primer was applied to the aged alkyd surfaces before overcoating with a waterborne acrylic dry fall coating. The tight dry fall was also allowed to remain. Where it was intact, it was feathered, lightly abraded, and primed before overcoating.

JPCL

Nine Coatings Projects Receive High Honors at SSPC 2013

By Charles Lange, *JPCL*

On Monday, Jan. 14, at SSPC 2013 in San Antonio, TX, SSPC President Steve Collins and Executive Director Bill Shoup presented the Society's seventh annual Structure Awards, given for noteworthy coatings projects on an array of interesting and complicated structures.

This year's winners faced a variety of challenges completing these jobs, from performing work at extreme heights, to dealing with sweltering temperatures inside of containment structures, to restoring a beautiful mural high above the ground on an elevated water storage tank.

The winners are presented over the next several pages. The photo essay is based on nomination materials submitted to SSPC in 2012 and on information given at the awards ceremony.

MILITARY COATINGS PROJECT AWARD OF EXCELLENCE

(EX) USS Iowa, BB-61 Exhibit

The Military Coatings Project Award of Excellence honors exceptional coatings work performed on U.S. military ships, structures, or facilities.

The third-ever recipient of the award is the (EX) USS Iowa, an 887-foot-long World War II-era battleship that is now an exhibit at the Pacific Battleship Center. Approximately 133,000 square feet of superstructure were water-blasted and recoated with two-component, marine-style epoxies and a single-component acrylic polysiloxane finish.

This project presented several key challenges. Previously, the ship had received little to no maintenance for over 20 years. In addition, contractors needed to work in a compressed schedule to meet a firm deadline for towing the ship to its docking point. Due to environmental concerns, contractors performed all work with the ship in water. The complex superstructure of the historic ship also required use of extensive scaffolding to finish the job.

• Location: San Pedro, CA
• Structure Owner: Pacific Battleship Center
• Contractor/Applicator: Bay Ship & Yacht Co. (SSPC-QP 1)
• Coating Material Supplier: PPG
• Start Date: March 5, 2012
• Completion Date: May 19, 2012

Military Coatings Project Award of Excellence recipients Hector Trujillo and David Ashton, Bay Ship & Yacht Co.; and Julio Mojica, PPG Protective and Marine Coatings, Technical Service Representative.

Award ceremony photos courtesy of SSPC

Photos courtesy of Jeremy Bonelle, Pacific Battleship Center

Photos courtesy of Joel Harry, Brock Services LLC

GEORGE CAMPBELL AWARD

Trails Arch Bridge

Geroge Campbell Award recipients Doug Moore, Carboline Company; Kellin Ebert, El Paso Pipeline (Kinder Morgan); Tomas Franco, The Brock Group; Gonzalo Martinez, The Brock Group; Hunter McKeever, Pacific Gas & Electric Corp.; Don Porni, Pacific Gas & Electric Corp.; Paul Parslow, Pacific Gas & Electric Corp.

This year, three projects received the George Campbell Award, given for outstanding achievement in the completion of difficult or complex industrial or commercial coatings projects. Named in honor of the late George Campbell, founder of Campbell Painting Company in New York, the award recognizes owners and contractors who overcame issues such as extreme environmental conditions, strict time constraints, limited access or high-traffic areas, complex structural components, or coordination with multiple trades and subcontractors.

The 97-year-old Trails Arch Bridge, a former U.S. 66 route that now carries a natural gas pipeline over the Colorado River, required extensive rehabilitation and recoating, including a sizable amount of lead abatement. As a result, the project called for extra attention to environmental and safety concerns, as well as to quality and scheduling considerations.

Using a calcium-silicate abrasive additive to encapsulate the lead, the contractors removed over 150,000 square feet of lead-based paint on the bridge, yielding over 1 million pounds of non-hazardous waste that needed to be contained over the river. On some days, temperatures inside of the containment structure shot up to 130 F, necessitating carefully scheduling the workers to help protect them from overexposure to the heat.

Weight limitations on the bridge made constructing and maintaining over 1.3 million pounds of scaffolding access equipment a constant challenge, as well. Access to the bridge posed another issue, with contractors navigating backroads between Arizona and California to get to the site's only access point. With careful planning and execution, though, the contractors successfully completed the project in three phases.

- **Location: Spans Colorado River, connecting Topock, AZ and Needles, CA**
- **Structure Owner: El Paso Pipeline (Kinder Morgan) / Pacific Gas & Electric Corp.**
- **Contractor/Applicator: Brock Services, LLC (SSPC-QP 1 and -QP 2)**
- **Coating Material Supplier: Carboline Company**
- **Abrasive Additive Material Supplier: Blastox (TDJ Group)**
- **Start Date: November 2011**
- **Completion Date: September 2012**

Photos courtesy of BC Pavilion Corporation

GEORGE CAMPBELL AWARD

BC Place

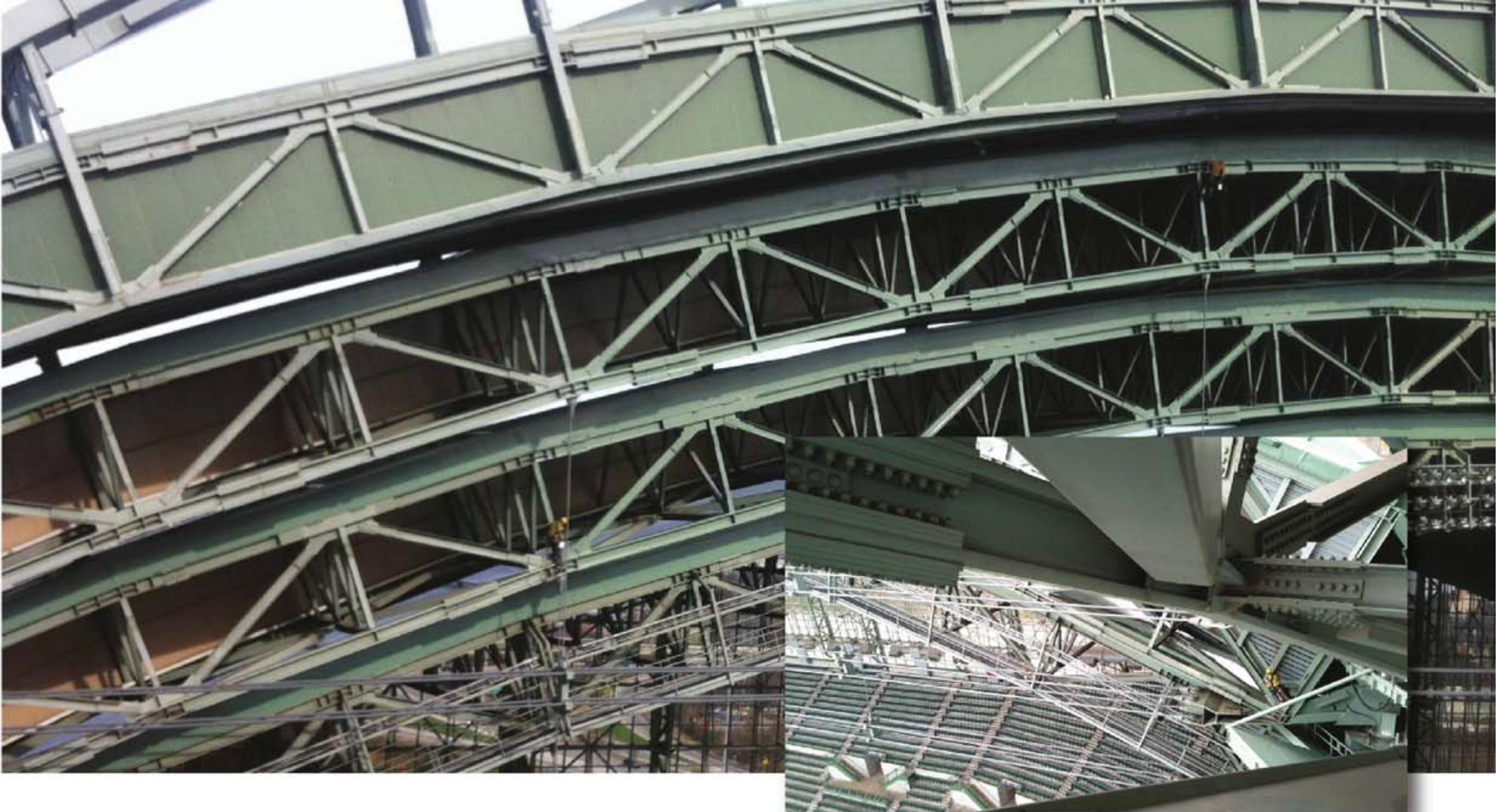
BC Place, one of Canada's most well-known sporting venues, needed some coatings help during a recent facelift. This 30-year-old, 59,841-seat stadium hosted the opening and closing ceremonies of the 2010 Vancouver Winter Olympics. The stadium closed after the Olympics in 2010 for a round of major renovations and reopened in 2011 with a new cable-supported retractable roof, making it the world's largest stadium of its kind.

Certified Coating Specialists, Inc. provided NACE-certified inspection and repair services throughout the last renovation of BC Place. CCS oversaw the installation of new shop-coated steel items on the new roof and throughout the stadium. After installation and inspection, CCS workers performed necessary repairs, including hand- and power-tool cleaning spots to Bare Metal (SSPC-SP 11) and recoating the steel with various epoxy systems.

Many of the repairs took place at heights of over 300 feet, so the contractors made use of rope access techniques, swing stages, and specially designed access platforms during construction. Workers also received extensive fall prevention and rope access training. This attention to detail, especially with regard to safety, helped the contractors meet a tight deadline with no lost-time accidents over the nine-month duration of the project.

- **Location: Vancouver, BC, Canada**
- **Structure Owner: BC Pavilion Corporation**
- **Contractor/Applicator: Certified Coating Specialists, Inc.**
- **Coating Material Supplier: AkzoNobel**
- **Start Date: April 4, 2011**
- **Completion Date: December 20, 2011**

SSPC President Steve Collins presents the George Campbell Award to Cliff Harper, Certified Coating Specialists, Inc.; Brian Griffin, BC Pavilion Corp.; and Dr. Mike O'Donoghue, International Paint, LLC.



GEORGE CAMPBELL AWARD

Miller Park Stadium

Photos courtesy of BASE Group

Constructed in 2001, this 42,200-seat stadium serves as the home of Major League Baseball's Milwaukee Brewers. The project involved cleaning and recoating select steel trusses and metal ceiling panels on the underside of the stadium's retractable roof, roughly 270 feet above the playing field surface. Specifications called for abrasive blast-cleaning, hand and power-tool cleaning, and recoating the steel with moisture-cured urethane systems.

Several factors made this a complicated and challenging project. The extreme height and difficult access of the roof surfaces being painted required contractors to employ various rope access techniques. The contractors carefully crafted a plan with the owners to avoid the cost and inconvenience of traditional access equipment. The contractors' use of low-impact rope access negated the need for swing staging.

Additionally, the short period between the end of the baseball season in September or October and the cold, non-paint-friendly Wisconsin winter made for a very tight time frame for completion. Also, when the roof opened or closed, the trusses being painted moved hundreds of feet in midair, forcing the contractors to coordinate work accordingly. Thanks to conscientious planning and hard work, however, the newly painted roof was up and running for the Brewers' next season.

- **Location: Milwaukee, WI**
- **Structure Owner: Southeast Wisconsin Professional Baseball District / Milwaukee Brewers**
- **Contractor/Applicator: BASE Group**
- **Coating Material Supplier: The Sherwin-Williams Company**
- **Start Date: October 2011**
- **Completion Date: November 2011**

SSPC President Steve Collins presents the George Campbell Award to Rich Purnell, BASE Group; and Sid Oakes, The Sherwin-Williams Company.

Hollywood, FL Water Tank

The William Johnson Award represents outstanding achievement in aesthetic merit in industrial or commercial coatings projects. The award's namesake is the late William Johnson, a former consultant with KTA-Tator, Inc., whose work in coatings formulation, failure analysis, and surface preparation paved the way for future advances in the coatings industry. SSPC presented William Johnson Awards for two projects at this year's awards ceremony.

This 1 MG elevated tank in Hollywood, FL, features a colorful ocean scene mural, complete with loggerhead sea turtles and fish. Tanks like these, with such intricate, artful designs, naturally require more attention to detail than your standard water tank rehab project.

For this tank, the contractors Brush-Off blast-cleaned (SSPC-SP 7) and recoated the exterior surfaces with an epoxy primer, an aliphatic acrylic polyurethane intermediate, and a fluoropolymer finish, before repainting the tank mural with a two-coat fluoropolymer system. The final design used 19 different colors of paint, from tank white to different blues, greens, and browns. The fluoropolymer system is expected to keep the mural looking like new and protected from the harsh Florida coastal environment for years to come.

- **Location: Hollywood, FL**
- **Structure Owner: City of Hollywood, FL**
- **Contractor/Applicator: Utility Service Co., Inc.**
- **Coating Material Supplier: Tnemec Company, Inc.**
- **Tnemec Representative: Florida Protective Coating Consultants**
- **Mural/Lettering Painter: Jim Kelly, Industrial Commercial Signs**
- **Design Consultant: Team Consulting, LLC**
- **Start Date: Spring 2011**
- **Completion Date: Spring 2011**

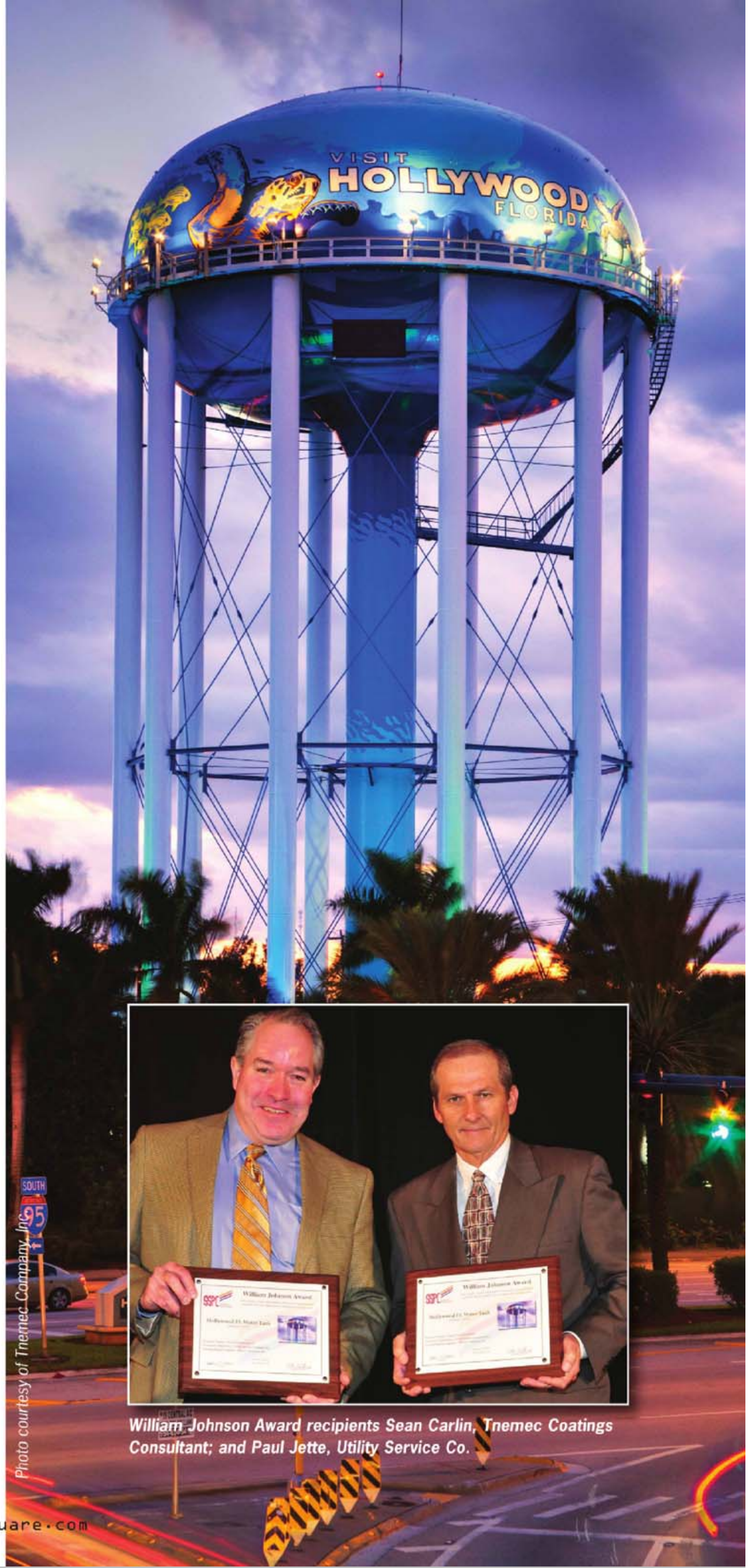


Photo courtesy of Tnemec Company, Inc.

William Johnson Award recipients Sean Carlin, Tnemec Coatings Consultant; and Paul Jette, Utility Service Co.

The Earthoid Water Tank

Another tank project garnering recognition at this year's awards ceremony is the repainting of the Earthoid tank on the campus of Montgomery College in Germantown, MD. Constructed in 1980, this 2 MG, 100-foot-tall spheroid storage tank was painted by famed muralist Peter Freudenberg to resemble an astronaut's view of earth from space, even complete with a cloudy ozone layer.

Horizon Bros. Painting Company assisted the tank's owners in performing periodic evaluations of the tank's previous coatings system and in recommending a suitable coatings system. Based on the contractor's recommendations, the interior of the tank was cleaned and relined with an epoxy system, while the exterior was fully blasted inside containment and recoated. The newly painted tank remains both an aesthetically pleasing civic landmark and a thriving example of functional art.

- **Location: Montgomery College, Germantown, MD**
- **Structure Owner: Washington Suburban Sanitary Commission**
- **Contractor/Applicator: Horizon Bros. Painting Co.**
- **Coatings Consultant: Tank Industry Consultants, Inc.**
- **Coating Material Supplier: The Sherwin-Williams Company**
- **Muralist: Eric Henn, Eric Henn Murals**
- **Start Date: June 6, 2011**
- **Completion Date: December 5, 2011**

Photos courtesy of Tracy Holmes, Washington Suburban Sanitary Commission

William Johnson Award recipients Gregory R. "Chip" Stein, Tank Industry Consultants, Inc.; Tracy Holmes, Washington Suburban Sanitary Commission; Brian Monczka, Horizon Brothers Painting; and Kevin Morris, The Sherwin-Williams Company.

Photos courtesy of Muehlhan A/S

E. Crone Knoy Award recipients Vandad Pachai, Muehlhan A/S; Mark Mason, Hempel A/S.

E. CRONE KNOY AWARD

Wind Tower Segments

Sometimes it's not just the structure being recoated, but also the recoating process itself, that makes a project stand out. The E. Crone Knoy Award, named after the late founder and president of Tank Industry Consultants, Inc., recognizes outstanding achievement in industrial or commercial coatings work that demonstrates innovation, durability, or utility.

One of this year's two recipients, a project out of Give, Denmark, involved shop-coating interior and exterior surfaces of onshore and offshore steel wind tower sections with new fully-automated robotic coating devices. These devices coated the steel with a multi-layered, high-level corrosion protection system.

This new highly-industrialized coating process has several key economic and environmental benefits. It resulted in a reduction of paint consumption of up to 25%, as well as a reduction in harmful VOC emissions of up to 25%. In addition, coating thickness distribution improved, with a reduction in the standard deviation of DFT distributions of up to 50%. While robots certainly won't be replacing all human workers, advances in technology like this can help owners and contractors complete projects more efficiently and with less harm to the environment.

- **Location: Give, Denmark**
- **Structure Owner: Welcon A/S**
- **Contractor/Applicator: Muehlhan A/S**
- **Coating Material Supplier: Hempel A/S**
- **Start Date: August 2011**
- **Completion Date: May 2012**

E. Crone Knoy Award recipients Larry Getz, The Sherwin-Williams Company; Byron Beamer, Sika Corp.; Mark Jelinek, The Sherwin-Williams Company; Eric Hanson, Nestle Nutrition; Billy Myers, Coatings Unlimited, Inc.; Steve Philipp, Jr. Coatings Unlimited, Inc.; Steve Philipp, Sr. Coatings Unlimited, Inc.

Photos courtesy of Billy Myers, Coatings Unlimited, Inc.

E. CRONE KNOY AWARD

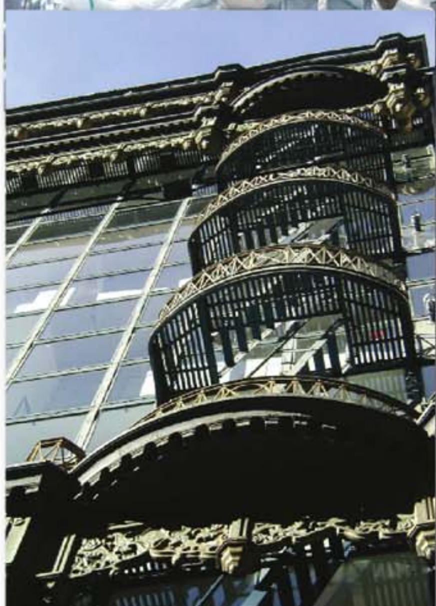
Nestle Plant Expansion

When Nestle Nutrition announced plans for an $89.9 million expansion project at its Gerber facility in Fort Smith, AR, Coatings Unlimited, Inc., was brought in to handle the coatings work of the project. The contractors installed new FDA-compliant protective coatings for concrete walls, floors, and ceilings throughout the expanded, state-of-the-art 900,000-square-foot facility.

Approximately 30 highly experienced coatings applicators profiled and resurfaced over 170,000 square feet of concrete surfaces, hand-trowelling over 70,000 square feet of process flooring, and using more than 12,500 bags of epoxy concrete repair materials. In total, contractors went through more than 200 tons of abrasive and 11,000 gallons of coating materials.

To meet the strict specifications regarding concrete moisture and relative humidity, contractors made use of hot and cold dehumidification equipment. With outside temperatures ranging from below 30 F in the winter to above 100 F in the summer, and without a working HVAC system in the building, the contractors also made efforts to maintain surface temperatures between 50 F and 80 F throughout the project. These measures paid off, with over 42,000 incident-free worker-hours logged in the end.

- **Location: Fort Smith, AR**
- **Structure Owner: Nestle**
- **Contractor/Applicator: Coatings Unlimited, Inc. (SSPC-QP 1 and -QP 2)**
- **Coating Material Supplier: The Sherwin-Williams Company**
- **Concrete Repair Material Supplier: Sika**
- **Start Date: November 15, 2011**
- **Completion Date: November 30, 2011**



Charles G. Munger Award recipients Sean Carlin, Tnemec Coatings Consultant; Greg Jeffress, ABC Painting; and Annie K. Lo, McGinnis Chen Associates, Inc.

CHARLES G. MUNGER AWARD

Hallidie Building

The winner of this year's Charles G. Munger award for longevity is the Hallidie Building project out of San Francisco, CA.

This award, named after the late Charles Munger, honors an outstanding industrial or commercial coatings project that demonstrates the long service life of the original coating. The structure may have had spot repairs or overcoating with the original coating still intact.

This year's winning project, a curtain wall remediation project, took place at the Hallidie Building, the country's second building to feature a glass curtain wall. Designed by architect William Polk and constructed through 1917 and finished in 1918, the building is listed on the U.S. National Register of Historic Places.

While the building only took two years to construct, recent restoration work took over twelve years to complete the intricate detailing that this project entailed, including repainting of the decorative gold building trim and other surfaces. Contractors cleaned select building surfaces to the SSPC standards specified and recoated the surfaces with an organic zinc-rich primer, an aliphatic urethane intermediate, and a fluoropolymer finish. With new coatings, this historic gem of a building will remain a treasure in the middle of a modern, ever-changing city.

- **Location: San Francisco, CA**
- **Structure Owner: Edward J. Conner and Herbert P. McLaughin, Jr.**
- **Owners' Representative: The Albert Group, LLC**
- **Contractor/Applicator: Abrasive Blasting & Coating, Inc.**
- **Coating Material Supplier: Tnemec Company, Inc.**
- **Consultant Architect: McGinnis Chen Associates, Inc.**
- **Constructor: Cannon Constructors North, Inc.**
- **Engineers: Murphy Burr Curry, Inc., Toft, de Nevers & Lee**
- **Historic Preservation Architect: Page & Turnbull**
- **Start Date: Spring 2012**
- **Completion Date: November 2012**

By Warren Brand, Chicago Coatings Group

Coating Concerns for

Typical tank farm
All figures courtesy of CB&I

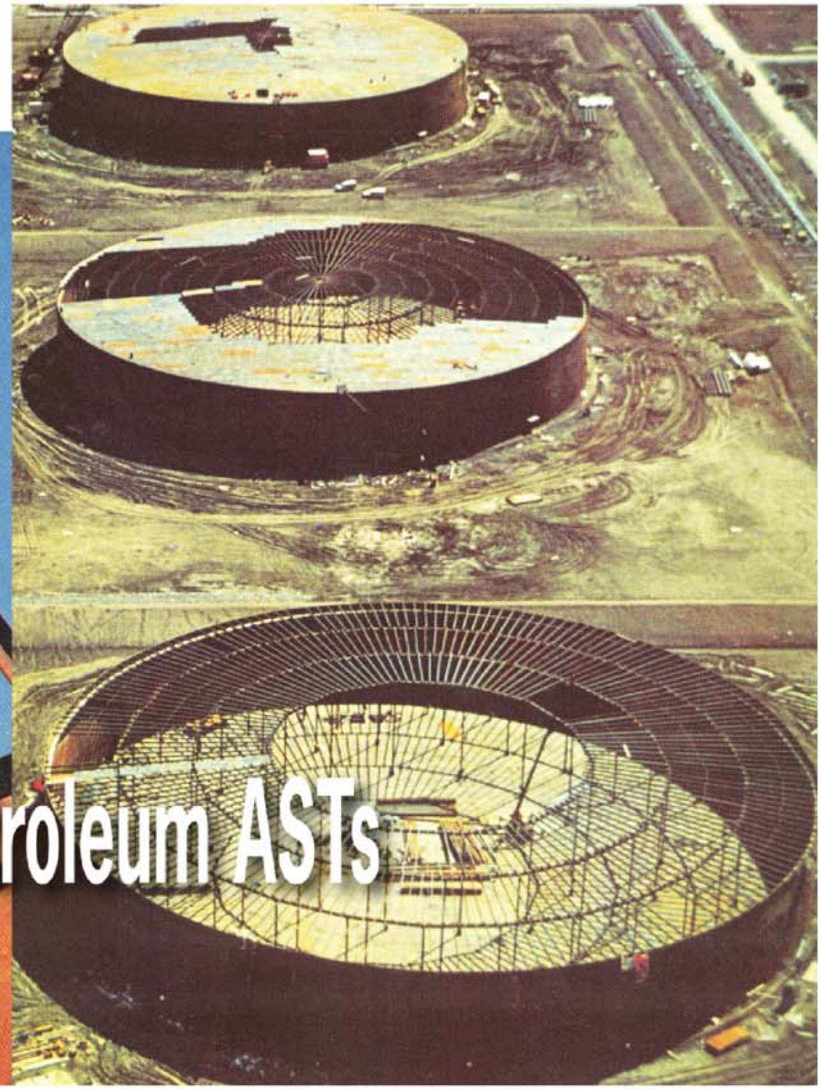
There are many different designs of aboveground storage tanks (ASTs), particularly in chemical and petrochemical facilities. In fact, listing all of the different types, sizes, composition, and functionalities would fill a small book. And these tanks typically call for coating work. But are coating concerns considered during the design process? This article will address the question.

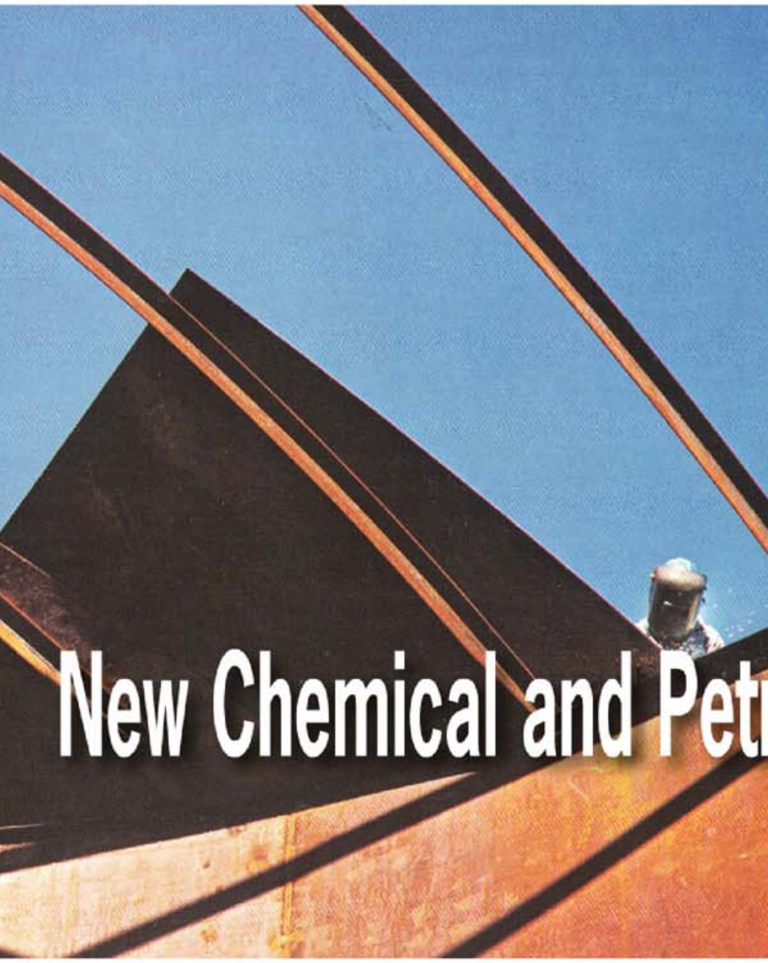
Process tanks simply have too many design parameters to address in a single article. Parameters can vary because of the wide range of storage needs, from products stored at ambient temperatures and under no pressure to products stored at pressure, at elevated or reduced temperatures, under agitation, and under many other conditions.

So, for the purposes of this article, we are going to focus specifically on design issues and coating considerations for field-erected ASTs that are not insulated and are used for bulk storage. In particular, we will look at two basic types of welds in ASTs and coatings issues related to the welds.

To avoid complicating the article with issues pertaining to the cold wall effect, we will not address insulated tanks. Further, we will also avoid issues pertaining to corrosion under insulation (CUI). We'll save those topics for another day.

Fig. 1 (Right): Column-supported cone roofs under construction
Inset (Below): Detail of column-supported cone roof





New Chemical and Petroleum ASTs

Field-Erected ASTs: The Basics

ASTs vary in size and dimensions. They can, for example, be 25 feet in diameter and 15 feet tall with a capacity of approximately 55,000 gallons, or 250 feet in diameter and 48 feet tall with a capacity of more than 17 million gallons.

By "field-erected tanks," we mean those that are too large to fabricate in a shop and ship to a facility, as well as those that are intended for areas where shop fabrication and shipping are not economically feasible. For example, picture for a moment that a section of Los Angeles was shut down for more than two days while moving the space shuttle Endeavor over 12 miles of streets and highways, from Los Angeles International Airport to the shuttle's new home at the LA Science Center. The shuttle is approximately 122 feet long and 78 feet

Fig. 2: Hand welding

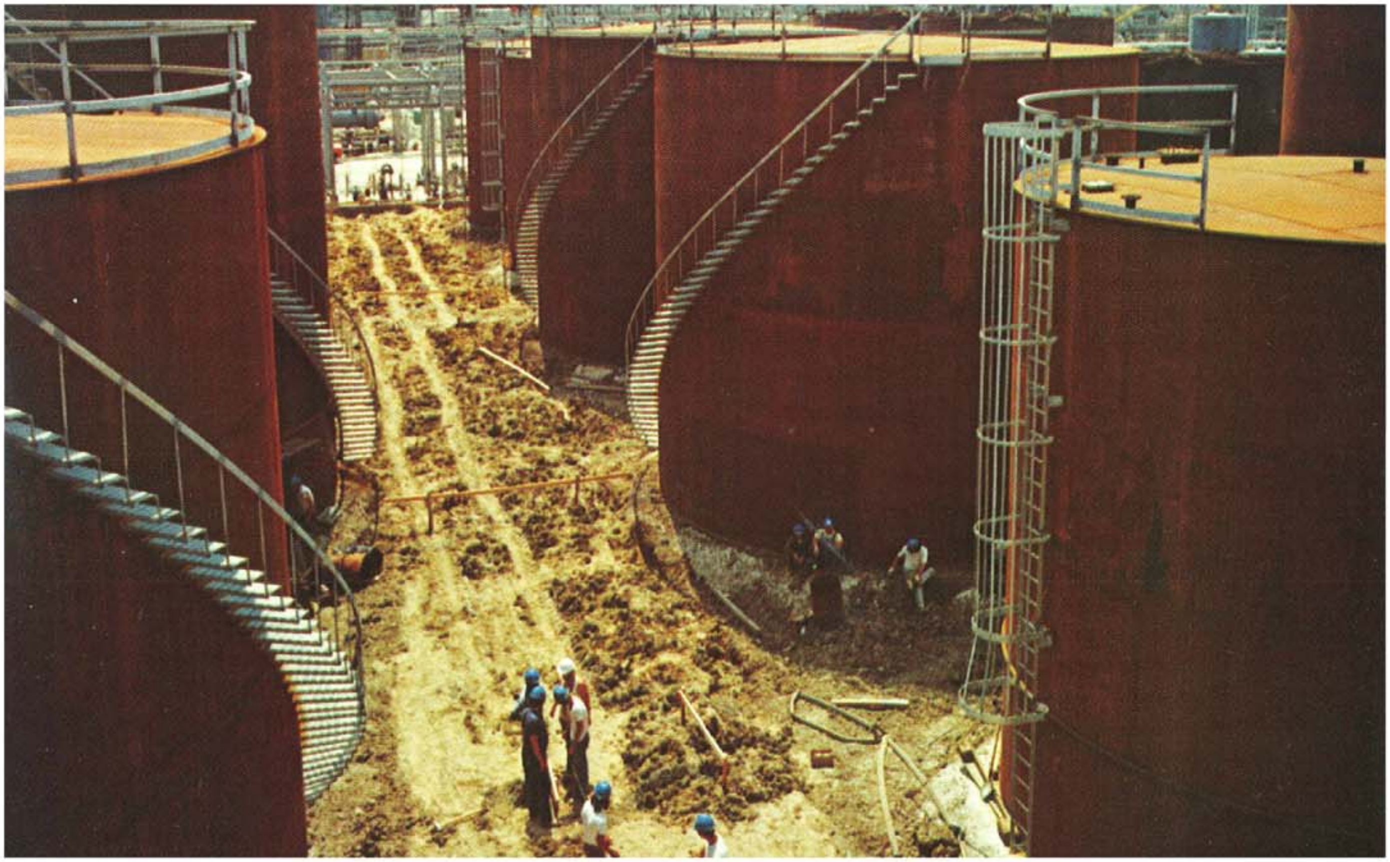


Fig. 3: Tank farm before painting. Often, coatings are not considered until the tanks have been designed.

wide, and two space shuttles easily fit in some of the larger ASTs. So shipping tanks can become problematic.

ASTs can have floating roofs (steel pan, pontoon, etc.), domed roofs, umbrella roofs, and other roof designs (Fig. 1). Regardless of the roof type, they are made predominantly from carbon steel, which is particularly prone to corrosion, compared to more noble types of materials such as stainless steel or other alloys. The use of more noble alloys, as you can imagine, is generally cost prohibitive for ASTs. So to protect carbon steel ASTs from corrosion, coatings are typically used.

Fig. 4: Butt weld seam grinding

The general anatomy of a field-erected tank is relatively simple. The tank is highly engineered, specifically designed, and pieced together like a behemoth jigsaw puzzle in the field, with welds holding everything together (Fig. 2, p. 33).

Tank Design and Coatings: The Big Picture

Conceptually, we must first understand that from a coating perspective, the coating doesn't know if it's being applied to one square inch of steel or 100,000 square feet of steel. In the vast majority of cases, more than 97% of any AST is flat or curved plates of steel. Coating flat or curved steel is not typically the problem. The problem, from the perspective of coating the tank, generally comes into play with the remaining percentage of the steel tank—welds, angles, support columns, and other appurtenances. Welds are particularly troublesome and are hence our focus.

For our purposes, we will focus broadly on the two fundamental types of welding processes (and welds) used during construction of a field-erected AST: butt welding and lap welding. Within these two basic types of weld processes and welds are numerous subsets, such as double butt welds, vee groove welds, double-vee groove welds, single butt welds, fillet welds, double and single welds, and girth welds.

Fig. 5: Non-sealed lap weld at roof support showing problems resulting from open (non-sealed) side

Organizations such as NACE, API, ANSI, and AWWA publish documents that discuss the types of welds and their characteristics. But there appears to be a fundamental gap between the guidelines and coating considerations.

That is, the folks who design and build

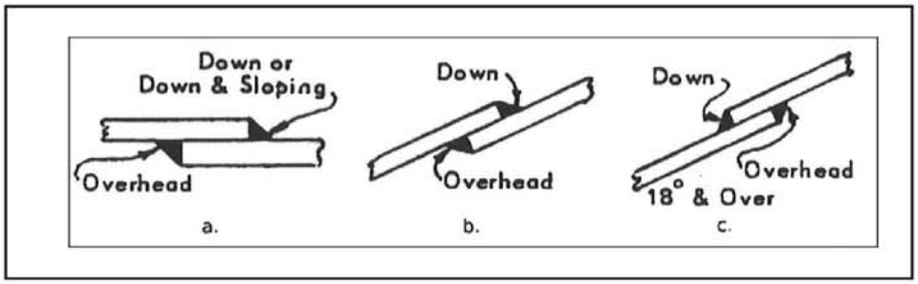


Fig. 6: Typical detail for a lap weld, welded on both sides

the tanks follow very specific guidelines for tank volume, structural integrity, ability to withstand various winds, and other structural considerations. However, frequently absent from the design considerations are coating considerations. For the most part, the designers and builders of the tank rely on others for coating information.

At some point—usually after the tank has been designed or is under construction—the engineering firm, a coating consultant, or a coating manufacturer is asked to recommend a coating system (Fig. 3, p. 34).

An RFQ for coating application is produced, and bids are obtained. A good specification will, of course, have detailed guidelines and relevant NACE (RP0178-95) and SSPC references on how to prepare the welds to be coated.

So, the tank is built, and the coating contractor installs the coating system.

But herein lies the rub. In countless cases, coating contractors have spent significant amounts of time and money addressing welds—grinding them, smoothing them, removing weld spatter, and stripe coating them.

The good news is that, assuming that appropriate QA/QC protocols were followed during the erection of the tank and subsequent coating, the facility owner ends up with a well-designed asset that is properly protected against corrosion.

The bad news may be, however, that for lack of simple communication, the owner may have overpaid. Our research and experience indicate that a bit more communication between the tank builder and the coating specifier may lead to significant savings in cost and time.

But we'll say more about that later.

A Closer Look at Building the Tank and the Problems with Welds

For now, let's get back to the guidelines for building an AST and the problems with welds. At this point, we are going to concern ourselves only with the broader terms of butt and lap welding.

Butt welding is taking two pieces of steel, placing them edge to edge, and welding them together (Fig. 4, p. 37). Lap welding, which is typically faster and less costly, takes one piece of steel and places it on top of the other piece of steel, with an overlap of, say, 2 inches; then, the two pieces are welded on top of each other. Lap welds must be welded on one side, of course, but, depending on the specification, can be welded on both. While both welds have issues pertaining to coatings, lap welds, as we will discuss later, can pose very serious issues for long-term corrosion protection (Figs. 5 and 6).

It is at the juncture of these two technical issues, technical design of the tank, including its welds, and coating surface prepara-

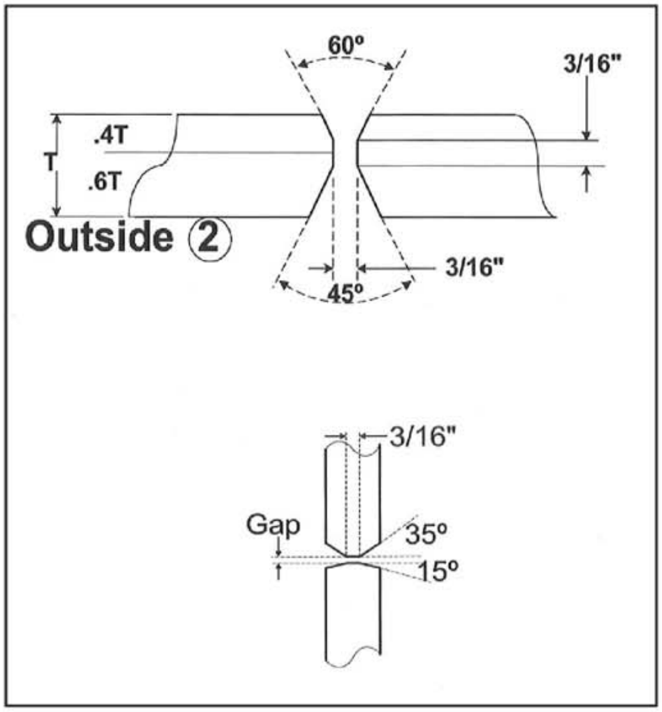


Fig. 7: Typical detail for full fusion (two-sided) butt weld, done properly

tion requirements for the welds, that we first see a possible disconnect between tank design and coating considerations, particularly, for the purpose of this article, coating the tank for corrosion protection.

Let's go through the process of how an AST tank is conceived. A company, let's call it, Acme, is fortunate in these hard times to require additional storage capacity. Design and process engineers of the owner typically will meet to determine the required storage capacity.

The next steps are to develop an RFQ, submit it to various tank erectors or engineering firms, and look for the lowest bid.

At some point in the process, either Acme or the bidding firm comes up with specifications for building the tank. The specifications, at this point, are concerned only with structural issues. All parties want to ensure that the tank is structurally sound to hold the enormous weight and volume of the stored fluids, and can also withstand environmental stresses, such as wind, rain, and snow. The parties involved will determine factors such as the type of roof, the types of welds, and the location and number of manways and vents.

In most cases, these specifications are blind to coating considerations. It is highly unusual during the design and fabrication process for anyone to ask a question such as: "Hey, should we reconsider the types of welds we're using here because we know the tank is going to be coated once it is erected?"

And because such questions are typically not asked, coating concerns are left out of the initial design-build phase.

The owner, fabricator and engineering firm are, again, concerned and incentivized to deliver in two fundamental ways: quality and price. And, the unspoken mantra within the industry is: "If it's not in the spec, it doesn't get done."

And this mantra brings us back to the troublesome lap weld. If a lap weld meets the required design specifications, and is considerably less costly to use than any other weld, that's what will be used.

For a moment, let's take a look at the anatomy of a lap weld. First, there are two general types, a single fillet and double fillet.

From a coatings perspective, overcoating a lap weld, particularly when using a thin-film coating system, say, less than 12 mils, is problematic because the weld is somewhat of a cross between a right angle (requiring stripe coating or edge-retention coatings) and a flat piece of steel. This design requires more work from the coating installer (Fig. 6, p. 48).

Butt welds, on the other hand, if specified properly, can be made almost perfectly smooth, requiring, in many cases, no additional attention from the coating installer other than perhaps a stripe coat (Figs. 7 and 8). Of course, a butt weld is more costly.

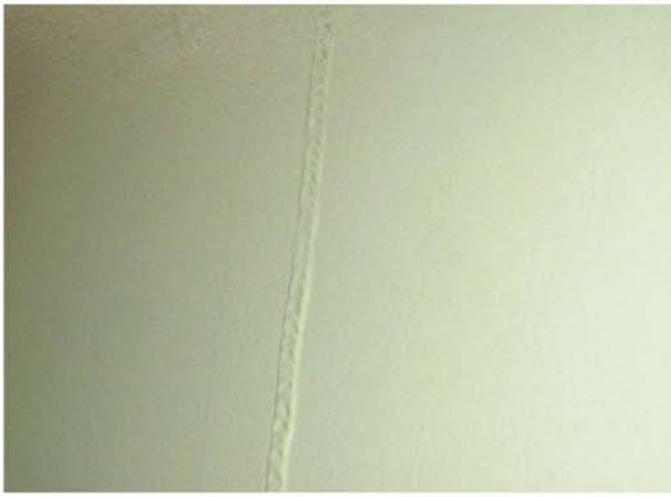


Fig. 8: Coated vertical hand-welded seal seam of butt weld

Full fusion butt welds are primarily used for the body of the tank (straight walls), but the roof and floor of the tanks are typically pieced together with lap welds. Of particular concern from a coating perspective is the roof, which has the "open" side of the lap weld on the tank interior (Fig. 9). The floor of the tank has the "open" side on the tank bottom, which may present other issues due to bottom-side corrosion (underneath the tank), but bottom-side corrosion is also beyond the scope of this article.

The open side of a lap weld can be highly problematic from a coatings perspective. The open side will, by definition, present a gap, and that gap can vary in size.

In many petroleum tanks, it is customary to apply coatings to the bottom and several feet up the walls. This practice is common because many petroleum products are not corrosive and, in fact, protect the steel from corrosion. The bottom areas are frequently coated to protect against water precipitating out of the product and ending up in the bottom of the tank. In some crude oils and other products, sulfur may be present and, over time, could precipitate into dilute sulfuric acid at the tank bottom. Potential exposure to sulfuric acid, of course, would require the correct coating identification and specification to resist acid attack.

Coating systems on tank bottoms can be fundamentally different from the coating systems on the straight wall or ceiling, due to the oil-canning effect, the tendency of the tank bottom to flex downward under pressure. When a large tank is filled with tons of fluid, it is not uncommon for the bottom to flex downward because of all of the weight of the material. For example, it is possible that with a 250-foot-diameter tank, the tank bottom may deflect in the center dramatically during filling and emptying, thus requiring a coating system designed for significant movement. Alternatively or concurrently, coatings on tank bottoms can differ from those for the walls or ceiling because of a desire to protect against bottom-side corrosion.

Fig. 9: Inside view of open side of lap weld. Rust is coming from the open side of the weld, which is difficult to protect with coatings.

Tank bottoms are routinely coated with epoxy coating systems, with or without fiberglass reinforcement.

In the open areas of lap welds confined to the roof of ASTs, corrosion may be less of a concern, depending on the product being stored in the tank and its environment. Further, virtually all coating manufacturers have a mastic, putty, or some other material/specification to address the issue of sealing open and exposed seams.

There are, however, two fundamental issues pertaining to lap welds exposed in the tank interior. First, if the tank is ever going to change service and require complete internal coating, it may be very costly and difficult to coat the entire interior because the product stored in the tank would have likely penetrated the open space of the lap weld. Second, even if the liquid level never reaches the top of the tank, vapors, humidity, and other contaminants can enter into the space, causing coating difficulties. Removing this residue would be required, and, depending on the product, might be very difficult and costly to accomplish.

However, there doesn't appear to be anyone in the manufacturing and design process conducting a cost benefit analysis of comparing the costs of modifying the welding protocols to accommodate a subsequent coating installation.

That is, is it less costly during tank erection to provide butt welds to NACE Weld Preparation Standard A, or is it less costly for a tank erector to leave the weld modification to the coating contractor? In simplest terms, is it less costly to have the erector remove weld spatter (or, if possible, prevent it in the first place), or is it less costly for the coating contractor to do it?

For example, in a large tank, there can be a lot of welds. The average sheet of plate steel measures 8 feet x 8 feet. Therefore, in a tank measuring 250 feet in diameter, there will be roughly 4,000 linear feet of welding. If the tank is erected and the welds require modification by the coating contractor before coating application, the costs could be considerable. For instance, if the welds require grinding, removal of weld spatter, and filling with mastic, those are all additional costs that, perhaps, could have been mitigated by communication between the coating specifier and fabricator.

So if it takes a coating applicator two man-hours for every 10 linear feet of weld requiring modification and the cost per man hour is $65.00 per hour, that is an additional cost of $52,000.00, not including material, scaffolding or costs of delays.

We've just briefly touched upon our concerns about internal corrosion associated with welds and coatings. We have not talked about welds and external corrosion or welds and bottom-side corrosion. While we are leaving these topics for other articles, there are a couple of points about them to keep in mind, as long as we are on the subject of welds.

Many designers and professionals are less concerned with external corrosion issues because the outside of the tank is readily accessible. If there are failures or other coating deficiencies, they are typically apparent to the naked eye (unless, of course, the tank is insulated).

Further, the coating concerns for the outside of the tank typically receive less attention than those for the inside because it is understood within the industry that the welds and general appearance of the tank exterior need to have some aesthetic appeal, whereas the inside does not. So, even if we're dealing with single fillet lap welds, the weld will be on the tank exterior, leaving the "open" side of the weld on the interior.

But what about that tank bottom and bottom-side corrosion concerns? In many cases, owners will leave the underlying bottom uncoated and opt for laying down a bed of material that is naturally non-corrosive and/or use cathodic protection. Some companies have also taken to installing double-walled tank bottoms (and in some cases, retrofitting older tanks to have double walls). A double-walled tank bottom allows for monitoring the interstice, which will provide an indication of through-corrosion and leakage, but does nothing to effect or engender corrosion protection. Moreover, the double wall requires welding, which in turn creates additional corrosion concerns.

Closing Thoughts

There are numerous other types of welds, fittings, nozzles, columns, beams, and other appurtenances within the various types of ASTs. There are coating specifications associated with these, and we chose to focus on welding for two reasons.

1. It is endemic to all non-bolted ASTs.
2. It is an area that designers and erectors have some control over.

At the end of the day, there needs to be a connection or some communication among the owner, the tank builder and coating specifier. Some questions that need to be answered are the following.

1. Is there a chance that the service of the tank will change? If so, it may be advantageous to consider double fillet lap welds throughout the tank roof.
2. What is the product to be stored? If a tank is storing oil and the service will never change, then single fillet lap wells may be sufficient. Further, perhaps it would be more cost effective for the welder, not the coating contractor, to properly prepare the welds on the bottom and 3 feet up the side walls to reduce the costs of coating application and of putting the tank in service.

It appears that the typical manner in which an AST is built is driven, first and foremost, by capacity and cost. But it doesn't appear that coating cost is typically included in the pricing matrix.

In fact, it may be more cost effective to identify the appropriate coating after the capacity and type of tank is determined. Then, the coating professional (manufacturer, installer, consultant, etc.) and tank designer could discuss and determine the best types of welds to use and the most efficient means for finishing the welds for coating application, thus reducing the overall cost to the client.

Acknowledgment

The author would like to acknowledge the invaluable assistance of Ken Jacobi of CB&I in reviewing the article, offering insights, and providing illustrations for it.

Warren Brand is the founder of Chicago Coatings Group, LLC, a consulting firm he formed in 2012. Before opening his consultancy, Brand was the president of Chicago Tank Linings. He has more than 25 years of

experience as a coatings contractor, is an SSPC-certified Protective Coatings Specialist and a NACE-certified Level 3 coatings inspector, and holds an MBA and a BA in Journalism. JPCL

Fluoropolymers for High-Performance Applications

By Bob Parker, AGC Chemicals Americas

Fluoropolymer on the Tsurumi Tsubasa Bridge over Yokohama Bay in Japan.

This article is the second in *JPCL*'s 2013 series on generic coating types.

The Akashi-Kaikyo Bridge has fluoropolymer protection against the aggressive environment of Japan's Akashi Strait.
Photos courtesy of AGC Chemicals Americas

In the increasingly complex world of protective finishes, fluoropolymer-based coatings have gained a respectable position in today's marketplace. Originally restricted to OEM applications, this family of fluorine-rich hydrocarbons has expanded to include coatings that can be applied in the field as single-component coatings and as catalyzed finishes. The common thread of their performance is their resistance to degradation caused by the ultraviolet (UV) rays of the sun. This article describes the two most popular fluoropolymer resin technologies, which are the backbone of fluoropolymer coatings, and explains their role in the protective coatings field.

PVdF Resin Technology

The first family of fluorinated resins is the polyvinylidene fluoride (or PVdF) products. Introduced to the marketplace in 1960, PVdF resins originally were targeted for applications where the PVdF exceptional resistance to chemical degradation would be put to the test. The basic chemical structure is shown in Fig. 1.

The PVdF resin is a long, repetitive chain of the structure in Fig. 1 and is known as a thermoplastic polymer or resin. This type of polymer can best be described as one that becomes flexible as its temperature increases and returns to its rigid state as the temperature cools. This behavior is in contrast to that of thermosetting polymers, which will change their chemical structure when exposed to higher temperatures and maintain a greater level of rigidity that did not exist before their exposure to heat.

These fluorinated systems are still

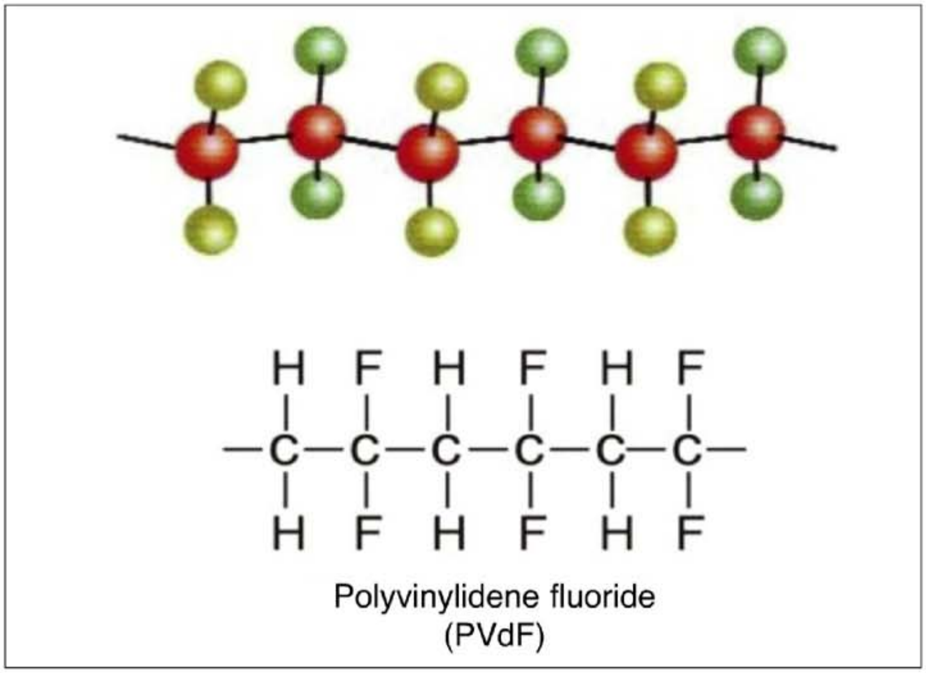


Fig. 1: Structure of Polyvinylidene fluoride

predominantly used as factory-applied finishes for aluminum and steel substrates. The number of exterior markets is quite extensive: door and window frames, curtain walls on commercial buildings, metal roofs and facades, skylights, and decorative railings. Coatings based on PVdF resins can also contain a certain level of acrylic polymers, which increases their adhesion to the metal substrates. The percentage of acrylic resin as part of the total resin system of the coating can be either 30% or 50%. At a 30% level of acrylic resin, PVdF systems will tolerate 10 years of exterior exposure in South Florida and will still pass a long list of performance criteria that is spelled out in AAMA 2605 (a specification written by the American Architectural Manufacturers Association). The 50% level of acrylic resin will reduce the performance, but will still survive 5 years of exterior South Florida exposure and meet the requirements of another AAMA specification, 2604.

PVdF resins have also been successfully emulsified in water and incorporated into single-component, ambient-cured formulations for a variety of markets. These PVdF emulsions behave quite similarly to conventional acrylic emulsions, with the resin particles forming a dry film by fusing together as the water evaporates from the coating. Coalescing solvents play a big part in these formulations, helping to soften the resin particles before they pack together and form a film.

Some of the markets that have introduced commercial water-based PVdF products are roof coatings, plastic siding finishes, wood composite decking finishes, and particularly consumer house paints. The performance properties that accompany a PVdF-containing coating are excellent weatherability and color fade resistance, dirt pickup resistance, and mildew resistance. Also, the level of VOC is less than 100 grams/liter.

The application methods for these systems are the same as those used for conventional water-based acrylic coatings. However, in markets such as roof coatings, the standard application methods need to be modified. Because the main intent of the PVdF roof coating is to provide a surface that will retain its color and reflectivity, thus extending the "cool roof" properties of the roof and reducing energy costs, the dry film thickness (DFT) of this coating need not be greater than 3 mils. The work of sealing the roof still relies on thicker acrylic basecoats applied before the PVdF topcoat.

FEVE Resin Technology

The second family of fluorinated resins is the fluoroethylene-vinyl ether (or FEVE) products. The basic chemical structure of the FEVE resin family is shown Fig. 2 (p. 48).

The long chain of alternating fluoropolymer segments (blue components) and vinyl ether segments (green components) is the backbone of every member of this family of resin prod-

UV resistance from a fluoropolymer coating on the roof of the Ferrari World Theme Park in Abu Dhabi, UAE.

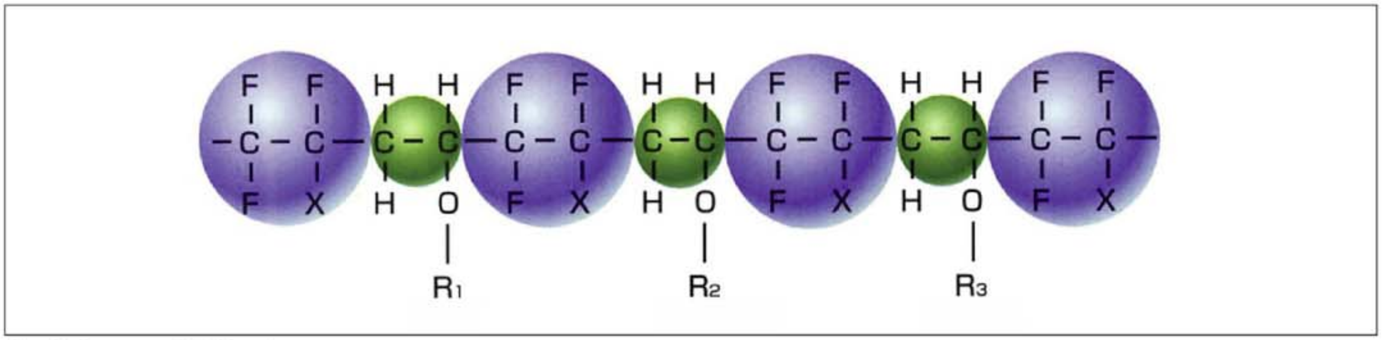


Fig. 2: Structure of FEVE resin components

ucts. The "R" groups that are pictured as side chains of this backbone will vary from resin to resin, depending on the desired properties of each product. It is the side chains that give coating-friendly properties like solvent solubility and compatibility with non-fluorinated resin components to the FEVE fluoropolymer resins.

The FEVE resin technology was first introduced to the coatings market in 1982. The first product came as a resin solution in a solvent carrier. Attached to its side chains were hydroxyl functional groups, which gave the FEVE the ability to be crosslinked with both amino resins and isocyanates. This property allowed the resin to be used in factory-applied, oven-cured finishes and in field-applied coatings. It was then possible to use fluoropolymer resin technology in protective coatings for metal and concrete structures that could be coated only after they had

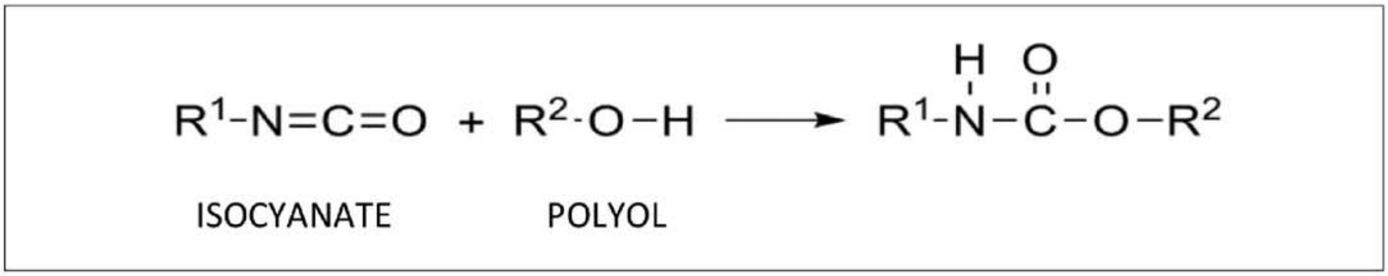


Fig. 3: Isocyanate-Polyol reaction

been erected on site. The field-applied coatings were two-component products, applied by methods identical to those used for the conventional polyurethanes in the industrial coating market at that time.

The simple reaction of an isocyanate and a fluorinated FEVE polyol is shown in Fig. 3.

The isocyanate resin typically has two or three reactive groups (-N=C=O) attached to each resin particle, which allows this resin to connect the hydroxyl groups (-O-H) of the polyol resin particles together to form a crosslinked matrix. The increase in molecular size of the cured polymer film gives the polyol the properties such as film toughness and water resistance, which are lacking when there is only a simple polyol resin particle in the liquid coating.

Since 1982, there have been numerous additions to the FEVE fluoropoly-

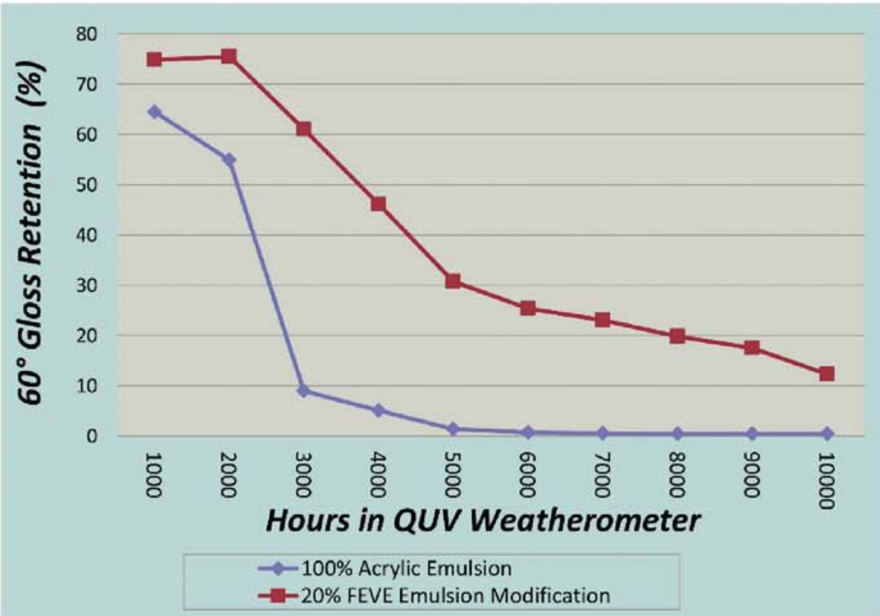


Fig. 4: QUV Weatherometer exposure of metal panels coated with Black DTM Coating; Light source is UVA-340 bulbs

mer line. In the group of FEVE resins sold as resin solutions, there are several different levels of hydroxyl functionality. Higher numbers of hydroxyl groups on the side chains will create higher crosslink densities in the cured film, which can improve properties such as solvent and chemical resistance. There are also solution resins with lower molecular weight that can produce coatings with a lower VOC content than earlier FEVE fluoropolymers. This modification has proven to be quite important because the VOC limits for industrial coatings continue to be reduced in several geographic areas of the USA. All of these resins can be blended with non-fluorinated coatings to improve the weatherability and chemical resistance of these non-fluorinated systems.

In addition to the solution resins, several solid flake FEVE resins have been added to the fluoropolymer line. This collection of raw materials can be broken down into two segments—resins for powder coatings and resins for coatings with low or no VOC content.

The FEVE powder coating resins are manufactured specifically for the architectural building component market. They can be utilized in formulations the same way as conventional (e.g., polyester) powder resins. The FEVE powder coating resins can be used as 100% of the polyol portion of the formulations, or they can be added as modifying resins.

The other flake resins are too soft to function in a powder coating formulation. They are simply 100% solids versions of FEVE solution resins. The benefit is the formulators' ability to choose the complete solvent system for their formulations, which can lower VOC levels to comply with local government regulations as needed.

Japan's new Tokyo Gate Bridge is protected with a system that includes a fluoropolymer topcoat.

In 1992, FEVE resin technology was incorporated into water-based emulsion products. This technology opened a new window for these hybrid fluoropolymers, which was the ability to form a protective film without the presence of a crosslinker. The molecular weight of the emulsion particles is high enough that the curing mechanism of an FEVE emulsion coating mimics that of a typical latex paint, which is the coalescing of the emulsion particles during the drying of the paint. The standard coalescing solvents used for latex paints will also be sufficient to soften the FEVE emulsion particles for proper film formation.

The markets for these FEVE emulsion coatings are many. The substrates include metal, plastic, masonry, and wood. Although these types of FEVE-based coatings do not have the degree of chemical and solvent resistance and hardness level of the two-component coatings, they still retain excellent weatherability properties. Also, the resins are perfect candidates for use as blending emulsions, with a wide variety of acrylic emulsions already tested for their degree of compatibility with the FEVE emulsions. Figure 4 (p. 50) shows a comparison of two typical water-based, direct- to-metal black formulations, one containing 100% acrylic resin and the other having a 20% modification of the binder with the FEVE emulsion:

One of the FEVE emulsions also has hydroxyl functionality included in its structure. The OH groups allow crosslinking with water-dispersible isocyanates, which will improve the hardness of the coating film and its degree of water resistance. The VOC levels of these water-based FEVE formulations will meet current state and federal regulations. Application methods for water-based FEVE coatings are similar to the application methods used with conventional water-based acrylic finishes.

A novel water-based FEVE resin, called an FEVE dispersion, was introduced to the marketplace in 2012. The product is manufactured by a different method than the FEVE emulsions.

Instead of a synthesized emulsion, the FEVE dispersion is actually a modified flake resin, which means that the dispersion has no additional chemical constituents in its structure. This change in chemical structure for the dispersion allows for improved properties in the coatings that are manufactured with this resin. The one difference that needs attention is the limitation of the FEVE dispersion resin for use only in two-component formulations. Its molecular size is too small to form an adequate film without crosslinking with either water-based isocyanates or amino resins.

The markets for coatings based on the FEVE dispersion are as large as those for the solvent-based FEVE coatings. The benefit of this type of coating is its decreased impact on the environment. FEVE dispersion coatings have a lower level of the hazardous characteristics compared to coatings containing solvents—namely, flammability, odor, and toxicity. Again, the application methods required for these types of coatings are the same methods currently in use for conventional two-component coatings.

Corrosion Resistance

As protective coatings, both PVdF and FEVE types play a role in the protection of metal substrates from corrosion. First and foremost, their ability to stay intact and resist degradation makes them superior to non-fluorinated coatings as topcoats in multiple coating systems on metal substrates. The barrier that they form on the surface of the metal structure will outlast other coatings by a factor of 4 to 5. One exposure test in a marine environment showed a surface erosion of only 0.2 mils after 16 years of exposure. One mil of an acrylic polyurethane finish, exposed at the same time, eroded away in 13 years. Secondly, the presence of fluorine atoms is a deterrent to water migration through the film. Less water migration means less corrosion.

Conclusion

It is evident that the future of protective coatings will include fluoropolymer chemistry and its diversified products. The ability of the resins present in these coatings to be used in combination with so many different raw materials and to fine-tune the properties of the coating to a specific level makes them a versatile addition to every formulator's tool box. Newer fluoropolymer technologies are still being pursued at the development level. It will be important to keep an eye on what this technology can do to improve protective coatings down the road.

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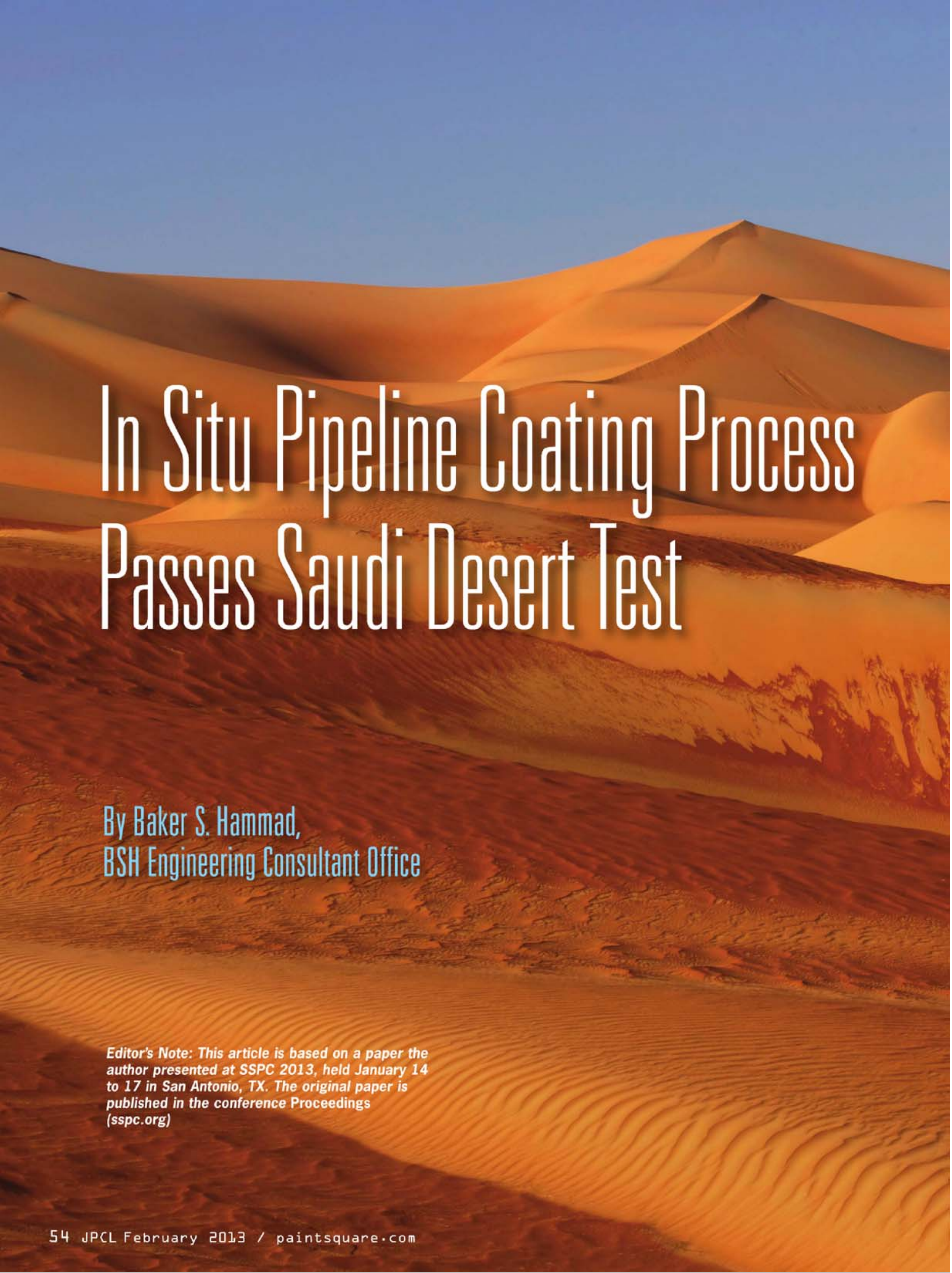
Bob Parker is a technical service chemist for AGC Chemicals Americas in Exton, PA. He has been involved in formulating paints and coatings for over 30 years. He received his BS in chemistry from Alvernia College. He is currently responsible for technical service for LUMIFLON® fluoropolymer resins in the U.S. JPCL



In Situ Pipeline Coating Process Passes Saudi Desert Test

By Baker S. Hammad,
BSH Engineering Consultant Office

Editor's Note: This article is based on a paper the author presented at SSPC 2013, held January 14 to 17 in San Antonio, TX. The original paper is published in the conference **Proceedings** *(sspc.org)*

The in situ coating process has proven in many parts of the world to be a viable alternative for rehabilitating corroded pipe interiors with a wide range of diameters and lengths. Compared to replacement with new pipeline, this one-run field process is cost-effective. The coating effectively controls internal pipeline corrosion through the application of multiple coats of a high-build liquid epoxy that covers the entire internal surface of the pipeline including girth welds, corrosion pits, channels, corrosion lakes or general corrosion and other internal pipeline imperfections, thus delaying leaks and extending the remaining pipeline service life.

Surface, buried, and subsea pipelines have been coated in various geographies ranging from the North Sea, North America, Continental Europe, and Africa to Hong Kong and Indonesia. This article details the in situ coating process and then reports on an assessment of the process in rehabilitating pipelines suffering from internal corrosion at an oil desert field complex in Saudi Arabia. A trial was required to qualify the technology within a Saudi Arabia pipelines network system.

History of the In Situ Coating Process

The in situ coating process was developed to apply an epoxy barrier coating to the internal surfaces of pipelines to prevent future corrosion and extend pipeline useful life. The process has been successfully undertaken for more than 30 years in many parts of the world. More than 160 new and existing pipelines have been coated successfully, with diameters ranging from 15 to 75 cm (6 to 30 inches) and in lengths up to 25 km (16 miles). The coating process is designed to provide full internal coverage, including the coating of girth welds, bends, pits, general corrosion and erosion, and other surface discontinuities.

While the bulk of the applications have been in the oil and gas industry, coatings have been applied to other pipelines including water, chemical, food, and fuel logistics. Exposure environments for all applications have varied widely. The coated pipelines have a long history of post-coating service, with certain lines coated as far back as 1978 that are still in service. To the author's knowledge, no pipelines have been withdrawn from service due to a compromise of the coating applied using this process, except for demolished or mothballed pipe.

Outside of extending pipeline life (negating the need for pipeline replacement), other benefits of the process include effectively reducing internal pipe friction (high pipeline volumes and reduced energy costs), reducing future scraping requirements and maintenance costs, producing a cleaner product, reducing the use of inhibitors, and reducing fouling. The process is also, potentially, one of the solutions for mitigating the generation of black powder in pipes if the source of the black powder is the uncoated internal pipeline surfaces. 'Black powder' is a broad term for byproducts, mainly iron oxides, in addition to mill scale, dust ,and other irons, that formed during pipeline operations. The size of these substances varies between 1 and 100 microns.

How the Process Works

The in situ internal coating process is primarily based on the use of scrapers propelled by either compressed air or nitrogen. The coating is required to deliver

- consistent coverage,
- a moisture barrier,
- resistance to the product transported across the scoped operating temperatures,
- high levels of adhesion when applied and over its useful life,
- no adverse reaction to the pipeline,
- sufficient physical strength to resist erosion,
- a non-toxic and environmentally benign coating, and
- attractive costs relative to other viable solutions.

Generally completed within 30 days, depending on the pipe length, diameter, and internal condition, the in situ internal pipeline cleaning and coating process comprises of the following steps, which were followed in most of projects.

1. Field Inspection & Planning: This phase of the operation involves gathering the necessary technical information, including pipe diameter; suitability of line for the passage of scrapers; elevation profile; mapping of junctions, joints, restrictions, and other features, such as access at the launcher and receiver sites; planning; and logistics.
2. Site Preparation: This phase calls for procedures such as installing specialized launchers and receivers; mobilizing compressors and dryers; installing (drop-out) spools and shoes; setting up effluent handling facilities; establishing the fuel and water supply; training for operator induction; and situating mobile workshops, compressors, and storage facilities for consumables. It is important for the compressor string to deliver dry and particulate-free air into the pipeline.
3. De-oiling/Dewatering: Depending on the hand-over condition of the pipeline, this phase has the objective of delivering a hydrocarbon-free pipeline that will allow the surface preparation phase to begin in earnest. All effluent will be disposed of in a manner acceptable to the client or facility owner.
4. Mechanical Cleaning: This phase requires removing all loose material (such as rust, mill scale, and dust) on the internal surfaces of the pipeline and is achieved through multiple-run passes of mechanical and brush scrapers through the pipeline in conjunction with water flushes, if necessary (Figs. 1 and 2).
5. Chemical Cleaning (Fig. 3): This phase targets the removal of all iron oxide and mill scale and leaves the internal pipe surface cleanliness comparable to a Near-

Fig. 1: Mechanical Scraping
All photos and illustrations courtesy of MOGSIL.

Fig. 2: Brush Cleaning

White Metal finish (SSPC-SP 10/NACE No. 2). This degree of cleanliness is required to guarantee the adhesion of the coating to the internal surface of the pipeline. This is achieved by running a dilute HCl solution containing a corrosion inhibitor between two acid-resistant scrapers. (The solution is inhibited to mitigate the risk of a negative impact on the clean internal surface of the carbon steel pipe.) The solution is titrated before and after its passage through the pipeline to determine the degree of depletion of the concentration of the solution. The effluent is also tested for solids. Batching of HCl solutions will continue until both the depletion and solids tests are within acceptable parameters. HCl is then purged from the line with a water rinse; the rinse water will also be tested for pH, chlorides, and solids. Water rinses continue until these parameters are again within acceptable limits. Where possible, the line at drop-out spools and other access points, such as pipe ends, should be inspected visually to confirm the cleanliness of the pipeline.

6. Passivation: This phase serves to remove any oxidation (rust blooming/flash rusting) that results from the previous water rinses and to stabilize the metal surface to prevent any further oxidation. Passivation is completed by running a pH-balanced phosphoric acid wash through the pipeline.

7. Inhibited Water Rinse: To buffer the low pH of the phosphoric acid in the pipeline and further passivate the pipeline, a dilute inhibited water batch is run through the pipeline.

8. Drying: To ensure that the pipeline is dry before applying the coating two procedures are undertaken: solvent drying and dry air purging:

- Solvent drying involves running suitable solvent batches through the line to remove moisture from the pipeline.
- Dry air purging is done slowly using dehydrated air that is tested until dew point measurements are within acceptable limits.

9. Coating Application: The coating is a specially formulated polyamide or amine-cured epoxy to ensure a longer pot life and hanging-properties needed for the coating to bond to the internal pipe wall at the 12 o'clock position during and after the coating application (Fig. 4). The coating is applied between two modified urethane coating scrapers and, depending on the pipe length and size, the coating is applied over a number of multiple runs, with appropriate coating drying periods, to deliver the specified dry film thickness (DFT).

10. Testing and Quality Control (QC): Throughout the process and after coating, numerous tests, including DFT and adhesion tests, and other quality control measures, are undertaken to ensure the quality and long life of the final coating.

Field Application

A 40-centimeter (16-inch) crude oil trunk line was selected to test the in situ internal coating method described above and offered by one of the oil field service specialist pipe coating companies in Saudi Arabia. The trunk line used in the trial is 10 kilometers (6 miles) long and links two gas and oil separation plants' lateral lines, which connect several oil wells in the Empty Quarter desert. The corrosion identified was a combination of general internal corrosion and pitting, concentrated in the 4 to 8 o'clock position in the internal surface of the pipe. The corrosion had resulted in a number of leaks recently after the pipeline was commissioned.

Fig. 3: Chemical & Acid Pigging

The process involved the application of an internal epoxy coating with a DFT of approximately 8 mils (200 microns) on the internal surface of the pipeline, providing a barrier to control further corrosion on the internal surfaces. Because the cleaning and coating processes are based on scraper operations, access to the pipes was essential only at either end of the pipeline being repaired, which are identified as the launcher and the receiver. The work involved the intensive process of preparing the pipe internal surface by de-oiling and de-water-

Fig. 4: Coating Application

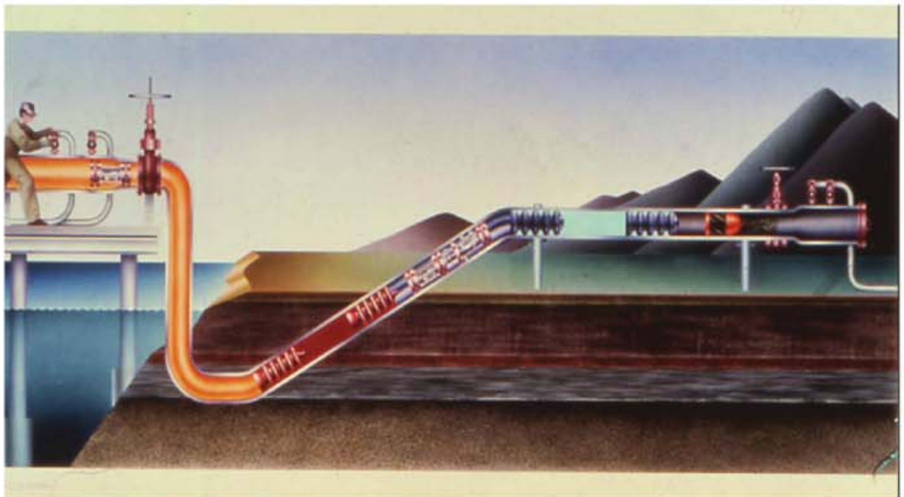


Fig. 5: In-situ internal cleaning and coating overall process

ing, mechanical cleaning, chemical cleaning, passivation, drying and internal coating, including inspection.

For the project to begin, the pipeline had to be taken out of service and drained of oil within a specified timeframe and strict schedule. The pipeline was then given to a coating applicator for site commissioning, final de-oiling and hydrocarbon removal, mechanical cleaning, chemical cleaning, passivation, drying, and coating.

The pipeline has a maximum elevation differential of 300 m (985 ft), and the launcher end is at 100 m (328 ft) above the receiver end. Figures 5 and 6 illustrate both the in situ internal cleaning and coating overall process and the core cleaning and coating tools of the pipeline respectively.

After the pipeline section was handed over to the applicator, the next step was to establish the site, which took one week. Figures 7 and 8 show the launcher and receiver sites respectively.

The pipeline had not been purged of hydrocarbons, so after site establishment, the removal of hydrocarbons began and

Figure 6: Standard set of different pipeline pigs/scrapers

Fig. 7: Launcher site

was completed within 14 days.

The corroded pipeline (Fig. 9) was successfully cleaned, coated (Figs. 10 and 11) and handed back to facility owner within 21 days of the first scraper being run through the pipeline.

Conclusions

The test run at the Arabian desert's oil field confirms the usefulness of the internal pipeline "in situ coating process" in providing a cost-effective solution for the rehabilitation of corroded and pitted pipelines,

Fig. 8: Receiver site

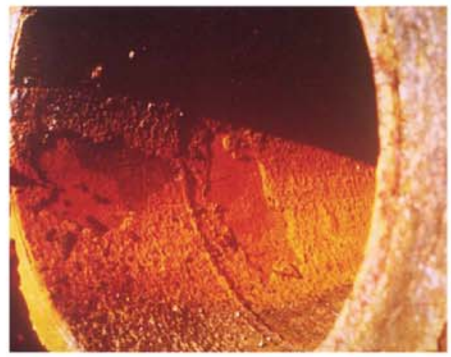


Fig. 9: Internal surface of corroded pipe

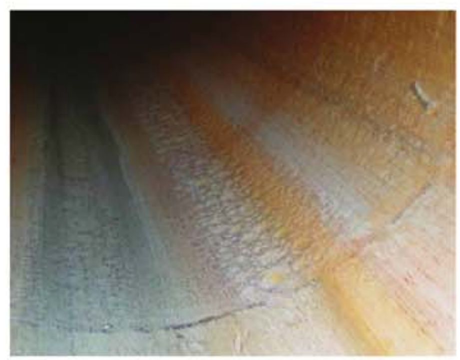


Fig. 10: Internal pitted surface of pipe before coating.

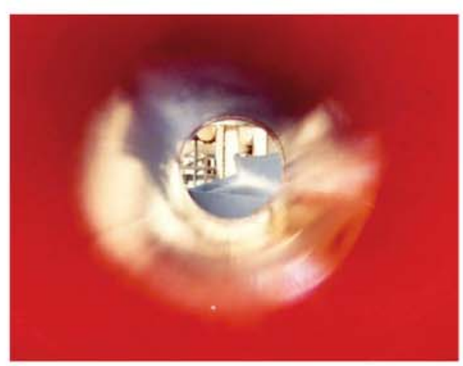


Fig. 11: Internal pipe surface finish coating

delivering effective life extension to the pipelines services. The process can be completed with limited downtime for the pipeline, requiring access to the pipeline for approximately 30 days depending on the pipeline length and diameter. In the trial described above, the coating was proven to effectively cover pits, channel corrosion and erosion, girth welds, bends and other disconformities on the internal surface of the pipeline in the desert. Consequently, the in situ coating is a viable and reliable alternative for pipeline rehabilitations, and due to the success of the trial, has resulted in further internal coating applications in the area.

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Mining Oil and Gas Services, 32 Impala Road, Chislehurston, Sandton, South Africa.

BSH Engineering Consulting Office, P.O. Box 76800, Alkhobar, Saudi Arabia (31952)

Baker S. Hammad is a retired certified Engineering Consultant & Coating Specialist from Saudi Aramco with 30 years of experience in the oil and gas industry. He worked as Responsible Standardization Agent (RSA), Vice-Chair of Paints & Coatings Standard Committee, and Team Leader of the Coatings Unit of Saudi Aramco. He is a member of SSPC, NACE, and the Saudi Council of Engineers. He has written and presented papers for SSPC, NACE, and other International & Middle East Conferences and organizations. Hammad is the founder and chair of SSPC's Saudi Arabia Chapter (2010) and is an SSPC-certified instructor. He is also a NACE-Certified Coating Inspector, an Aramco-Certified Coating Specialist Engineer, an Aramco instructor for coatings and corrosion courses and a certified NACE co-instructor. He holds a U.S patent entitled "Economical Heavy CWC for Submarine Pipelines" (2011). Licensed by the Saudi Council of Engineers, he holds a B.S in M.E. and an M.S. in Polymers & Coatings Technology. JPCL

How Coatings Protect Steel

By Robert Barnhart,
retired from Devoe Coatings Co. (now International Paint LLC)

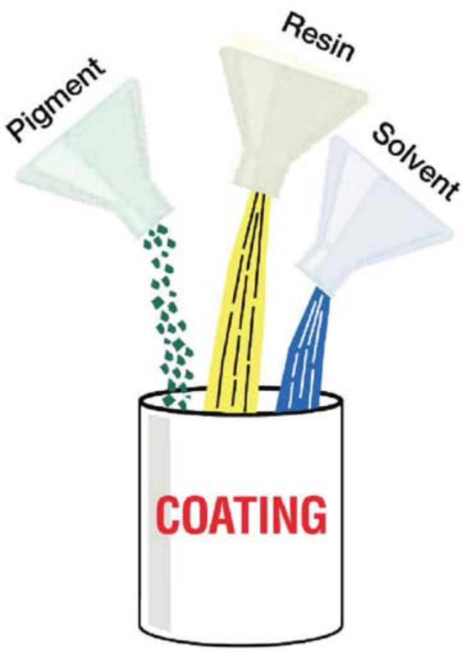


Fig. 1: Basic components of a coating

Previously, we discussed corrosion and mentioned that the function of the coating was to break the circuit by isolating steel from moisture (electrolyte). Actually, there is more to it than that. There are three ways by which coatings protect steel: barrier protection, inhibition, and sacrificial action. But some basic information is needed before we can explain these mechanisms and show which coatings protect by each of the mechanisms.

Basic Components of Coatings

All generic types of liquid industrial coatings are composed of three basic components: solvents, resins, and pigments (Fig. 1). The primary function of the solvent is for application. The solvent lets you get the material out of the can and onto the surface. The solvent dissolves or disperses the film-forming ingredients. It also places the solid ingredients (e.g., pigments) of the coating into suspension. In addition, the solvent provides flow-out of the coating once it is on the surface and contributes to the leveling, drying, durability, and adhesion characteristics of the final film. The solvents evaporate and do not become part of the final film after the coating dries.

The resin is the film-forming portion of the coating. It is the glue that holds the pigment particles together and binds the coatings to the surface. The resin plays a big part in contributing to the durability, strength, and chemical resistance of the final film. People often refer to coatings by the type of resin in the formulation. So when people talk about an alkyd or vinyl paint, for example, they are referring to the main resin used to make the paint. The liquid portion of the paint is normally made up of the resin and the solvent.

The third ingredient in a can of paint is the pigment. It is a relatively insoluble, finely divided powder. Most people know that the pigments provide hiding power (opacity) and color. But pigments also improve corrosion and weather resistance, increase paint adhesion, decrease moisture permeability, and control gloss. The pigment and the resin form the final film on the surface.

The chemical ingredients in each of the components vary widely from one generic type of coating to another. Each of the components (solvent, resin, and pigment) is also usually a mixture of different materials. For example, a formulation may contain three or four solvents. One of the solvents dissolves the resin, while others are added to control evaporation, and still others are used to dilute the solution. It is not important that a painter know all the ingredients in the paint formulation. Someone else is responsible for determining that the can of paint on the job has been tested and is approved for use.

Paints, Coatings, and Coating Systems

The terms "coating" and "paint" have been used a few times already, and you may be questioning whether they mean the same thing or not. People have tried to distinguish between paints and coatings. For instance, to some people, coatings are industrial materials used primarily for protection, while paints are used for decoration. Other people use the two terms to mean the same thing. That's the definition we will employ for this series, so the terms will be used interchangeably.

It is, however, necessary to distinguish between a coating system and a coat of paint. A coating system is more than just the material applied. It refers to factors such as surface preparation requirements and the application of a number of coats, separately applied, in a specific order and thickness, with suitable time to allow for drying and curing (Fig. 2). A coat is a single application (one layer) applied to form a properly distributed film when dry. A coat is sometimes applied in multiple passes and will be described in more detail in a future article.

Typical Coating System Components

Surface Preparation Requirements
Coatings
- *Primer*
- *Intermediate Coat*
- *Topcoat*

Dry Film Thickness of Each Coat
Application Methods
Inspection Requirements

Fig. 2: Components of a typical coating system

The common designation of the series of coatings applied to a steel substrate is a primer coat, intermediate coat, and topcoat. The total coating system protects the steel. Normally, each coat contains properties that contribute to the success of the total coating system.

Function of Each Coat

The primer is the first coat applied to the surface. A main function of the primer is to provide adhesion to the substrate. If the primer doesn't stick to the surface, the coating system won't work. Surface preparation helps the coating stick by removing contaminants that interfere with bonding and by creating a profile or roughened surface.

Many primers for steel also contain anticorrosive pigments that actively assist in the control of corrosion.

The intermediate coat is required in many coating systems and may provide one or all of the following functions: improve chemical resistance, serve as an adhesion or "tie coat" between the primer and topcoat when the primer and topcoat are not compatible, and increase the thickness of the coating system.

The topcoat is intended to be the final coat applied. Topcoats are formulated to improve the chemical and weather resistance of the coating system, and provide characteristics such as color, gloss, mildew

General Functions of Coats of Paint in a Coating System

Primer
- *Adhesion to surface*
- *Inhibition of corrosion if inhibitive pigments are present*
- *Sacrificial action if zinc-rich pigments are present*

Intermediate Coat
- *Additional thickness*
- *Chemical resistance*
- *Adhesion between primer and topcoat*

Topcoat
- *Weather and chemical resistance, color, gloss, mildew resistance, and wear or abrasion resistance*

Fig. 3: The functions of each coat in a coating system

resistance, and wear resistance.

The color of each coat in the system should be different to allow for identification of the coat being applied. This color contrast also helps the inspector easily see which areas have already been covered. Figure 3 reviews the functions of each coat in a coating system.

Mechanisms of Protection

Now it is time to answer the question, how do coatings protect steel. The three recognized mechanisms for protecting steel are barrier protection, inhibition, and sacrificial action (Fig. 4).

Mechanisms of Protection

Barrier Protection: *Prevention of moisture and oxygen from reaching steel surface*

Inhibition: *Interference with the electrochemical process of corrosion*

Sacrificial Action: *Consumption of zinc pigments in a primer rather than steel when corrosion occurs*

Fig. 4: How coatings protect steel

Barrier protection is just as the name implies. The dried film blocks moisture and oxygen from reaching the steel. So this mechanism most closely represents the definition of how paint protects steel: by isolating it from the moisture. All coatings do allow some moisture and oxygen to penetrate through them. This property is called permeability. Coatings that protect by the barrier mechanism have relatively low moisture permeability.

Typical barrier coatings are two-part epoxies (epoxy polyamides, epoxy amines, coal tar epoxies, epoxy mastics, etc., but not epoxy esters), vinyls, chlorinated rubbers, moisture-cure urethanes, and asphaltics.

Coatings that protect by inhibition contain special pigments to inhibit or interfere with the corrosion reactions on the steel surface. Typical inhibitive pigments that used to be quite common are lead compounds (red lead and basic lead silico chromate) and other chromates. Concerns about toxicity and environmental pollution associated with lead and chromates have resulted in the development of other anti-corrosive pigments that are now being incorporated into paint formulations.

Anti-corrosive pigments are used in oil-based paints, alkyds, and water-borne paints. They are needed in these types of formulations because the film formed does not have as low a moisture permeability as coatings that protect strictly by barrier protection. So as moisture passes through the coating film, the anti-corrosive pigments slowly dissolve and aid in stopping corrosion.

The third mechanism is sacrificial action and is the way zinc-rich primers protect steel. Zinc-rich primers are materials that are heavily loaded with zinc dust. A previous Bulletin pointed out that a battery has a casing made of zinc and a carbon electrode in the middle. The zinc casing is consumed when the battery supplies power. Zinc is also more active than steel, so if zinc is in contact with the steel, and the other elements needed for corrosion are present, the zinc will corrode to protect the steel. The term "sacrificial primer" comes from the zinc sacrificing itself to protect the steel.

Zinc is the most common element used for protection of steel by the sacrificial method. Zinc-rich paints are classified into two types: inorganic zinc-rich primers and organic zinc-rich primers. This classification system refers to the resins used in the formulation and not the form of zinc. Both types have tiny particles of zinc in them to provide the sacrificial

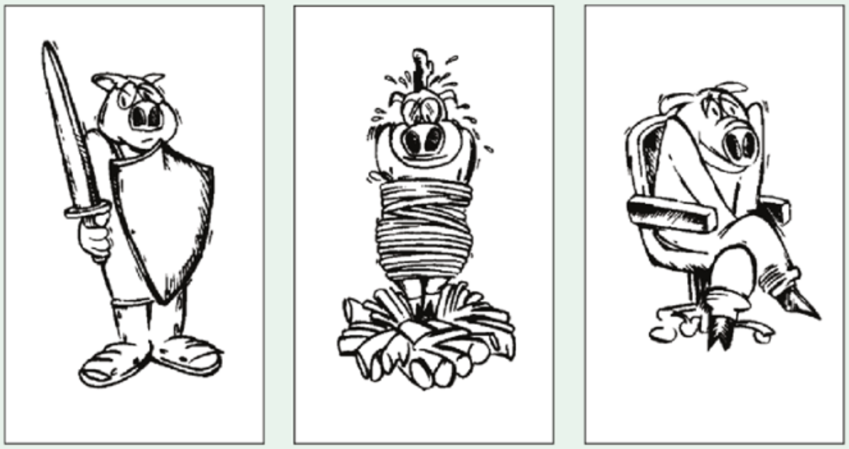
The following are among the upcoming Applicator Training Bulletins.

Basics of Corrosion and Coatings

- Basics of Concrete Deterioration for Applicators
- How Coatings Protect Concrete

Surface Preparation

- Why Surface Preparation Is Important
- Mechanical Methods of Preparing Concrete
- Chemical Cleaning of Concrete
- Power Tool Cleaning for Steel
- Using Paint Strippers on Steel and Concrete
- Setting Up Air Abrasive Blasting Systems
- Techniques of Air Abrasive Blasting
- Containing Dust and Debris during Air Abrasive Blasting



Barrier Pigment | Sacrificial Pigment | Inhibitive Pigment

Fig. 5: The three mechanisms for protecting steel

action. The binder in inorganic zinc-rich formulations is a form of a silicate and is similar to glass when the film is cured. Organic zinc-rich formulations can be any number of resins such as epoxies, vinyls, urethanes, or chlorinated rubbers.

The cartoon in Fig. 5 may help you to remember the three mechanisms for protecting steel: barrier protection, inhibition, and sacrificial action, all of which may involve the use of specialized pigments in the paint formulation.

Proper application of the coating system is needed to preserve the steel no matter what the mechanism of protection. It is the specifier's job to choose the coating system, matching the surface preparation to the mode of protection and properties of the coating layers. It is the applicator's job to make sure the proper surface preparation is achieved, and the various layers of coating are put on in the proper order and to the specified thickness.

JPCL

UPCOMING APPLICATOR TRAINING BULLETINS

- Using High Pressure Waterjetting

Application
- Product and Application Data Sheets
- Mixing and Thinning Paint
- Basic Training in Brush and Roller Application
- The Basics of Conventional Air Spraying
- Using Airless Spray Equipment
- Introduction to Plural Component Spraying
- Special Concerns about Applying Coatings in the Shop

Quality Control
- The Effects of Weather on Cleaning and Coating Work
- Conforming with Job Requirements
- Records of Work and Working Conditions
- Assessing Surface Cleanliness and Profile
- Assuring Quality during Abrasive Blasting
- Assessing Quality of Wet Methods of Surface Preparation
- Computing Film Thickness and Coverage
- Measuring Dry Film Thickness
- Measuring Adhesion of Coatings
- Recognizing and Correcting Paint Application Deficiencies

Safety and Health
- Safety Considerations for Abrasive Blasting
- Anticipating Job Hazards
- Respiratory Protection: Hazards and Equipment
- Job Hazards during Climbing and High Work
- An Introduction to Confined Spaces
- Protection against Worker Exposures during Hazardous Paint Removal
- Safety with Solvents and Paint Strippers

Time is Money! The "Buzz" in construction and bridge painting:

Time is Money – Spend Less/Make More!

Whether you are talking "Accelerated Bridge Construction" or "Design-Build," the buzz is on productivity improvements and cost savings. Coatings based on Bayer's polyaspartic technology have a long history of providing high performance, fast-cure coatings that can help move a project from three coats to two and accelerate handling in the fabrication shop up to five times as fast as polysiloxane or acrylic polyurethane coatings[1]. These productivity improvements contribute to significant financial improvement all along the value chain.

But don't just take our word for it:

Bayer's money-saving approach dovetails with the observations of Eric Kline, Executive Vice President, KTA-Tator Inc., a nationally known engineering and testing firm very familiar with coatings industry trends. According to Kline, "Time is Money." Kline believes the Industrial Maintenance Market will continue to focus on labor and productivity savings – and specifically on fast curing, easy-to-apply "just-in-time" coatings that facilitate shop through-put by minimizing "dry to touch" and "dry to handle" time.

Facilitating Design-Build and Fast Track Projects

Bayer, a pioneer in polyurethane coatings chemistry for the corrosion market, has long been a leader in providing innovative solutions to coatings formulators. We now offer two enhanced technologies for coatings that offer excellent corrosion protection:

1) Improved polyaspartic coatings technology - with a newly engineered polyisocyanate,

and,

2) Technologies that enable moisture-cure urethane topcoats to be used more easily in more wide-ranging applications.

Bayer MaterialScience recently introduced a new aliphatic polyisocyanate, Desmodur® XP 2763, to improve these desired performance characteristics. It provides improved **application robustness** -- dramatic improvements in the following areas: improved consistencies of cure across a large environmental application range, extended re-coat, 1:1 by volume mix ratios, and rapid re-coat of multi-layered coating systems with improved adhesion characteristics. Desmodur® XP 2763 also provides extended recoat and improved weathering over the standard polyaspartic coatings on the market today.

Finish Characteristics That Deliver Value

Our second improved technology relates to moisture-cure urethanes (MCUs). These have been widely used for over 30 years in the northeastern and northwestern United States. Historically, applicators found MCU topcoats difficult to apply due to its 2-4 mils dry film thickness requirement. In complex structures, this requirement could lead to putting the topcoat on too thick, resulting in blistering. Applicators will now find MCU topcoats easier to apply. Through meticulous resin and formulation development, Bayer has developed new, light stable, moisture-cure topcoats that can be applied at twice the film build without blistering. We also believe that this improved technology will enable MCUs to be applied and perform successfully in more extreme hot, humid environments, and in a wider geographic area.

Whether you're coating bridges, stadiums, buildings, floors, architectural structures or pipes, our improved polyaspartic and MCU coatings technologies offer application cost savings and fast return to service - with low VOCs – all trademarks of the *Proven* Power of Polyurethane Coatings built on Bayer Technology.

References: [1] *"Time is Money: Saving Shop & Field Painting Through-put by Reducing Finish Coat Handling Time"* published by Benjamin Fultz, Bechtel Corporation, William D. Corbett, KTA-Tator, Inc. and Kurt Best, Bayer MaterialScience LLC

Germany Set to Host European Coatings Show

Photo courtesy of NuernbergMesse

From March 18–21, the Exhibition Centre Nuremberg in Nuremberg, Germany, will host the annual European Coatings Congress and Show.

The event kicks off with a series of pre-Congress tutorials on Sunday, March 17. The Congress will then open from March 18–19, before the opening of the show, comprising of tutorials and information sessions pertaining to coatings, inks, adhesives, sealants, and construction chemicals. The subsequent show, open from March 19–21, will feature over 900 exhibitors from the protective coatings field and other related industries.

The following preview provides information about the show that may be of interest to industrial coatings professionals. All information is current as of press time. For more information, please visit www.european-coatings-show.com

Pre-Congress Tutorials

Sunday, March 17

- Pre-congress tutorial 1: Basics of functional coatings
- Pre-congress tutorial 3: Polyurethanes
- Pre-congress tutorial 4: Flame retardants and fundamentals
- Pre-congress tutorial 6: Sustainability without compromise
- Pre-congress tutorial 7: Formulating adhesives & sealants
- Pre-congress tutorial 9: Corrosion fundamentals
- Pre-congress tutorial 10: Basics on marine coatings
- Pre-congress tutorial 11: Fundamentals of epoxy coatings

Parallel Sessions 1–12

Monday, March 18

Session 2: Epoxy Coatings

- 2.1: Compliant, high-performance and robust waterborne epoxy systems for protective coatings
- 2.2: Beyond green: a toolbox for uncompromised industrial flooring
- 2.3: Finding the right "level"—High-performance waterborne epoxy hardener for zero emission self-leveling flooring
- 2.4: New amine epoxy hardeners and building blocks for coating, construction, and adhesive applications
- 2.5: Novel 1k epoxy waterborne binder systems for low temperature baking applications
- 2.6: Phenalkamide—New hybrid molecule and its unique coating properties

Session 10: Protective Coatings

- 10.1: A new way to ensure metal protection with waterborne dispersions
- 10.2: Zinc-free anticorrosives: Challenges and latest developments for protective coatings
- 10.3: Micaceous iron oxides as functional mineral in coatings: The potential of micronized grades and their new applications
- 10.4: New functional fillers for anti-corrosion paints
- 10.5: Zinc metal powders for waterborne anti-corrosion paints
- 10.6: The use of Didecyl Dimethyl Ammonium Bicarbonate/Carbonate (DDABC) as a corrosion inhibitor

Parallel Sessions 13–24

Tuesday, March 19

Session 14: Construction Chemicals I

- 14.1: Technology transfer processes in the construction chemicals industry
- 14.2: Synthesis of a high-silicon content material and its use as raw material for new insulating paint and material for the construction industry
- 14.3: Aerogel-based highly insulating thermal insulation coatings

- 14.4: Long-lasting concrete protection by silicate-based impregnation
- 14.5: Reactive transport in cement-based materials—from experimental results to the modeling
- 14.6: Airvoid management in cementitious materials

Session 18: Polyurethanes

- 18.1: An original way to accelerate the development of low-VOC acrylic polyols compliant with future regulations
- 18.2: Hard and invisible—Incorporating nanosilica technology for new improvements in 2-pack polyurethane coatings
- 18.3: Securing emission profiles beyond next decade—Novel waterborne polyurethane architectures for surface coatings
- 18.4: Fast curing of 2K-PUR coatings at room temperature with photo-latent metal catalysts
- 18.5: New sustainable window profile systems based on polyurethane pultrusion technology and fluoropolymer-urethane hybrid waterborne topcoats
- 18.6: Thermolatent catalysts for the urethane formation

Session 20: Construction Chemicals II

- 20.1: Calcium aluminate mineral suspensions (CAMS)
- 20.2: Shelf-life stability of self-levelling underlayment (SLU) mortars exposed to moist environment
- 20.3: Use of sepiolite to improve the photocatalytic activity of TiO_2 in construction applications: self-cleaning and degradation of Nox
- 20.4: The use of sleeping patents by small to medium size enterprises (SME)—a practical application of the foresight process methodology
- 20.5: Introducing shrinkage-compensating concrete to Europe for the prevention of shrinkage cracks in concrete
- 20.6: Practical application for heterocyclic ring-opening reactions in polyurethane coatings

Exhibitors

The following is a list of European Coatings Show exhibitors that may be of interest to persons involved in the protective coatings industry. All information is current as of press time.

Atlas Material Testing Technology GmbH ....5 - 5-343
BASF SE ....7A - 7A-523
Baxenden Chemicals Ltd., a Chemtura Company ....1 - 1-353
Bayer MaterialScience AG ....4A - 4A-624
Bitrez Ltd. ....7 - 7-335
BYK-Chemie GmbH...4A - 4A-614
Cardolite ....1 - 1-322

Celanese Emulsions GmbH	7A - 7A-105
Clariant International Ltd	7 - 7-123
Coatex S.A.S.	4A - 4A-424
CoRi Coatings Research Institute	5 - 5-138
Cray Valley HSC	1 - 1-147
Croda Nederland B.V.	4 - 4-464
Cytec Surface Specialties SA/NV	1 - 1-312
DeFelsko Corporation	5 - 5-444
DIC Performance Resins GmbH	4 - 4-451
Dow Corning GmbH	7 - 7-533
Dow Europe GmbH	4A - 4A-414
DSM Coating Resins	7A - 7A-329
DuPont International Operations Sàrl	7 - 7-635
Eastman Chemical BV	7 - 7-536
ECKART GmbH	4A - 4A-614
Elcometer Ltd	5 - 5-243
ERICHSEN GmbH & Co. KG	5 - 5-353
Evonik Services GmbH	7A - 7A-323
Ferro GmbH	1 - 1-456
Fischer, Helmut GmbH	5 - 5-453
Grace GmbH & Co. KG	4 - 4-409
HABICH GmbH	7 - 7-215
HALOX, a division of ICL Performance LP	7A - 7A-331
Heubach GmbH	7A - 7A-223
Huntsman	7 - 7-563
Incorez Ltd	1 - 1-508
Kärntner Montanindustrie GmbH	1 - 1-523
Lapinus Fibres	7 - 7-124
Liebisch GmbH & Co. KG	5 - 5-153
Luengo Color S.L.	7 - 7-642
Mäder, Walter AG	7 - 7-245
Momentive Specialty Chemicals GmbH	7A - 7A-231
NUBIOLA PIGMENTOS S.L.	7A - 7A-229
Nuplex Resins BV	7 - 7-133
Omnova Solutions	7A - 7A-122
Perstorp	7A - 7A-623
Pigmentan Ltd.	7 - 7-225
PPG Industries, Inc.	7 - 7-213
Q-Lab Corporation	5 - 5-131
SARTOMER Europe, a division of ARKEMA	4A - 4A-424
SNCZ SAS SOC NOUVELLE DES COULEURS ZINCIQUES	4 - 4-640
TIB Chemicals AG	7A - 7A-528
TQC bv / GmbH	5 - 5-144
VIL Resins Limited	7 - 7-327
Vinavil S.p.A.	7 - 7-343
Wacker Chemie AG	1 - 1-121
WIWA Wilhelm Wagner GmbH & Co. KG	5 - 5-337
Wolf Safety Lamp Co. Ltd.	5 - 5-411
Worlée-Chemie GmbH	7 - 7-533

Photo courtesy of Orange County Convention Center

CORROSION 2013 Comes to Orlando

CORROSION 2013, NACE International's annual conference and exhibition, will take place from March 17-21 at the Orange County Convention Center in Orlando, FL.

More than 5,000 corrosion professionals will participate in technical symposia, committee meetings, seminars and lectures, training opportunities, and networking events with their peers.

The show features a wide array of technical programs, special events, and exhibits for corrosion professionals involved in industries such as coatings and linings, infrastructure, marine, military, oil and gas production, petroleum refinement, pipeline systems, and others. This year's show marks NACE's 70th anniversary.

The following information describes sessions that may be of special interest to persons involved in corrosion control through coatings. Information is current as of press time.

For more information, visit www.nace.org.

Technical Symposia, Committee Meetings, Workshops, & Forums

Sunday, March 17

- TEG 428X, Hot-Dip Galvanizing for Steel Corrosion Protection
- TEG 424X, Liquid-Applied Thermal Insulative Coating for Atmospheric Service at 0 to 375 °F
- TG 266, Coatings and Lining Materials in Immersion Service: Review of NACE Standard TM0174
- TEG 311X, Threaded Fasteners: Coatings and Methods of Protection for Threaded Fasteners Used with Structural Steel, Piping, and Equipment
- TEG 189X, Atmospheric Corrosion
- TG 148, Threaded Fasteners: Coatings for Protection of Threaded Fasteners Used with Structural Steel, Piping, and Equipment
- TG 034, Pipeline Coatings, External: Gouge Test
- TEG 314X, Pipelines: Liquid Petroleum Industry Corrosion Control Issues Forum

Monday, March 18

- Managing Corrosion with Polymers
- Oil/Gas Coating Technology Forum
- TG 461, Standard for Hull Roughness Measurements on Ship Hulls in Dry Dock
- TG 352, Coating Systems (External) for Pipeline Directional Drill Applications
- TG 381, Fire Protection Systems
- TG 018, Steel, Structural: Corrosion Control of Pilings in Nonmarine Applications
- STG 44, Marine Corrosion: Ships and Structures Forum
- TEG 474X, Nanotechnology in Corrosion
- TG 237, Microbiologically Influenced Corrosion on External Surfaces of Buried Pipelines: Detection, Testing, and Evaluation—Standard
- TEG 267X, Pipelines: In-Line Inspection
- STG 44, Marine Corrosion: Ships and Structures

Tuesday, March 19

- TEG 118X, Failure Prevention Case Histories
- Understanding Coating Failures
- TG 339, Railcars: Coating Application on Exterior Surfaces of Steel Railcars
- TG 378, Waterborne Coatings on Railcars
- TG 379, Surface Preparation by Encapsulated Blast Media for Repair of Existing Coatings on Railcars
- TG 061, Revision of NACE Standard RP0592, "Application of a Coating System to Interior Surfaces of New and Used Railway Tank Cars in Concentrated (90-98%) Sulfuric Acid Service"
- TG 019, Pipelines: Cathodic Protection of Concrete Pressure and Mortar-Coated Steel
- TG 271, Removal Procedures for Nonvisible Contaminants on Railcar Surfaces
- TEG 346X, Offshore Coatings: Laboratory Testing Criteria
- STG 33 - Oil and Gas Production—Nonmetallics and Wear Coatings (Metallic)
- TEG 291X, Land Transportation: Information Exchange on Corrosion and Coating-Related Issues
- TG 437, Maintenance Overcoating of Railcar Exteriors
- TEG 126X, Materials, High-Temperature: Current Issues
- TG 456, Coating Thickness Measurement, Methods, and Recording—Specific to the Railcar Industry

Wednesday, March 20

- Pipe Coatings, Corrosion Control, and Cathodic Protection
- Research Topical Symposium (RTS): Functionalized Coatings for Durable Materials and Interfaces
- TG 394, Guidelines for Qualifying

Personnel as Abrasive Blasters and Coating and Lining Applicators in the Rail Industry

- TG 470, Cathodic Disbondment Test for Coated Steel Structures Under Cathodic Protection
- TG 406, Review of NACE SP0398-2006
- TG 451, Corrosion-Resistant Non-Skid Surfaces for Railcar Exteriors
- TEG 159X, Building Fire Protection Systems: Corrosion and Deposit Control
- STG 43, Transportation, Land
- TEG 145X, Vapor Corrosion Inhibitors and Rust Preventives for Interim (Temporary) Corrosion Protection: Advances and Novel Applications
- TEG 469X, Surface Preparation Issues
- Top-of-Line Corrosion
- TG 444, Guidelines for Data Collection and Analysis of Railroad Tank Car Interior Coating/Lining Condition
- TG 260, Review of NACE Standard TM0304-2004
- TG 263, Review of NACE Standard TM0104-2004
- TG 264, Offshore Exterior Submerged Coatings: Standard Test Method
- TG 312, Offshore Platforms: Coatings for Atmospheric and Splash Zone New Construction
- TG 360, Piping Systems: Review of NACE SP0169-2007 (formerly RP0169)
- TG 067, Review and Revise or Reaffirm NACE SP0302-2007
- TG 370, Pipeline Corrosion Management
- TG 425, State of the Art in CUI Coating Systems
- TG 333, Review and Revise or Reaffirm as Necessary NACE SP0295-2008
- TG 332, Review and Revise or Reaffirm as Necessary NACE SP0386-2007
- TG 249, Review and Revise as Necessary NACE Standard RP0402-2002
- STG 01, Reinforced Concrete
- STG 41, Electric Utility Generation, Transmission, and Distribution
- STG 40, Military and Aerospace Systems and Facilities

Thursday, March 21

- TG 296, Coating Systems, Wax, for Underground Piping Systems: Review of NACE Standard RP0375
- TG 031, Pipeline Coating, Plant-Applied Fusion-Bonded Epoxy: Review of NACE Standard RP0394
- TG 052, Fusion-Bonded Epoxy Coating of Steel Reinforcing Bars
- STG 02, Coatings and Linings, Protective: Atmospheric
- STG 03, Coatings and Linings, Protective: Immersion and Buried Service
- STG 04, Coatings and Linings, Protective: Surface Preparation

Exhibitors

The following is a list of exhibitors at Corrosion 2013, as of press time, that may be of interest to protective coatings professionals.

3M Infrastructure Protection Division....................1301
Accoat A/S....................................1553
Advanced Polymer Coatings.........811
AkzoNobel Powder Coatings......1433
Belzona, Inc.................................1254
Binks 1747
Blair Rubber Co............................1219
Brand Energy & Infrastructure Services 1426
Canusa / Bredero Shaw 501
Carboline Co. 1101
CHLOR*RID International, Inc.......532
Clemco Industries Corp. 561
CoatingsPro Magazine 1669
Cortec Corp...................................800
Curran International 519
D.E. Stearns Co. 1129
Dampney Co., Inc. 1209
DeFelsko Corp..............................1307
Dehumidification Technologies.....833
Denso North America....................817
DoD Corrosion Prevention and Con.................1356
Duraseal Pipe Coating Co...........1362
Elcometer, Inc.....................1147, 1239
Evonik Degussa North America .1355
Farwest Corrosion Control Co. 747
Fischer Technology, Inc..................702
GMA Garnet Group.......................413
Graco, Inc. 423
Greenman-Pedersen, Inc. / VESI.....1156
Hempel USA 1653
Heresite Protective Coatings 904
Highland International 1418
HoldTight Solutions, Inc. 422
IBIX Surface Technologies, LLC......1558
International Marine & Industrial Applicators, LLC 1600
International Paint 1493
ITW PolySpec / Futura.................1414
KTA-Tator, Inc. 1211
Lone Star Specialty Products, LLC 835
M-TEST..1625
Mascoat Products..........................435
MATCOR, Inc. 1107
MONTI Werkzeuge, GmbH............547
Montipower, Inc...........................1623
NCP Coatings, Inc. 1511
Novatek Corp. 614
Opta Minerals, Inc. 607
Oxford Instruments 408
Paul N. Gardner Co., Inc. 502
Pipeline Inspection Co. Ltd. 1028
Platt Brothers & Co.......................330
PolyCorp.......................................552
Polyguard Products, Inc. 707
PPG Protective & Marine Coatings 1139
Praxair Surfaces Technologies, Inc...803
REMA Tip Top North America, Inc....960
Safety Lamp of Houston, Inc. 354
Sauereisen...................................1329
Sherwin-Williams Co. 839
Specialty Polymer Coatings, Inc. 353
Sponge-Jet, Inc.............................507
SSPC: The Society for Protective ...... Coatings..................................404
STOPAQ B.V. 737
Sulzer Mixpac USA, Inc. 609
Superior Products International, Inc. 1738
Tapecoat/Royston.........................1201
Temp-Coat Brand Products, LLC....1526
The Waterborne Symposium........659
Tinker & Rasor 901
Tnemec Company, Inc...................761
Trenton Corp. 539
TruQC..1510

Photos courtesy of Wikimedia Commons

Liberty-Alpha Nets $31M MD Bridge Coating Contract

Liberty-Alpha III J.V., LLC won a contract from the Maryland Transportation Authority to recoat structural steel surfaces on the westbound portion of the William Preston Lane, Jr. Memorial Bridge over the Chesapeake Bay. Valued at $31,380,000, this contract covers the third of four phases of this bridge repainting project.

Named after the former governor of Maryland, the bridge's original eastbound span opened in 1952, before the construction and opening of the westbound span in 1973. Nowadays, this 22,790-foot-long, dual-span bridge connects the Baltimore-Washington Metropolitan Area and Ocean City, MD.

The contract includes cleaning and recoating all exposed surfaces on the 804 steel railing posts and associated connection plates on 12 of the cantilevered deck truss spans. All internal surfaces of the box-shaped members accessed through manholes, up to and including the exposed sides of the seal plates, will be cleaned and recoated as well. The contract also includes replacing the bottom rail on both sides of the entire bridge, aside from the suspension spans and the through truss cantilever spans.

The contractors will abrasive blast-clean the existing steel to a Near-White finish (SSPC-SP 10), as well as spot-power tool-cleaning to Bare Metal (SSPC-SP 11), before recoating the steel with an organic zinc-rich primer, an epoxy intermediate, and a polyurethane finish. Containment is required to capture the existing lead-bearing coatings. The contract also includes coating the new steel railing with an inorganic zinc-rich primer, an epoxy intermediate, and a polyurethane finish.

Liberty-Alpha III J.V., LLC is a joint venture between Liberty Maintenance, Inc. (Youngstown, OH) and Alpha Painting and Construction Co. (Baltimore, MD). The two companies, both of which hold SSPC-QP 1 and -QP 2 certifications, have teamed up on several large-scale bridge rehabilitation projects in the past.

DOT Quick Hits

- Allied Painting, Inc. (Cherry Hill, NJ), SSPC-QP 1 and -QP 2 certified, won a $4,757,361 contract from the New Jersey Department of Transportation to abrasive blast-clean and recoat structural steel surfaces on 12 bridges.

- The California Department of Transportation awarded a contract worth $1,784,000 to F.D. Thomas, Inc. (Medford, OR), SSPC-QP 1 and -QP 2 certified, to clean and recoat structural steel surfaces on three bridges.

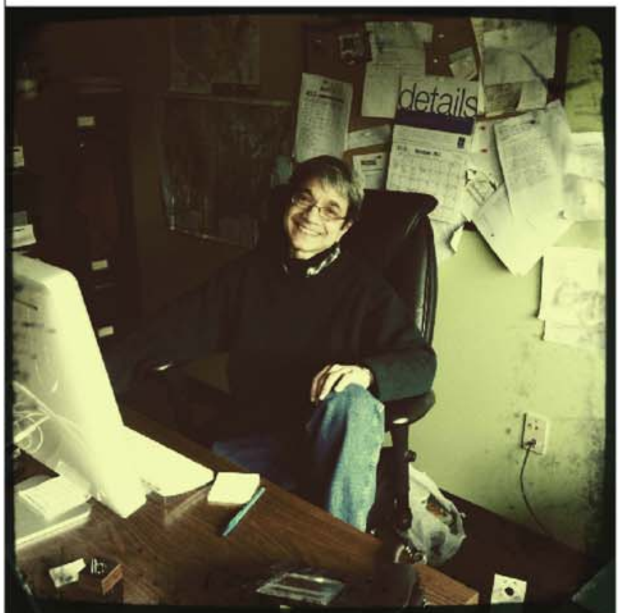
- APBN, Inc. (Campbell, OH), SSPC-QP 1 and -QP 2 certified, and the Ohio Department of Transportation have agreed on a $1,385,000 contract to clean and recoat 129,854 sq. feet of steel on four bridges.

Memphis LG&W Awards Water Tanks Job

The Memphis Light, Gas and Water Division and Thomas Industrial Coatings, Inc. (Pevely, MO), SSPC-QP 1 and -QP 2 certified, have agreed on a contract to clean and recoat interior and exterior surfaces of three elevated water storage tanks and two standpipes. The tanks range in size from 150,000 gallons to 500,000 gallons.

The $844,860 contract includes abrasive blast-cleaning and/or power-tool cleaning interior surfaces to a White Metal finish (SSPC-SP 5) and recoating the interiors with an elastomeric polyurethane system. The tanks' exterior surfaces will also be abrasive blast-cleaned to a Commercial finish (SSPC-SP 6) and recoated with an epoxy-alkyd system.

The Takeaway



Picture This

By Karen Kapsanis
JPCL

SSPC's Structure Awards, given at SSPC 2013 in San Antonio last month, certainly play a big role in this issue; nine projects received awards for excellence. The photo essay that starts on p. 20 gives you a look at the winning structures and some representatives of the winning teams.

Considerable teamwork goes into all projects, the SSPC winners included, but the picture of good painting work doesn't end with awards. The rest of the issue gives you a bigger view of coating work: Everything from raw materials for coating formulation to the finished project comes into play in the complicated work of successfully protecting structures from corrosion.

For instance, there's chemistry to understand, as indicated in the Applicator Training Bulletin's review of the roles of pigments in coatings (pp. 67–71) and in Bob Parker's article on the challenges of formulating fluoropolymer coatings for high performance and low environmental impact (pp. 44–53).

There's an engineering aspect to coatings, as described in Warren Brand's article on the gap between designing aboveground storage tanks for structural integrity and taking the role of coatings into account in the design (pp. 32–43). Successful maintenance of structures in the field needs proven practices and materials, as Baker Hammad describes in his piece on a trial of in situ cleaning and coating of oil and gas pipeline in the Saudi desert (pp. 54–64).

And under the category of "if at first the coating work doesn't succeed," there's more to failure analysis and remediation than guesswork. The F-files reports on conducting a failure analysis of a premature delamination attributed initially (and wrongly) to hailstones.

So although award-winning projects are not the focus of all articles this month, the issue does reflect, on a small scale, many of the kinds of coatings professionals and their contributions to successful projects. Congratulations to all of you out there who do your part in coatings work, whether you have a plaque for your efforts or not.