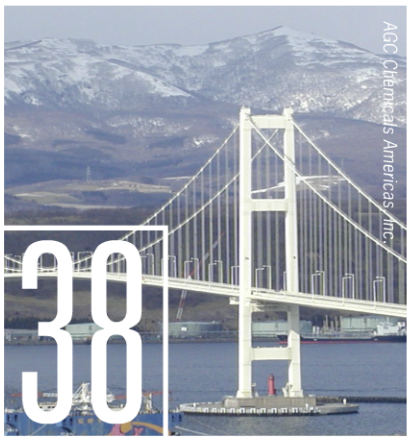
PAINTSQUARE.COM
JPCL
JANUARY 2015
VOLUME 32, NUMBER 1
The Voice of SSPC: The Society for Protective Coatings

Cover: © iStockphoto/flyrfixr

Features



Departments

Also This Month

From the Offices of SSPC

Staff

Periodical class postage at Pittsburgh, PA and additional mailing offices. Canada Post: Publications Mail Agreement #40612608 • Canada returns are to be sent to: American International Mailing, PO Box 122, Niagara Falls, ON L2E 6S4 Canada The Journal of Protective Coatings & Linings (ISSN 8755-1985) is published monthly by Technology Publishing Company in cooperation with the SSPC (877/281-7772). Editorial offices are at 2100 Wharton Street, Suite 310, Pittsburgh, PA 15203. Telephone 412/431-8300 or 800/837-8303; fax: 412/431-5428

Subscription Rates: $90.00 per year North America; $120.00 per year (other countries). Single issue: $10.00. **Postmaster:** Send address changes to Journal of Protective Coatings & Linings, 2100 Wharton Street, Suite 310, Pittsburgh, PA 15203. Subscription Customer Service: PO Box 17005, North Hollywood, CA 91615 USA, Toll Free: 866 368-5650, Direct: 818-487-2041, Fax: 818-487-4550, Email: paintsquare@espcomp.com

Printed in the USA PAINTSQUARE www.paintsquare.com

Wow, It's 2015 Already!

In many previous January editorials, I have written of my hopes for you, the readers of the *JPCL*, and I will do the same for 2015.

When you receive this issue, there will be two or three weeks left until we gather in Las Vegas from February 3 to 6 for SSPC 2015. As I mentioned in last month's editorial, there are a lot of exciting agenda items for this year's conference, along with our training and educational programs. So my first hope for 2015 is that you will be able to come to Las Vegas and that I will be able to share a word or two with you. As you may have read in the December issue, this conference will be my last, as I am planning to retire later this year. This intensifies my desire for you to come to the conference so that I may have a dialog with you in person.

One of the highlights of the conference is the Awards Luncheon on Tuesday, February 3. During our annual Structure Awards, we will award coatings projects involving the military, and one of this year's awards will go to a large group of coatings professionals who donated resources — whether that was manpower or supplies — in painting numerous armored vehicles at the Armor and Cavalry Museum at Ft. Benning, Ga. Two members of the museum's board of directors, along with the executive director, are scheduled to be at the Luncheon to present special awards to those individuals who participated in preserving the heritage of the Armor and Cavalry soldier. Those presenting the awards will be George Harmeyer, major general, USA, (ret.), chairman of the board; John Sylvester, lieutenant general, USA, (ret.), vice chairman; and Ricky Young, command sergeant major, USA, (ret.), executive director. Some may remember John Sylvester, who spoke in person at one of our SSPC shows and spoke a second time via teleconference when he was the chief of staff of the United States European Command.

My second hope for 2015 is for everyone has good health throughout the year. It seems that life is more stressful than ever. Stress affects health, and without good health, do other things really matter? Find a way to control your stress so that you may have a healthful 2015 and beyond.

I also hope that all of you have success in your careers and reach that feeling of self-esteem that we all strive for. When SSPC started the Coatings Applicator Specialist (CAS) program, I emphasized to everyone that that this was not about making money for SSPC, but about having the person at the end of the blast nozzle or the end of the spray gun feel good about him or herself, as he or she was performing meaningful and important work in combating corrosion. It makes me feel good when I hear that someone was at a job site and the workers had CAS stickers on their hard hats.

My next hope is that my successor feels just as fortunate as I have in being the executive director of this association. This person will be directing one of this association's most valuable resources — the outstanding staff. He or she will also have the privilege of working with some superb volunteers and members. I wish my successor and the entire staff Godspeed and the very best for 2015 and beyond as they chart this organization's path forward.

So for 2015 I wish you health, wealth and prosperity. I hope you take a minute to think of all the good things in your lives and be thankful for them. Make a goal in 2015 to have a better year than the last, which I hope you achieve. And finally, on behalf of the Board of Governors and myself, I want to thank all the members, the staff, and our readers for a good 2014.

Bill Shoup

Bill Shoup
Executive Director, SSPC

2015 Kicks Off With Two New, Free Webinars

The SSPC/*JPCL* Webinar Education Series will open its 2015 slate of offerings with two new, free online webinars.

Clint Ramberg

"Unique Rigging Applications for Suspended Scaffolding," will be presented by Clint Ramberg of Spider Systems Group on Tuesday, Jan. 20, from 11:00 a.m. to 12:00 noon, EST. This webinar is designed to help users solve complicated rigging application challenges that may arise on an array of different coatings and construction projects. Learn from examples and case studies about tank rigging, structural steel bridges, dams, angled wire ropes and rigging stairs.

Ramberg is the director of Spider Systems Group, a division of Safeworks, LLC. He has almost 20 years of experience in the scaffolding industry, with knowledge of both supported and suspended scaffolding, as well as industrial access and fall-protection solutions. Ramberg has developed access and safety solutions in the power generation, refining, structural steel and commercial high-rise markets. He has assisted in the development and instruction of the Spider Competent Person Training Program, he lectures for many industrial and commercial trade associations and consults on specialized rigging and safety applications.

PAINTSQUARE.COM JPCL SSPC The Society For Protective Coatings

Webinar Education Series

L. Skip Vernon

"Developing and Administering an Effective Coating Specification," will be presented by L. Skip Vernon of Coating & Lining Technologies, Inc., on Wednesday, Feb. 18, from 11:00 a.m. to 12:00 noon, EST. This webinar will describe the best practices for preparing and administering a quality specification for applying protective coatings and linings to industrial structures. A well-prepared, well-administered specification helps ensure that the contractor performs the work required in the allotted time. The presentation will focus on developing appropriate requirements for applying coatings and linings to obtain maximum system performance, service life and protection of substrates in the prevailing service environment.

Vernon, owner of Coating & Lining Technologies, Inc., and president-elect of SSPC, has over 40 years of experience in the coatings and linings industry. He is the an SSPC-certified Master Coatings Inspector and a Protecting Coatings Specialist, and holds certifications from NACE, the American Society of Professional Estimators (ASPE), Construction Specifications Institute (CSI) and the Paint & Decorating Retailers Association (PDRA). He is a retired New Mexico State Senator, having served in that body from 1984 to 2000, including time as Senate Minority Leader from 1998 to 2000.

Registration, CEU Credits

These programs are 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 paintsquare.com/webinars.

JPCL Mourns Passing of Contributing Editor Mark Schilling

On Dec. 7, 2014, the coatings industry said goodbye to Mark Stephen Schilling, 59, of Monmouth Beach, New Jersey. Born in Detroit, Schilling lived most of his life in Southern California. He had over 30 years of experience in the industry, having served most recently as a senior consultant for Corrosion Probe, Inc. He was a contributing editor of *JPCL*, authored a vibrant column entitled, "Truth & Consequences" and won the *JPCL* Technical Achievement Award in 2002. He also wrote many features for *JPCL* that focused on tank-lining materials and procedures, and was a frequent contributor to early "Problem Solving Forum" answers. In all his writing and speaking, Schilling was a passionate advocate for accuracy in technical communication.

Mark Schilling

He was a longtime member of SSPC and was elected to the Board of Governors in 1990, serving through 1994. In 1997 Schilling earned his Protective Coatings Specialist (PCS) certification from SSPC. He was a member of the SSPC Standards Review Committee (SRC), serving as Chairman from 2002 to 2005. Schilling was active on other SSPC committees as well including Epoxy Polyamide, Polyurethane Coatings, Application Methods, Thermal Spray, Surface Preparation and the Education committee.

Schilling is survived by his wife, Natalie; son, Matthew; and daughter, Juliana; his mother, Marie; two sisters, Nancy Armstrong and Marie Wood; and his nephew, Ryan Armstrong.

Donations in Mark Schilling's honor can be made by visiting the Run for Research page set up by his daughter at http://bit.ly/1CROVWO. Contributions will provide for community-based education, research, support and advocacy related to preventing liver disease.

Chris Mathis to Keynote at D+D 2015

Durability + Design 2015, *Durability + Design* magazine's second annual conference and exhibition, will take place from June 8 to 10, 2015, at Eden Roc Miami Beach hotel and resort. This yearly event on architectural coatings and substrates will feature top-level presenters and leading experts in architecture, building science, protective coatings technology, engineering, specifying, green building, restoration, color and more.

Chris Mathis, owner of Mathis Consulting Company (MC²), is slated to present the conference's keynote lecture, "Why Buildings Matter and the Role of Durability in Sustainability," on Tuesday, June 9, at 8:30 a.m. Mathis has spent the past 35 years focusing on how buildings and building platforms perform — from energy efficiency to long-term durability and sustainability.

Chris Mathis

D+D DURABILITY+DESIGN MIAMI 2015

The Conference and Exhibition for Architectural Coatings and Substrates

Mathis received his undergraduate degree in physics from the University of North Carolina at Asheville and his Master of Science degree in architecture studies from the Massachusetts Institute of Technology (MIT), where his work centered on energy use in buildings. He has served as a scientist in the Insulation Technology Laboratory at the Owens-Corning Fiberglas Technical Center; was the director of the Thermal Testing Laboratory for the National Association of Homebuilders (NAHB) Research Center; and was the director of marketing for Architectural Testing, Inc. Today, Mathis and his consulting team focus on improving buildings, building products and the codes and standards that govern them.

For more details and to view the entire Durability + Design 2015 program, visit durabilityanddesign.com/show.

Early-Bird Registration Announced

The deadline for early-bird registration for D+D 2015 is February 28, 2015. Attendees who register before this date will receive a discounted rate of $149.

To register, visit durabilityanddesign.com/show and click the "Register Now" tab.

Association partners for the conference include the Air Barrier Association of America (ABAA), American Coatings Association (ACA), American Institute of Architects (AIA) Miami, U.S. Green Building Council (USGBC) South Florida Chapter, Finishing Contractors Association (FCA), Master Painter's Institute (MPI), Roof Coatings Manufacturers Association (RCMA), Specification Consultants in Independent Practice (SCIP), and SSPC.

The Buzz on PaintSquare.com

Now Buzzing on PaintSquare . . .

"Grand Jury Calls MWBE Fraud Rampant" (Dec. 1)

© iStockphoto.com/ozgurdonmaz

A New York grand jury has found evidence of rampant MBE/WBE contract fraud in the city and state. DCM Erectors, the primary structural steel erector for 1 World Trade Center (above), was indicted along with CEO Larry Davis in October on charges of WMBE contract fraud. The projects included a $330 million contract for the 1 WTC transit hub.

What's Got Us Talking

"PA Taps Chinese to Fund I-95 Project" (Dec. 2)

Leveraging an immigration program that rewards wealthy foreign investors with U.S. visas, Pennsylvania is reaching into pockets overseas to fund much of a $420 million project to link I-95 with the Pennsylvania Turnpike. The funding plan, overseen by a limited partnership known as Delaware Valley Regional Center (DVRC), is rapidly subscribing Chinese investors at $500,000 a pop to pay for the massive project. The first part of the project funding, known as Tranche I, sold out Nov. 25, according to DVRC, and Round II of fundraising "will be available shortly," the group says.

Construction on the I-95/Turnpike project began in October.

John Fauth: *"Talk about a double-edged sword. This has all the flavor of a Nigerian Prince/Ghanaian General hoping to swindle those long on greed and short on common sense."*

Chuck Pease: *"WOW. What a circus. I guess I better have the kids and grandkids take up lessons in the Chinese language!"*

Anthony Kavouris: *"Despicable and deplorable. The quasi-governmental officials responsible for this one are truly selling us and the U.S. out!"*

Get the coatings industry buzz at paintsquare.com, or scan the QR code for instant access!

PSN TOP 10 (as of Jan. 2)

- Prison Terms Set in Marine Coating Case
- Paint Stripper CEO Accused of Bribery
- 'Widespread' PennDOT Scandal Nets 10
- Floating Silos Fall, Halt Concrete Work
- $120K Fine Set in Cellphone Tank Blast
- Concrete Maker's Plea Averts Prison
- Bottle Breaks Bridge's New Glass Floor
- Blast, Fire Injure 1 at Sherwin Plant
- 30 Years On, Lessons from a Catastrophe
- Sherwin-Williams Reins in Outlook

MOST POPULAR QUIZ (as of Jan. 2)

Which of the following is not an inhibitive pigment used in coatings for corrosion control?

A. Zinc dust
B. Zinc phosphate
C. Barium metaborate
D. Calcium borosilicate

Answer: Zinc dust. Zinc dust is a sacrificial rather than an inhibitive pigment. For a discussion of inhibitive pigments and their mechanisms of protection of steel, see Clive Hare's Protective Coatings: Fundamentals of Chemistry and Composition.

Assessing Coatings On Buried Pipelines

How do you gauge the remaining service life of an aging fusion-bonded epoxy (FBE) system on a buried transmission pipeline?

Warren Brand
Chicago Coatings Group
My understanding of fusion-bonded epoxy is, that, well, it is an epoxy. Due to the fact that it is buried, it is not exposed to one of epoxy's most nefarious enemies, UV. If we were hired to run this problem, we would look at the original specifications of the material and conduct various tests to determine how closely the old material compared to the original specifications. We would compare hardness, adhesion, and likely do some other tests as well, such as a solvent wipe. However, from doing this type of work for a really, really long time, the appearance of the FBE would likely provide a very good idea of its condition. If it looks good, that's a very good indication that there has been no degradation of the material. I've heard that epoxies, over time, tend to embrittle. I'm not sure how, and if, this applies to FBEs.

Barry Turner
Axson Coatings
It is difficult to be precise when answering this question. FBE-coated pipelines have been in service for many years in all parts of the world and are operating at different temperatures, so there is a good track record on which to base a general assumption. Being more scientific about it, one of the first signs of degradation is visual. FBE generally fails by blistering due to water penetration or thermal degradation, as evidenced by visible discoloration or even charring because the operating temperature was high (depending on cured Tg) and oxygen content in the soil.

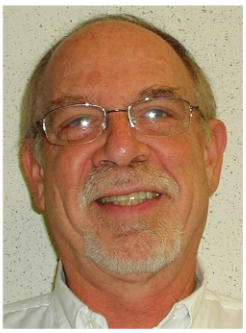
Older FBE-coated pipelines may suffer problems, particularly at girth welds, due to the older coating technologies used at the time. It may be that tests such as cross-cut adhesion or impact will show some deviation from the original specification also. In the end, however, estimating remaining lifetime is a very difficult question that is probably left to experience and reference to similar pipelines already in service.

Lydia Frenzel
Advisory Council
I just got back from a Crude Pipeline Asset Integrity Congress. The pipeline is buried. You can't get to the coating without digging up the pipe. So the

industry relies on smart pigs, looking for corrosion problems, and doesn't have a good handle for external coating issues which range from tree root damage, to pinholes, to cathodic disbondment, to resting on rocks that cause damage. I was showing in-the-ditch (in-situ) examination where the pipeline is uncovered. When the old coating was removed, some of the pipe was still in very good condition; some had extensive pitting and active anodic cells. However, the pipeline industry in the U.S. just opens small bell holes and examines the pipeline, let's say, 100 feet at a time. They almost never uncover a buried pipeline, even if aged. I don't have a good answer because I didn't hear anyone talk about a smart pipe-pig that could measure discontinuities or pinholes or blisters in the external or internal coating. This question is about remaining life, so one would think that a comparison was in order. This question was discussed: when should one start a base-line study for the pipeline? Answer: the first month as it is being put down. Of course, AC and DC corrosion is playing a part under the coating. They had a lot of data collection; none as far as I could tell related to the coatings.

Have a coating problem you'd like help with? Submit your question to paintsquare.com/psf for publication consideration.

Problem Solving Forum questions and answers are published in *JPCL* and *PaintSquare News*. To subscribe, visit paintsquare.com/subscribe.



Q&A with Lloyd M. Smith, Ph.D.

Lloyd M. Smith, Ph.D., is a coatings consultant with over 35 years of experience in the corrosion and coatings industries. Though he retired in 2012, he still works part time for Greenman-Pedersen, Inc. (GPI), and operates Lloyd M. Smith, Ph.D., LLC, where he does consulting and teaching. Before joining GPI, Smith worked for Federal Highway Administration (FHWA), S.G. Pinney & Associates, Inc. and Corrosion Control Consultants & Labs, Inc. He was a member of SSPC's first-ever Board of Governors, and he continues to teach a number of SSPC courses, including C3, Lead Paint Removal, and C5, Lead Paint Removal Refresher. "Lead is my middle name," he says.

Smith is an SSPC-certified Protective Coatings Specialist (PCS), a member of ASTM and NACE International and a contributing editor of *JPCL*. He has received numerous awards from industry associations, including SSPC's Coatings Education and Outstanding Publication Awards. He holds a Bachelor of Science degree in chemistry from the City College of New York and a Ph.D. in inorganic chemistry from the State University of New York at Buffalo.

JPCL: How did you get your start in the coatings industry?
LS: I forgot to duck. (laughs) After getting my Ph.D., I was working for FHWA in their Office of Research, where I was in charge of programs on waste utilization and non-corrosive deicers. I worked there with Dr. Bernard Appelman (who later became the executive director of SSPC), and I helped out on some of his research contracts. When he left FHWA, I took over the research program on coatings and corrosion control on atmospherically exposed steel — bridges and culverts, basically. Then, in 1985, I left for a coatings consulting firm, and I've been doing that ever since.

JPCL: What originally attracted you to coatings, and what are some of the aspects of the industry that keep you interested to this day?
LS: I'm a chemist and a scientist, so the application of the chemical and scientific principles to what I was seeing out there in the field intrigued me. I also liked that the industry was a small, niche market for Ph.D. chemists. I always say that I've got a jacket-and-tie mentality and a jeans personality, so the work suited that. Some days, I'd be in jeans and work boots out in the field, while other days I'd put on a suit and tie and go to court.

JPCL: With that said, is there a side that you prefer more? Would you rather be out in the field getting your hands dirty, in the laboratory running tests, or doing something else?
LS: I like solving problems. When I got out of school in my first job, I realized that I didn't want to be in the lab all day. That's another reason this job fits my personality. I enjoy doing failure analyses and teaching, so those are the two main things I focus on now.

JPCL: What has been the most significant development or change that you've seen in the coatings industry over the course of your career?
LS: When I started out, we were using oil-based alkyd paints on bridges, and I've watched the transition to using the zinc-rich, epoxy and urethane system. So the advancements in coatings technology have been the biggest changes for me. I've also seen changes in the way painting projects are managed. There's more professionalism, with an emphasis on certifications and quality control, than there was when I first started.

JPCL: Some of that, one might argue, could be attributed to the growing presence of SSPC and other industry associations like it. As someone who was on SSPC's first-ever Board of Governors, can you comment on the growth of SSPC and the role of associations in the industry that you've seen in your career?
LS: I remember my first SSPC meeting back in 1979 or 1980, when there were maybe 100 to 150 people, meeting at a hotel near the Pittsburgh airport. Back then, all we did was focus on committee meetings. I've watched SSPC grow from there, to having the conference in Las Vegas this February, with thousands of

people coming. Now people go to the annual meeting and conference and come to learn.

JPCL: What has been the highlight or proudest moment of your career?
LS: Every time I figure out a really hard failure. When the reason for the failure is not immediately obvious — when I solve one of those, that's when I get my biggest high.

JPCL: If you had to go back and choose a different career for yourself, what would it be, and why?
LS: I have a Ph.D. in chemistry, so it would be something to do with chemistry, but I don't know what it would be. I still remember the words of the professor who mentored me when I got my Ph.D. As I was leaving, he said, "Remember, what we really taught you here is how to think. Forget about the specific research project you did for your thesis — you'll never find a job there. What we really taught you was how to solve problems."

I look back at my life and I say, "Hey, when I came out of school, if I thought I'd be in the paint industry …" I mean, I didn't even know about industrial coatings when I left graduate school. So I can't really say what I would do differently.

JPCL: What advice would you give a young person looking to get into the coating industry? Do you feel that it is a good industry to pursue a career in moving forward into the future?
LS: I think it's a very good industry. The perception of coatings from a technical standpoint is not the highest. The "painting" industry — it doesn't really have the pizzazz of aerospace, computers, healthcare and other areas that chemists and other scientific people can go into. But you've got to determine what you want to do.

A coating formulation is such a complex thing, that when you start to apply or think in terms of your basic chemical knowledge, you realize that there's an awful lot here that we don't understand. We haven't advanced the technology to understand everything. Also, let's remember you're looking at different career paths. You have the paint companies, the people trying to formulate paints. You've got the owners who are concerned about corrosion protection of their assets. That's a different sort of chemistry going on than just the paint. Now you're concerned about how steel rusts, or how concrete deteriorates, and how do these coatings work in these situations? There are so many different areas you could go into if you're interested in this kind of work.

One of the things about this industry is, where are the young people? I've worked with some of them, but for the most part, where are the younger people who are going to take over for us grey-haireds when the rest of us retire? There's certainly a lot of opportunity for young people in this industry.

Smith holds up a 41-inch-long striped bass that he caught in the Chesapeake Bay, just south of Annapolis, Md.

JPCL: How's the transition into retirement going?
LS: Very well. I planned for it — I live my life on a series of five-year plans. My problem right now is that I have more work than I want! I'm still doing the same type of work I've done for the past 30 years as a consultant, and I still enjoy it. But trying to make sure I have enough time for myself — sometimes, that's a tough job. It is nice not having to go into work every day, though. Right now, I'm sitting at home, I just got back from lunch, and I feel like I've got all the time in the world.

JPCL: How do you like to spend your free time, now that you have some of it to enjoy?
LS: My two main activities right now are fishing, and trying to learn how to play golf. I live on the Chesapeake Bay, so I try to get out on the water at least once a week. I belong to a boat club — they have many different types of boats, so I may just grab a run-about and take a tour or go somewhere by water for lunch instead of going fishing. And I have my vegetable and herb gardens to take care of in the summer, as well as taking the occasional cooking class at the local community college. But most of all, I have four grandchildren that are in desperate need of being spoiled.

Fig. 1: This is the backside of an epoxy coating on structural steel that rusted and failed prematurely. The steel was supposed to have been prepared to a Near White blast (SSPC-SP 10/NACE No. 2), but microscopic observations clearly show the presence of large amounts of black mill scale. All figures courtesy of the author.

Investigating Failure: Microscopy

By Dwight G. Weldon, Weldon Laboratories, Inc.

Microscopy is usually the first step taken in the laboratory when doing a failure analysis. It, along with scanning electron microscopy, will be covered together in this column.

The first optical microscope (or light microscope) was invented by two Dutch spectacle makers, Zaccharias Janssen and his son Hans, around 1590. With crude lenses, this early compound microscope had a magnification of only around nine times. In the following century, Antonie Philips van Leeuwenhoek, an apprentice in a dry goods store who used magnifying glasses to count threads in cloth, fabricated much better lenses and constructed the first truly useful compound microscope, with a magnification of nearly 300 times.

Modern light microscopes can magnify objects up to around 1,000 times. However, these high-powered microscopes are often not nearly as useful for failure analysis as the stereo zoom microscope. Relatively large objects (think rusted, painted steel) can be easily manipulated under such microscopes, which provide good depth of field and magnifications up to around 150 times, although most failure analysis work is done at magnifications from 10 to 50 times. Recently, digital microscopes have been introduced that have a large magnification range, good depth of field and software that allows measurements and annotations to be made directly on the recorded image.

There are a number of reasons why a paint or coating might fail prematurely. The paint could be too thin or too thick. It could be full of voids, making it overly porous. Perhaps only two coats of a three-coat system were applied. The coating may not have flowed out properly, with excessive orange peel that may have compromised its barrier properties or even its adhesion due to insufficient wetting of the substrate. It may have been applied over dirt, mildew, mill scale (Fig. 1) or other contaminants. There may be a thin, glossy surfactant exudate on the surface, which is holding dirt. Or perhaps the "adhesion" failure was actually a cohesive failure in a

Even if the cause of the failure is not obvious upon microscopic examination, clues may be uncovered which might suggest other areas of study.

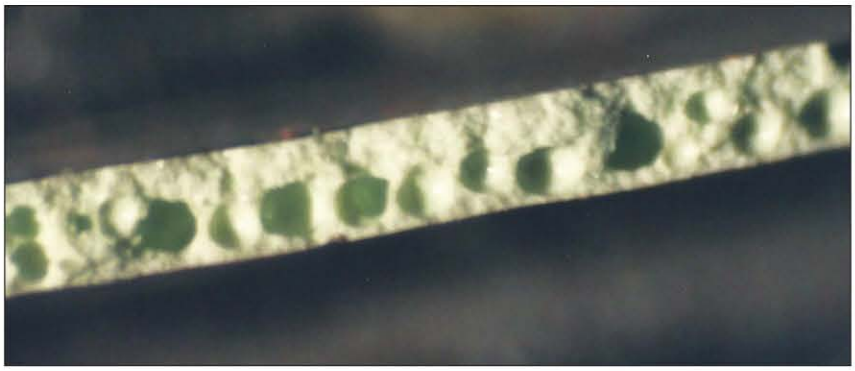


Fig. 2: This urethane shows poor adhesion to an underlying epoxy primer. Microscopic observations show a layer of voids near the back surface, indicating that the coating may have been applied over moisture.

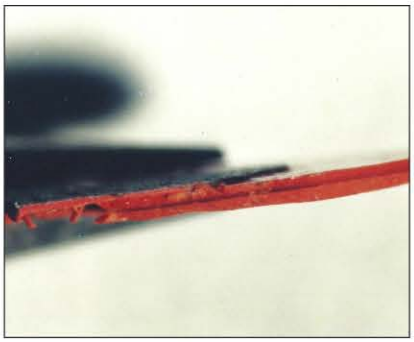


Fig. 3: This photo shows a cross section of what was supposed to have been a red base coat and a clear topcoat. However, the "clear topcoat" is actually the middle coat of a three-coat application.

Fig. 4: This epoxy coating was removed from a concrete floor. The owner was concerned that the coating was overly prone to wear and mechanical damage.

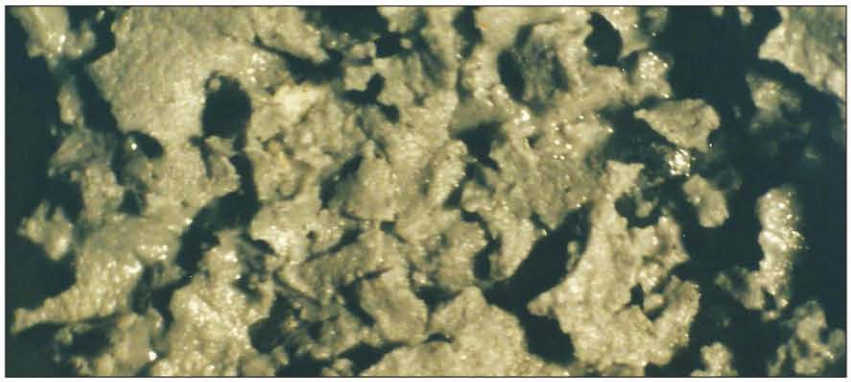


Fig. 5: This is the same chip of epoxy as shown in Figure 4 after a few drops of MEK were applied. The chip quickly became soft and gummy, suggesting that it had been applied at the wrong mix ratio.

lower coat of paint, or in a friable substrate such as spackling compound. A urethane might show a layer of excessive voids on or near the back surface of the coating. This indicates that the coating was applied over moisture, which can cause the formation of voids (Fig. 2) as the isocyanate reacts with water and forms carbon dioxide gas. All of these features can be observed with a good stereo microscope.

Furthermore, even if the cause of the failure is not obvious upon microscopic examination, clues may be uncovered which might suggest other areas of study.

Figure 3 shows the cross section of a chip that was removed from a structure that was to have been painted with a red basecoat followed by a clear topcoat. The paint did not achieve the gloss retention expected of it. Almost inexplicably, when examined microscopically, the chip actually showed three coats, with the clear topcoat being in the middle.

A non-skid epoxy coating was applied to a concrete floor. The owner was very unhappy with its performance, as it was softer and much more prone to wear and mechanical damage than expected. Figure 4 shows a chip of this coating viewed under the microscope, while Figure 5 shows the same chip after a brief exposure to a few drops of methyl ethyl ketone (MEK) followed by gentle probing with an X-ACTO knife. The coating had extremely poor solvent resistance and turned into a soft, gummy mess. The observations indicated that the epoxy coating had not been applied at the correct mix ratio.

A light microscope obviously involves the focusing and collection of light. A scanning electron microscope (SEM) involves the focusing and collection of electrons. Without going into the underlying theory, suffice it to say that electrons have much better resolving power than visible light, which means that the electron microscope, developed in the 1930s, has much higher magnifying power than a light microscope. While an electron microscope can achieve magnification of over 100,000 times, most failure analysis work is done at about 100 to 1,000 times.

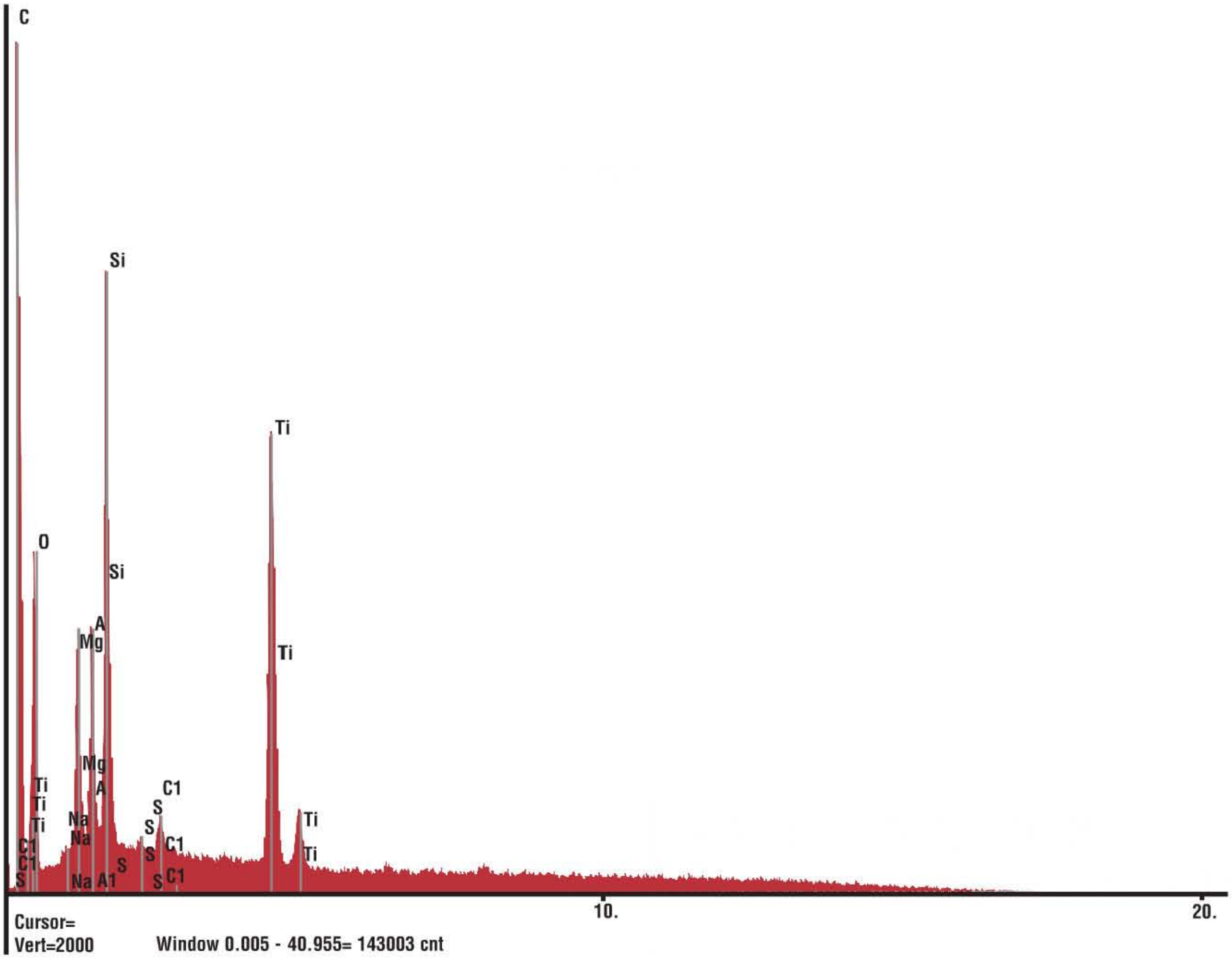


Fig. 6: This figure shows the X-ray spectrum of a primer obtained from a scanning electron microscope equipped with an energy dispersive X-ray spectrometer.

But, you might be thinking, why bother with such an expensive instrument if you are only working in the range achievable with a good light microscope? There are two answers to this question.

First, at high magnification, an SEM has much better depth of field than a light microscope. This means that objects can be viewed in a more three-dimensional way, which sometimes gives a better understanding of their possible significance in the failure.

Second, and more importantly, if an SEM is coupled with a special type of detector called an energy dispersive X-ray spectrometer, one has an extremely powerful tool called scanning electron microscopy-energy dispersive X-ray spectroscopy (SEM-EDS).

Unlike other spectroscopic techniques, EDS does not involve the interaction of electromagnetic radiation with matter, but instead involves the interaction of high-energy electrons. These electrons are produced in an electron gun (the key part of which is a hot filament), accelerated via an applied electrical voltage or potential and focused on the sample with a series of electromagnetic "lenses." The sample, which can actually be reasonably large, is mounted on a movable stage contained in a vacuum chamber. Some of the high-energy electrons from the electron gun kick out or eject electrons from the elements making up the sample. Again, without delving too deeply into atomic theory, when an electron is ejected from an element, some of the remaining electrons will "readjust" themselves to obtain a lower energy configuration (sort of how people might "readjust" their seats in the ninth inning of a baseball game). When an electron drops from a high-energy "location" to a lower-energy configuration, the excess energy is released in the form of an X-ray. The energy of the emitted X-ray depends on the chemical element from

which it was released, which allows the element to be identified. For instance, the energy of the main X-ray emission from magnesium is 1.25 kiloelectron volts (keV), and the main X-ray emission from chlorine is 2.62 keV. The depth of penetration of the high-energy electrons is typically only a few microns, so it is only a very thin surface layer that is actually being analyzed. This is usually a good thing, as coating failures often involve interfacial phenomena.

Figure 6 is an X-ray spectrum obtained from a primer. The bottom, or x-axis, is the energy (in keV) of the collected X-rays, while the vertical y-axis is an intensity unit. The positions of the peaks along the x-axis allow the various chemical elements to be detected, and their concentrations are proportional to the height, or area, of the peaks. The spectrum shows that the primer contains carbon, oxygen, magnesium, aluminum, silicon and titanium, and possibly a trace of sulfur. The carbon, and perhaps some of the oxygen, is coming from the resin. The sulfur is likely from the environment. The other elements suggest the presence of magnesium silicate (talc), aluminum silicate (china clay), titanium dioxide and also possibly silica pigments.

SEM-EDS can be very useful in failure analysis. The detection of sodium chloride or other salts in corrosion products might suggest a reason for premature corrosion. The presence of fluoropolymer coatings can be confirmed by the detection of fluorine. A paint chip which appears to have peeled from galvanized steel might have a thin layer of zinc on the back side, suggesting that the problem is with the galvanizing and not with the paint. The presence of certain elements on the backside of a failing or blistered lining might indicate that it is being permeated by the tank contents, or that surface preparation was poor. The detection of traces of chromium on the surface of a metal substrate underneath peeling paint likely confirms the presence of a pretreatment.

One thing that SEM-EDS is not good at is detecting organic contaminates, such as grease, oil, exudates, and blushes. The proper tool for that task is infrared spectroscopy, which illustrates the importance of understanding the various laboratory tools available for failure analysis.

JPCL

Basic Training

Field Identification of Concrete Contaminants Commonly Encountered in Wastewater Environments

By Vaughn O'Dea, Tnemec Company, Inc.

Concrete is inherently durable and is used extensively in both industrial and municipal wastewater construction. However, concrete structures can quickly deteriorate due to exposure to some contaminants unless properly protected with high-performance coating systems. Other contaminants may not necessarily be deleterious to concrete but can affect the adhesion of protective coatings. This edition of Basic Training discusses common types of concrete surface contaminates found in wastewater environments and several field detection methods that can be used before and after performing surface preparation.

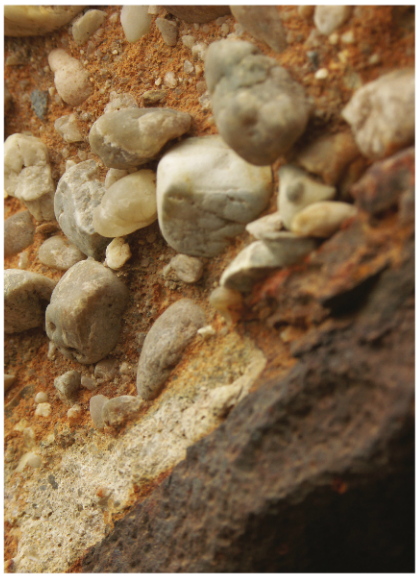


Fig. 1: Contaminated concrete remaining on surface following surface preparation. All photos courtesy of the author.

What is Surface Contamination?

Simply put, surface contamination is the presence of harmful materials that may attack concrete, reinforcing steel or impede the adhesion of a protective coating. In the case of wastewater concrete structures, contamination may arise from exposure to chemicals such as acids, sulfates or carbonation; visible contaminants such as fats, oils and grease (FOG), dirt or dust particles; or non-visible contaminants such as soluble salts. Contaminants should be properly identified and removed prior to the application of a high-performance coating system (Fig. 1).

Some Common Surface Contaminants

Acid Attack

Portland cement has poor resistance to acids, especially mineral acids such as hydrochloric, nitric or sulfuric. All strong acids (those with a pH of less than 4.5) and many weak acids (those with a pH of 5.5 to 6.5) can effectively dissolve the cement matrix that binds the aggregate in the concrete. In most cases of acid attack, the chemical reaction results in the formation of water-soluble calcium salt compounds that are leached away by the aqueous solutions. If allowed to progress, the cement binder paste securing the aggregate is eventually attacked — exposing the aggregate — and ultimately affecting its integrity.

Sulfate Attack

Portland cement can also be degraded by exposure to solutions of sulfate salts. Sulfate attack occurs when soils, wastewater solutions or enclosed sewer headspaces contain sufficient sulfate levels which react with the cementitious paste of the concrete. Generally, deterioration starts at the contact zone between the concrete and the sulfate-containing environment, forming a propagating front. The consequences of sulfate attack include disruptive expansion and cracking and the decrease of strength of the concrete due to the loss of cohesion in the hydrated cement paste and adhesion with the aggregate particles. Sulfate attack can be progressive with further reaction occurring throughout the concrete interior as long as sulfate ions are able to penetrate the concrete interior.

Carbonation

When exposed to carbon dioxide (CO_2), Portland cement produces a carbonate reaction — termed carbonation — that is effectively a neutralization of the alkaline components in concrete. The source of CO_2 can be either the atmosphere, water carrying dissolved CO_2, or microbial production of CO_2 that forms a surface acidification of carbonic acid. Carbonation of the surface layer of concrete does not intrinsically damage concrete. Instead, carbonation generally proceeds as a front that decreases the pH of the pore solution to approximately 8.5 to 9. At this pH level, the passivation layer on reinforcing steel is not stable and is ultimately destroyed allowing for corrosion. Beyond this penetration depth the concrete is not affected and the pH is not reduced.

FOG

The accumulation of fats, oils and grease is the greatest single factor in sanitary sewer overflows and has become a major concern for wastewater municipalities in recent years. Not only does FOG cause sewer blockages, it proves to be damaging to concrete as fatty acids and oils float on wastewater and deposit onto concrete surfaces. As FOG breaks down by hydrolysis, acidity increases as a product of fatty acid release at the oil-water interface. FOG also reacts with the alkali in the cement binder, producing a soap and glycerin that can turn into powder. However, even if FOG does not attack the concrete, it can contaminate the concrete surface ultimately affecting adhesion of a protective coating. It is important to properly remove any fats, oils and grease by pre-cleaning with an alkaline detergent, steam or an approved commercial product that emulsifies the oil and grease for subsequent removal. Solvents, high-pressure water cleaning, or both, can also be used to assist in the removal of grease from the surface. Removal of hydrophobic chemical contaminants should be accomplished before any other surface preparation takes place. Another possible source for oil on the concrete surface is from the surface preparation equipment. Abrasive blasting is commonly used to mechanically prepare concrete in wastewater projects. Air compressors used for supply air for abrasive-blasting equipment can be a source of oil if not properly maintained and outfitted with an oil separator and moisture trap. A contractor could unwittingly be contaminating the surface with oils during the abrasive-blasting or air blast cleaning process.

Field Assessment Methods

Concrete must be assessed before and after surface preparation and prior to the application of a protective coating. Several field assessment methods are relatively easy to perform and produce qualitative or quantitative results.

Phenolphthalein Test

This test is essentially a pH test indicating the depth at which the concrete is reduced below about a 9 pH. The test is performed by simply spraying a solution of 1 percent phenolphthalein in 60-to-70 percent isopropanol diluted with deionized or distilled water (1-to-2) onto the prepared concrete surface. The application of the phenolphthalein solution to a concrete surface will appear pink if the pH is higher than approximately 9.

Fig. 2: This image illustrates the water drop test being performed with water flowing (wetting) the concrete surface.

Fig. 3: A water bead forms on a contaminated surface.

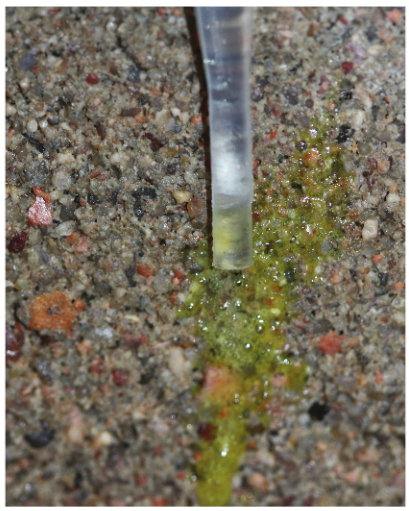


Fig. 4: This image illustrates the muriatic acid drop test producing a yellowish-foaming reaction.

Surface pH Testing

In lieu of a visual indicator, a quantitative verification of pH can be accomplished by measuring the chemical pH of cement dust removed from a vertical or horizontal surface using pH paper or a pH meter. This method requires the collection of cement paste from the prepared surface into a plastic testing vial. Using a flat screwdriver, scrape a 1 mm layer of cement paste into the vial to collect a minimum of 0.5 grams. Add distilled or purified water to the vial maintaining a 1-to-2 dilution ratio. For example, 0.5 grams of cement paste would be diluted with 1 milliliter of water. Close the lid, shake the vial for 30 seconds and then let it stand for two minutes. Measure the slurry solution using pH paper or a pH meter.

Blotter Test

The air supply used with abrasive blast cleaning equipment should be tested for oil and moisture in accordance with ASTM D4285, "Standard Test Method for Indicating Oil or Water in Compressed Air." A clean blotter sheet is held about 1 foot away from the stream of supply air for one minute and then visually inspected for signs of contamination.

Black Light Test

With this test, an ultraviolet (black) light is used to detect invisible grease or oil on cleaned concrete surfaces. A bright yellow or green fluorescence will indicate the presence of grease or oil.

Water Drop Test

Also called a water-break test, this visual test is often used to judge general surface cleanliness and the presence of hydrophobic contaminants (Fig. 2, p. 23). Oil and other penetrating contaminants will reduce the surface energy of the concrete substrate. When a drop of water is placed or sprayed onto these surfaces, the water will bead (Fig. 3, p. 23). A substrate free of penetrating contaminants will allow the water droplet to flow (wet) out over the concrete surface and immediately form a thin, continuous, uniform film of water. In this case, the theoretical contact angle is very small or effectively zero.

Muriatic Acid Test

If the water drop test is inconclusive, a few drops of muriatic (hydrochloric) acid may be dropped onto the surface. Muriatic acid will readily react with cement particles and produce a yellowish-foaming reaction (Fig. 4, p. 23). If there is no visible foaming reaction then a contaminant is present. After testing, the muriatic acid must be properly removed from the surface.

Translucent Tape Test

In this test, a clear, pressure-sensitive tape is adhered to the concrete surface to detect residual dust, dirt, or other loosely adherent solid contaminants. To run this test, a 2- to 3-inch-long piece of tape is placed on the surface and thoroughly rubbed with a fingertip. The tape is peeled off and placed onto a clean piece of white paper. If significant contaminant is observed, the surface should be re-cleaned in accordance with ASTM D4258, "Standard Practice for Surface Cleaning Concrete for Coating."

Conclusion

It is important to properly remove surface contaminants to preserve the integrity of a concrete surface and to facilitate the adhesion of coating systems in wastewater environments. Field techniques can be an effective method for a qualitative assessment of removal on vertical and horizontal concrete. In some cases, petrographic examination or other visual instrumental analytical methods may be required. Refer to SSPC-SP 13/NACE No. 6, "Surface Preparation of Concrete" for additional information.

Vaughn O'Dea is the director of sales for water/wastewater at Tnemec Company, Inc. and has 15 years of experience in the protective coatings industry. He is an SSPC-certified Protective Coatings Specialist (PCS); a NACE-certified Coating Inspector; an active participant on both SSPC and NACE technical committees; and a member of the American Water Works Association (AWWA), the Water Environment Federation (WEF), the American Concrete Institute (ACI), the International Concrete Repair Institute (ICRI) and the National Association of Sewer Service Companies (NASSCO). A graduate of the University of Kansas, Vaughn is also a contributing editor of the *JPCL* and was named a *JPCL* Top Thinker in 2012.
JPCL

2015 Coatings Industry Forecast

Thought leaders share their views on what's ahead

Gerald L. Witucki, Associate Coatings Scientist
Dow Corning Corporation

Three trends expected to impact the 2015 coatings industry are perennial favorites: regulatory compliance, such as volatile organic compound (VOC) emission control and environmental health and safety (EHS) issues; raw material costs; and the cost of labor.

Water-based coatings formulators are being challenged by regulatory and application demands to create coatings with performance matching that of traditional, solvent-based coatings. To support these development efforts, resin manufacturers are launching a new generation of functionalized resin emulsions, designed in response to an expanding list of performance demands, such as low-VOC, low-odor, self-crosslinking, early water resistance, low dirt pick-up, pigment efficiency and exterior durability. As these coatings evolve, traditional problem-solving technologies such as mineral oil defoamers are being found to be less effective. Formulators are turning to alternative technologies, such as polymeric siloxane defoamers to strike a new balance of miscibility and foam control.

Raw materials costs are impacting formulating and system specification decisions. The global price of oil, reversing a five-year trend, since July, has undergone significant reductions, but as a result of increased demand, supplies of titanium dioxide (TiO_2) feedstock and pigment have become tight, especially for the higher-grade pigments used in demanding applications. According to IHS Inc.'s *Chemical Economics Handbook,* TiO_2 prices rose about 35 percent in 2011. The dramatic increase in TiO_2 pricing has prompted many large users, especially in the coatings industry, to reduce use. Major coatings producers are looking to cut costs by sourcing TiO_2 from suppliers of lower-grade material for some applications.

While VOC regulations continue to tighten, forcing coatings formulators to redesign their products, labor cost changes have varied geographically. Over the last decade, U.S. wage growth has been flat. Only a handful of European countries have shown wage increases — and those, very modest. On the other hand, according to *Bloomberg News,* wages in China will likely show annual wage growth of between 10 and 15 percent from 2010 through 2015. Few, if any, countries are seeing a decrease in labor costs.

These shifts in material and labor costs, in particular for high-performance, protective coatings projects, influence the decision-making process for paint system selection. Many engineers, architects and property owners are now taking the long view and are opting to select premium performance paints, such as polysiloxane hybrids, to extend the repainting schedule and reduce paint usage, long-term environmental impact and ownership costs.

The coatings industry is in continuous flux. Global factors and regional influences create opportunities across the value chain. End-users, formulators, raw material suppliers and the environment will benefit from new technologies and a new focus on the long-term impact of our industry.

Michael Sellars, Managing Director, Elcometer

"While trying to predict the future we should start by looking to the past." When coating thickness gauges were introduced in 1947, long distance telephone calls had to be booked in advance, telexes were sent at 60 words a minute and the first PCs were still 35 years off. Today, cell phones allow us to call anyone in the world, at any time.

In 1984, microprocessor-based coating thickness gauges were launched and customers questioned why the gauges printed out readings. In 1991 they asked why gauges came with statistics. Now most customers require statistics, wireless communication to PCs and mobile devices, batching and very fast measurement speeds.

Technological advancements continue to influence global supply chains — faster internet speeds, video conferencing and cheap transportation costs now make it just as large structures are manufactured in multiple facilities around the globe — and freighted for final assembly.

With cloud computing and mobile devices, inspectors are able to digitally collect every aspect of their coating inspections and provide seamless, real-time access to the data across their organization. It is not unusual for an inspection company based in the United States, for example, to monitor in real-time the progress of hundreds of inspectors, working on thousands of projects around the globe, and obtain real-time progress reports and updates.

© iStockphoto/arekmalang

Throughout 2015, the coatings industry will continue to move away from writing measurements on paper. Seamless paperless QA software applications will be used to generate instant inspection reports for their customers — for all process parameters; profile, cleanliness, dry film thickness (DFT), adhesion and more.

In addition to global paperless QA, the coatings industry continues to strive for greater understanding of in-service performance of coatings in addition to their laboratory performance. Traditional laboratory tests need to become field based.

This is starting to happen as inspection equipment manufacturers develop more robust and easy to use field-based technologies. Recent research into how soluble salts crystallize across blasted steel surfaces, for example, has led to the development of cutting-edge field measurement techniques which will soon allow Inspectors to visualize the concentration of soluble salts on the surface (salt profile), in under five minutes, to a resolution of 0.1 cm^2 (140 $mils^2$), helping the industry to develop even more robust coatings in the constant battle against corrosion.

Additionally, the industry will continue to look to save money by speeding up inspection times. Scanning probes now allow the coating inspector to drag a probe across a coated surface, storing two coating thickness readings per second into memory, thereby providing them with a much more accurate and detailed understanding of the coated surface, in a fraction of the time.

Advancements in test equipment must allow inspectors to have a real-time understanding of the state of the coating, at every phase of the project, enabling coating inspectors to become a key part of the coating process — and not just checking a box at the end of each job.

Bill Shoup, Executive Director
SSPC: The Society for Protective Coatings

Trying to predict the future is a tough proposition and there are many experts who claim to excel at this, yet the majority that I see fail. That being said, my goal is to give you an idea of how we see the future from our perspective. Much of the future of this industry is driven by regulations and government involvement. The Republican Party has gained control of both the U.S. House and Senate and is perceived as pro-business. Therefore we may see regulations being curtailed, more tax incentives allowed for growing businesses and other major projects being started, for example, the Keystone XL pipeline. With Republicans in control of the U.S. Congress, military spending may increase, therefore improving opportunities for coatings industry stakeholders. However, in a recent radio piece I heard, a survey of economists stated that no matter which party is in power, they did not see much change in our economy and we should be focusing our concerns on the economic slowdown in China and Germany.

Everything we have seen and heard at SSPC says our membership, which consists of over 35 percent contractors, sees business as good, or better, than in 2014. The states that are heavily involved in either oil or the natural gas boom have seen an increase of coatings work in the industry sector. Western Pennsylvania's economy is quite healthy because of the Marcellus Shale work occurring here, however, the amount of drilling for shale oil could decrease in 2015 due to falling oil prices occurring right now. In a recent McGraw Hill Construction Outlook presentation I was privileged to hear, a 2.7 percent increase in the gross domestic product (GDP) was predicted in 2014, and a recent report by the Congressional Budget Office stated that they do not see that growth rate changing over the next few years. The McGraw Hill report also stated that the U.S. highway and bridges construction sector has been increasing steadily since 1988 with a few minor downturns over the years. Their data shows that between 2012 and 2014 there was an upswing in the amount of money being spent, but it was to decrease in 2015. Highway and bridge construction growth is really dependent on Federal government support. Since 2008, the Highway Trust Fund has been on the brink of bankruptcy with Congress always coming up with stopgap measures to prevent its insolvency. Until a long-term solution is found, predicting the amount of spending in that area remains a challenge.

As far as SSPC is concerned, we have challenges ahead. The coatings workforce is aging and getting young people interested in coatings and the vast number of jobs available in the industry is something this association will be working on for years to come. Communicating our message, that protective coatings remains the number one way to address corrosion, is a work in progress. We are still an association that focuses on the United States, but we see the potential for real international growth where training and education are sorely needed. To do this we need to work with other associations and individuals worldwide, informing them of what we have available and how we can make it a "win-win" for all. Marine and offshore continues to be a growing area for SSPC, especially in international regions where shipbuilding and ship repair are expanding. With continuing growth in energy exploration and development, both renewable and conventional resources, we see opportunities increasing globally for the coatings industry. Training and education will be the focus for SSPC for years to come. The content of the programs will adjust to keep up with changing coatings technology and our means of delivering the training will have to be flexible considering the continuous evolution of our electronic world.

Joe Payer, Ph.D., Chief Scientist
NCERCAMP, The University of Akron

"These are exciting times for corrosion mitigation, and we anticipate major advances for increased safety, reduced risk and reduced corrosion costs," notes Dr. Joe Payer, Chief Scientist of the National Center for Education and Research for Corrosion & Materials Performance (NCERCAMP) at The University of Akron.

A 2002 Federal Study, "Corrosion Cost and Preventive Strategies in the United States," FHWA-RD-01-156; September 30, 2001, remains a landmark study on costs and control of corrosion in the U.S. Total annual costs were estimated at the time to be $276 billion or 3.1 percent of the 1998 U.S. GDP. As

Joe Payer, Ph.D. continued

important as the costs findings, preventive strategies were identified with benefits, approaches and specific recommendations for improved corrosion control, increased integrity, durability and savings. There are major efforts underway dealing with implementation of these strategies.

There is a refreshing shift in emphasis from documentation of the huge costs of corrosion to emphasis on what can be done to reduce corrosion risk and costs. Systems Health Monitoring (SHM) combines monitoring of the current system status with prediction of future performance and failure states. The ultimate goal of SHM is twofold: to facilitate rational decision-making regarding the safety and reliability of a structure; and to show proper actions to take when safety or performance concerns arise, such as maintenance, repair or retrofit. There are great opportunities for technological advances that bridge the detailed knowledge of corrosion damage at the local level (pits and cracks) to full systems (vehicles, ships, bridges and power plants). The multi-level and coupled nature of degradation processes and damage evolution are important, and bridging methodologies for the treatment of full systems and specific assets are identified.

NCERCAMP leads the way in corrosion education, advanced corrosion science and engineering, and corrosion technology transfer to solve industrial and government programs. Home of the nation's only program to offer a Bachelor of Science in Corrosion Engineering, the first class of corrosion engineers will graduate in May 2015 and nearly 100 others are following. Industry and government, in particular the U.S. Department of Defense, identified the need for workforce development and have been most supportive. The Corrosion Squad is a multi-disciplinary, undergraduate organization of students. This group participates in corrosion research and gains practical experience through co-op work, visits to companies and from visitors to campus. Payer notes, "Our students are our most important product and will have the greatest impact in the fight against corrosion."

Conrad Keijzer
Executive Committee Member, Performance Coatings, AkzoNobel

In the coming year, we expect generally neutral to positive developments in the key end-use market segments for our performance coatings business, namely buildings and infrastructure, transportation, consumer goods and industrial. Growth is being led by high-growth markets although at a slightly slower pace than in previous years and weakness remains, particularly in parts of Europe.

The performance coatings business is continuing to invest to strengthen its position in the key growth economies. Examples include our new powder coatings factory that will open in Chengdu and a technology center that will open in Songjiang, China in mid-2015 serving all the performance coatings businesses. We have also recently opened a new powder coatings facility in Dubai, which is currently ramping up production.

The infrastructure market is strong in the developing world, although growth is slowing compared to previous years, especially in China. This is a key end-use sector for AkzoNobel's performance coatings business.

There continues to be some stress in the marine business, with freight rates remaining under pressure. Nevertheless, our commitment to innovation is helping our marine coatings business, with next-generation fouling control products introduced in the past year.

Industrial sectors continue to grow quite strongly, particularly the energy and utilities and chemical industries, although continued weakness in oil prices will slow investment somewhat. The oil and gas market remains quite strong, which is providing opportunities for our leading fire protection products as part of our protective coatings businesses.

There continues to be a drive to more sustainable products, which is increasing demand for many of our innovative products. These include fully recyclable coatings for paper cups, our water-based coatings for the automotive refinishing, and our new powder coating that can replace chrome plating in interior applications.

Deidre Dunkin, CEO, Dunkin & Bush, Inc.

The November 2014 Department of Labor Jobs Report provided a glimpse into the forecast for the U.S. economy in 2015; 321,000 jobs were added in November, the largest one-month gain in nearly three years, led by growth in professional and business services, retail trade, health care and manufacturing. Construction employment continued to trend up, with over half the gain reported among specialty trade contractors, although primarily in the residential sector. Of continuing concern on the labor front for all employers, is the flat participation rate; the impact of a retiring baby boomer workforce coupled with a growing skilled labor shortage. Remaining flat at 62.8 percent, it is hardly a surprise, as the skilled labor shortage has shifted from a trend to a truth, and as an industry the challenge continues to source, develop and retain skilled workers to adequately address the anticipated shortfall. The successful contractors, however, will have employed strategies years ago, as this hard data was forecasted, emerged, and has shaped the landscape for some time now.

What lies on the horizon for diversity in the industrial coatings industry? Nothing substantially different than 2014 with neither progression nor regression — merely the status quo. Female representation in the skilled workforce has gained little momentum as aggressive STEM programs (science, technology, engineering and mathematics) continue to push technology careers for females. A continued low level of support from U.S. Social Institutions for trades training turns the focus to college training and technology education for females.

Being a woman-owned business and a female CEO in the industrial coatings industry, I will face the same challenges as any other contractor in 2015. While I have the utmost respect for the organizations that push and value diversity spend, and those agencies that provide the certifications, the reality is, my experience as a female in this industry can't be shaped by my gender in the long term. That is a failing proposition. A strong work ethic, unwavering integrity, the ability to hire your weaknesses, and a drive for continuous improvement will shape my experience and determine whether my company is successful; not my gender. My gender may make me unique in this industry, and may be one of the many unique things about my company. It is a story that many like to tell, and may inspire others; my wish is that it does. But most importantly, the ability to forecast change in the industry whether regulatory, standard-based, technology and material driven, or otherwise; and proactively adapt long before the change, still remains one of the critical factors to drive success.

The changes that affect the industrial coatings industry which we will likely see in 2015 shouldn't impact my company, female or otherwise, if I have been paying attention; for we should be operating under the new rules long before they come to fruition, and find ourselves now looking ahead to anticipate the next shift. In a year nearly guaranteed to be remembered by a lack of political clarity, discord in our administration, the reality of the costs that go hand-in-hand with the healthcare mandate, and growing minimum wage initiatives, it is time to run offense, not defense. Generating a business plan, model or strategy around diversity in the year 2015 is a way to ensure that you need not worry about planning for the future, as you will likely be left behind.

Rodrigo Daud, President, U.S. Zinc

The protective coatings industry is seeing a changing environment going into 2015 and beyond, with regards to its raw materials. It is an exciting time for growth; it also presents challenges.

Zinc dust and zinc oxide are key raw materials that go into the production of protective coatings. These products provide essential ingredients that deliver protection properties to combat deterioration and corrosion.

Several zinc mines across the globe are

Rodrigo Daud continued

closing down due to depletion, creating a smaller pool of existing resources. As a mine reaches depletion, the ore is less zinc-rich. This causes increased operating costs to extract the ore and in turn, leads to lower recovery from zinc concentrate, which puts upward pressure on raw material costs. Ultimately, the price of zinc and zinc products rise for the end user of these critical ingredients in paints and coatings.

Additionally, the European Union (EU) is enforcing compliance with the standards under the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). REACH is an umbrella regulation that requires registration of all chemicals crossing the EU's borders and acts as notification to the importing country that the product is being sold within its borders. Many other countries are also adopting REACH standards and are requiring this registration across all zinc products. This adds cost in both production processes and administration, creating a barrier to entry for exporters of zinc products. As such, U.S. Zinc has invested in infrastructure to be REACH-registered.

Overall, the global economy is recovering, albeit slowly, fueled by investment in infrastructure and industry. Recent U.S. Zinc investments to increase capacity at its facilities are a prime example. Despite the challenges, we see positive signs for growth in 2015 and beyond in the paint and coatings industry, and look forward to continuing to supply the market as it grows.

Allen Irish, Director, Industry Affairs and Counsel
American Coatings Association (ACA)

The coatings industry, reflecting the economic downturn during the Great Recession, fell significantly from peak production in 2006–07 to a deep trough during the period 2008–10. Since that time, production has recovered to roughly the level last seen in the peak economy of 2006–08. With the industry having made up most of the output lost during the recession and the gradual recovery, what might happen in 2015?

ACA conducts an annual survey of the industry's senior leadership, including both raw material suppliers and coatings manufacturers, and this fall's results reflect relative optimism. A large majority of the nearly 70 industry leaders who provided their views on the upcoming year indicated their expectation for coatings industry growth was between 2 and 5 percent, although some indicated that they foresaw industry growth of between 5 and 10 percent, with raw material suppliers being somewhat more optimistic than the coatings manufacturers.

Industry optimism is supported by confident outlooks by the industries that influence coatings demand, including the construction sector and durable goods manufacturing. The production of coatings is driven in a quite direct way not only by the general economic climate, but more specifically the health of those two key components of the U.S. economy. Clearly, if one understands what is likely to happen in those two areas, forecasting coatings production becomes much simpler. With that in mind, the manufacturing sector (particularly the economically critical automotive industry), which is the economic driver for OEM coatings, has recovered significantly and appears poised for continued growth in 2015. The National Association of Manufacturers (NAM) currently forecasts that durable goods production will rise 5.2 percent in 2015, which should translate to a comparable growth trajectory for OEM coatings.

The outlook for protective coatings is generally favorable. The Associated General Contractors of America (AGC) is currently predicting potential growth in such construction areas as petrochemical manufacturing, oil and gas production, pipelines and warehouses. The project to expand the Panama Canal could produce demand not only related to the actual canal project itself, but also in the upgrading and expansion of Gulf and East Coast port facilities necessary to accommodate additional shipments and larger vessels. On the other hand, the recent steep drop in energy prices has the potential to slow the growth in exploration and production from shale formations, as marginal projects are not undertaken or are placed on hold. If prices remain at current levels or move lower, that could have a negative effect on demand for coatings for drilling sites, equipment and pipeline.

Randy A. Nixon
President/Principal Consultant, Corrosion Probe, Inc.

Looking forward, I feel that there are several fundamental technical issues which should be addressed in order for the coatings industry to move forward over the next 10 to 15 years.

First, the continued regulatory pressure to reduce VOCs in protective coatings must be met head-on with some collective industry response founded on both technical reality and commercial pragmatism. If the industry continues to be pushed to lower VOCs, product performance in a substantial percentage of industrial and infrastructure applications will be compromised. When one ponders the actual contribution of VOCs from the use of protective coatings on atmospheric ozone depletion, the absurdity of this ever-expanding regulatory nonsense becomes clear.

No informed individual doubts that lowering VOC concentrations from many sources has been helpful to the environment.

The technical question which begs an answer is: should coatings be high on the hit list? This author contends they should not be. The technical reality needs to be explained to our industry, to the environmental regulators and particularly to the public. Data will need to be collected, analyzed, interpreted and presented in a manner in which technical reality becomes consumable by scientists and administrators in regulatory positions.

On the commercial, common-sense side of this argument, optimizing coating performance reduces the number of times coatings must be applied. Good coating performance saves our industries enormous expenditures on recurring corrosion problems. Won't that money be better spent on developing sustainable, good jobs? The same politicians from all parties profess to work for middle class jobs, but support unjustified coating VOC

continued on p. 32

Randy A. Nixon continued

regulations in the name of cleaner air, which results in poor product performance. This sucks capital investment from increased industrial output which is the engine for good middle class jobs.

Secondly, the ever-expending use of protective coatings on concrete is plagued by the lack of clear and proven guidance on establishing and determining acceptable moisture content in concrete substrates. This problem goes to our lack of a clear mechanistic comprehension of what many of us have called moisture-vapor-driven osmotic blistering of coatings. And it presents substantive project conflict about when and when not to coat and how to adequately dry the substrate. The test methods we use are all either suspiciously non-repeatable or are often accompanied by published threshold levels which have no apparent effect on coating performance. For example, relative humidity probes rarely indicate sufficient reductions in moisture content to meet a manufacturer's published thresholds. Yet, when coatings have to be applied due to plant start-up requirements under what will become immersion conditions, the coatings perform flawlessly. Similarly, moisture vapor transmission rates measured using the ASTM F1869 test can be very misleading vis-à-vis floor coating performance despite published threshold values, for example, less than 3.0 lbs. of moisture per 24 hours per 1,000 square feet is ok, but 3.1 lbs. is not.

These moisture issues have resulted in an inordinate number of legal conflicts over coating performance. Responsibility for the measurement and reduction of excess moisture in the concrete to be coated is an area as gray as the substrate itself.

As a third point for consideration, we have a conundrum in the coatings industry involving an over-emphasis on the use and interpretation of tensile pull-off adhesion testing results for coatings applied to concrete substrates. Specifications continue to mandate frequent use of destructive pull-off testing as a quality-control requirement for acceptable coating work. Some coating manufacturers report ridiculously high pull-off strength values for tests conducted in accordance with ASTM D7234 to present superior product test data when compared to their competitor's products. Those products were tested under controlled laboratory conditions on nice flat bench surfaces. This is a far cry from the testing difficulties encountered in the field including surface irregularities, overhead and vertical surfaces, uncontrolled temperature and humidity conditions. Repeatability can be a problem in the field and the destructive nature of the test often causes more problems with coating performance than it averts. And the specifications which require routine pull-off adhesion tests every few thousand square feet with a minimum acceptable value of 450 psi, can cause wasted time and project conflict. This author has been guilty as charged in the past, but he has seen the light.

One important thing to recognize is that acceptable pull-off strength values in our industry are roughly based on the fact that concrete tensile strength is approximately 10 percent of the concrete's strength in compression. So for 5,000 psi concrete, commonplace in today's fast-track construction, the tensile pull off should be a minimum of 500 psi, but the conditions required to create 500 psi of pull-off force almost never exist in any coated concrete tank or structure. And the failure plane requirements often specified are no less onerous. One-hundred percent failure within the concrete is required. While the failure plane criteria is more important than the pull-off number in my opinion, the variability of aggregate and cement paste at the surface, more often than not, affects the uniformity of the failure plane and these comments don't even address other important issues such as instrument alignment, the replacement of core drilling with cast-in-place steel rings or molds and selection of adhesives.

The underlying emphasis should be on revising the use of pull-off adhesion testing as a quality control method. Rather, it should be utilized as a quality assurance tool on the coating project's front end to validate the surface preparation methods and will minimize finished coating rework and avoid unnecessary and nonproductive conflict on coatings projects. Our industry needs better guidelines, including a more realistic consensus on acceptable pull-off values and failure plane criteria. With that, we can better educate specificers, suppliers, contractors, inspectors and owners about the real value of coatings-adhesion testing for concrete substrates.

Leo Procopio, Ph.D.
Application Scientist, The Dow Chemical Company

There are a number of key trends that are influencing the direction of coatings development in the industrial maintenance and commercial architectural markets, and that are influencing our focus and direction as a raw material supplier in the development of new resin and additive technologies.

The shift towards the increased use of waterborne and high-solids technologies for industrial applications continues, often as a means to address increasingly stringent VOC regulations. VOC reduction is an important aspect of nearly all new coating developments these days, and has become a norm in the way coating manufacturers and raw material suppliers operate. The continuing trend towards waterborne has also made it necessary for these technologies to evolve towards higher performance, as making concessions on performance is rarely an option when replacing higher-VOC technologies. As an example, we are actively engaged in pushing the performance of waterborne acrylic direct-to-metal (DTM) coatings to higher levels while moving VOC levels downward, and in 2015 the industry will see new products that now have the capability of being formulated under 50 g/L while displaying excellent corrosion resistance over steel. For industrial maintenance, the strictest limits are currently at 100 g/L in the South Coast Air Quality Management District (SCAQMD) of southern California, but going lower to under 50 g/L makes sense in anticipation of future limits, and also because acrylic DTMs are being increasingly used in the architectural space where VOC limits are even tighter.

Another key trend in resin technology is the use of hybrid materials as a means of increasing performance levels. There is increasing interest in getting the performance benefits of multiple resin technologies, but combined in a single resin. Polysiloxane coatings are a clear example of a solventborne technology that has already made an impact in the industrial

maintenance space. Considering waterborne coatings, one area where we have been active is in combining the benefits of both waterborne acrylic and epoxy technologies into a single hybrid resin. New two-component acrylic-epoxy hybrids that facilitate properties such as fast dry, long potlife, low VOC, excellent durability and excellent chemical/solvent resistance in waterborne coatings will be introduced in 2015 for industrial and commercial applications. Key uses are for flooring and structural steel, as well as for wall coatings in settings like hospitals and schools, where coatings can be subjected to harsher cleaning regimens. This technology also ties into another trend, where end-users are increasingly expecting coatings to facilitate better hygiene practices, particularly in commercial environments. Developing coatings with better chemical resistance to withstand more aggressive cleaning is certainly one aspect that has been getting more attention.

Increased focus is being directed to the development and use of coatings that offer a function beyond the traditional aesthetic and protective roles of coatings. Examples of this movement towards functional coatings include recent advances in coatings that address several important trends, including the improvement of indoor air quality, the reduction of noise and vibration, and improved energy management. Recently, coatings have become available that can actively and permanently remove formaldehyde, a known air pollutant, from the air of an indoor space, and are based on a unique acrylic polymer technology. Research continues into utilizing the large surface areas presented by coatings for eliminating other types of air pollutants. Liquid-applied coatings that offer sound damping properties are already being used in automotive applications, and are being explored in other applications, such as within other transportation sectors and the building envelope. Finally, coatings to manage

continued on p. 36

Leo Procopio, Ph.D. continued

the loss and gain of heat, and the accompanying energy consumption, are becoming a reality via several unique technologies that exhibit thermal insulation, IR reflectivity, and solar reflectivity properties. Interest in coatings with low thermal conductivity is growing because they offer personnel protection (e.g., from hot surfaces), insulation properties important for energy management, and a method to address corrosion under insulation (CUI) often found with traditional insulation materials. IR reflective coatings are being used to facilitate cooler surfaces such as concrete decks, and to prevent heat build-up in (and potential warping of) building materials such as vinyl siding. Continuing research on new and improved materials and formulations will lead to further advances in these and other functional coatings.

Jim King, President, John B. Conomos, Inc.

While trying to predict the future is always a risky proposition, we'll attempt to provide some insight into how we are seeing the 2015 economy in our industry. Our outlook is based on various reports we have read and discussions with customers and industry colleagues.

Many economic reports are predicting a 2 to 3 percent increase in GDP, fueled primarily by continued job growth, reductions in fuel costs, and slight upticks in wages. All of these are factors that should trigger increased consumer confidence, an integral factor to a strong economy.

In discussing 2015 with various customers, we are expecting spending patterns to be very similar to 2014. However, several of our customers are waiting to see what impact the changes in Washington might bring. Now that the Republican party controls both houses of Congress, there is anticipation that certain regulatory pressures may ease and tax incentives may be provided that would spur additional capacity investment.

Another factor to watch is what happens with interest rates. We suspect we will see a rise in short term interest rates, but with our government still in an economic growth state of mind, any increase will most likely be minimal. As part of the economic package passed before the Christmas holidays, it appears that there may be some relaxing of certain regulations placed on the banking industry several years ago. This may lead to banks becoming more willing to extend credit, yet another means to spur capital investment.

Overall, it would appear that we can expect a slight economic uptick in 2015. If consumer confidence is up, spending should follow. This will allow the manufacturing sector to consider increasing capacity (hopefully more new construction spending) and spend money making sure they keep the facilities running (more maintenance spending). This should provide increased opportunities for our painting industry.

That said, there is still the impact of global factors. Clearly, the political situation in the Middle East, the economic softening in Europe and terrorist activity around the world could create significant economic disruption, dramatically affecting economies around the world.

Daniel J. Dunmire, Director, DoD Corrosion Policy and Oversight Office

Within the DoD Corrosion Policy and Oversight Office that I oversee, we fight corrosion and materials degradation on multiple fronts — as we construct and maintain aircraft, armored vehicles, tanks, ships and military bases, and as we use a myriad of new primers and coatings to better protect these assets.

The paint and coatings industry is projected to become a $116.4 billion global enterprise by 2015, economists say. The application and maintenance of coatings make up 80 percent of the amount that government and industry spend on preventing corrosion.

In spite of these projections, the job outlook for workers in paint and coatings occupations is not as robust as you would expect. In its *Occupational Outlook Handbook*, 2014-15 Edition, the Bureau of Labor Statistics reports that "the overall employment of painting and coating workers is projected to grow 4 percent from 2012 to 2022, slower than average for all occupations." The Bureau also notes: "As with many skilled manufacturing jobs, employers often report difficulty finding qualified workers. Therefore, job opportunities should be very good for those with painting experience."

Employment growth in this field, however, varies according to each particular coating specialty and industry. In 2015 several organizations are working tirelessly to increase the qualified pool of workers who can fill the employment gap in skilled manufacturing. These groups are reaching out to military veterans — a rich reservoir of talent.

SSPC: The Society for Protective Coatings recently approved five new training and certification courses that will be included in its list of 28 courses for which veterans can seek tuition reimbursement from the U.S. Department of Veterans Affairs. These new courses certify students in aerospace coating application, coating application, protective coatings inspection, and protective coatings. This year, SSPC will also offer veterans the chance to retroactively seek reimbursement for course exam fees incurred since June 1, 2010.

Recently the International Union of Painters and Allied Trades (IUPAT), debuted its "Earn While You Learn" initiative called the Painters and Allied Trades Veterans Program. The burgeoning program places veterans and transitioning service members into the industrial and commercial coating and painting trades, while allowing them to earn college credits at no cost.

A coalition of more than 170 companies committed to the "100,000 Jobs Mission" has hired 190,046 veterans since 2011, according to recent figures. The coalition aims to hire 200,000 veterans by the year 2020. BAE Systems, nationally recognized for its veterans programs, is committed to matching a veteran's military occupational specialty or rating to its advertised jobs. Vigor Industrial and Newport News Shipbuilding, two large employers of coatings workers, have designated resources to identify qualified veterans. Indeed, these and many other companies are committed to helping veterans establish new careers in the coatings sector.

Since 2005 the DoD Corrosion Office has funded a variety of training and certification programs for military personnel. But we also champion programs that prepare military veterans for careers in materials sustainment. If more organizations would answer the pressing need to transition veterans into the coatings industry, more jobs would be filled, allowing us to make headway in the war against corrosion — the silent, pervasive menace.

FEVE Technology for Higher Performance Coating Systems on Bridges

By Bob Parker, AGC Chemicals Americas, Inc.

The history of coating system types used on steel bridges has always paralleled the evolution of coatings technology as a whole. When breakthroughs have occurred, the bridge coating market has paid attention and embraced these advancements. Sometimes, regulations have played a significant part in altering this course of evolution, but the goal of the stewards responsible for bridge maintenance and preservation has never changed. The ideal coating system will always be the one that offers the best protection of the substrate at a reasonable cost, with due respect for compliance with regulations.

The most popular long-life coating system in place at this time for bridges with challenging applications and environments is a three-coat system consisting of a zinc-rich primer, an epoxy midcoat and a polyurethane topcoat. Other less expensive coating systems still exist, but many provide lesser protection and have a shorter lifetime. Depending on the available funding for any specific bridge project, these options may be the only choice. However, if the goal of the bridge steward is the ultimate protection of the bridge against structural degradation for the longest period of time, the standard three-coat system is the preferred choice.

Fluoroethylene vinyl ether (FEVE) fluoropolymer technology has proven to be a successful addition to the global bridge coating market (Fig. 1). In the U.S., there is a growing interest from state DOTs, local municipalities and the private sector (Fig. 2). The discussion of the life cycle of a coating system has paved the way for this growing interest, as the cost of coating a bridge decreases dramatically when it is based on the lifetime of the coating system. When the life cycle costs of bridge painting and maintenance are taken into account, then the use of fluoroploymer coatings becomes cost effective.

This article will discuss the chemistry behind FEVE technology, coating types that can be formulated with FEVE resins, and the performance of FEVE-based coatings used as topcoats on steel bridges.

FEVE Resin Structure

FEVE technology is most effective when incorporated into the aforementioned three-coat system. The FEVE polyol resins play an integral part in the topcoat layer, replacing the standard acrylic or polyester polyols as the principle binder. This technology has been commercial since 1982 and has been used on bridge coating systems across the globe since its introduction. The key performance improvements of the FEVE polyol resins over traditional polyesters are their resistance against UV degradation and their resistance to moisture permeation. The structure of the resin's backbone is illustrated in Figure 3.

The uniqueness of this resin lies in the combination of fluoropolymer chemistry with vinyl ether chemistry, allowing both chemistries to bring their respective strengths to the polymer's performance. Without the presence of fluorine, the polyol would lack its superior weatherability and resistance properties. Without the vinyl ether, the common properties of most organic resins — solubility in solvents, available functional groups, and adjustability of the glass transition temperature (Tg) — would be absent and the resin could not function in liquid coatings.

Coating Formulations with FEVE Resins

As with any coating, the performance of the finished product is dependent on many factors. Each raw material plays a part in either improving or weakening the coating's performance. When an FEVE polyol is part of a formulation, it can only benefit from the careful choice of other components in the formulation. The

Fig. 1: The Swan Bridge in Muroran, Japan, is one of many bridges worldwide that has seen a longer life cycle thanks to its FEVE resin-based topcoat. All photos and figures courtesy of AGC Chemicals Americas, Inc.

whole concept of creating a coating that will endure for many years necessitates consideration of every ingredient in the coating to be the best choice for weatherability and resistance properties. There can be no weak link in the chain.

Several types of coatings can be produced with FEVE resin technology. The original coating in 1982 was a solvent-based, two-component finish that used an aliphatic polyisocyanate as the cross-linker. It strongly resembled conventional polyurethane finishes in curing behavior and methods of application. This system cures and applies just like a conventional polyurethane finish, but with far superior exterior durability. This coating type is still the fluorinated topcoat of choice on bridges. VOC regulations in certain regions of the U.S. have made reformulation necessary, but the availability of solid FEVE resins and their ability to dissolve in VOC-exempt solvents have preserved the presence of this technology to date.

In 2012, a water-based FEVE polyol dispersion entered the coatings market. This resin utilizes water-emulsifiable aliphatic polyisocyanates as its cross-linking partner. Up to now, water-based, two-component polyurethane technology has not been widely accepted in the bridge coating market, due to the increased sensitivity to atmospheric conditions like temperature and humidity when these coatings are applied. Consequently, this resin has only been tested in laboratory trials. To date, the advantages of FEVE water-based resin chemistry are only being realized in factory-applied finishes for prefabricated bridge components, where the reduction in VOCs will improve the air quality of the interior working space.

A third FEVE resin type, a water-based emulsion synthesized to a high molecular weight, is available for use in one-component coatings for bridges. Several DOTs across the country have incorporated one-

Fig. 2: FEVE resin-based coatings are becoming more widely accepted for bridges in the U.S., including the Gateway Bridge in Nashville, Tenn.

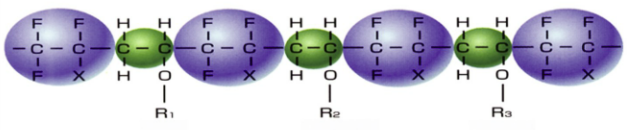


Fig. 3: This graphic illustrates the structure of the FEVE resin backbone. The fluorinated segments (blue) provide weatherability and chemical resistance; the vinyl ether segments (green) provide gloss, solubility and crosslinking properties; and the R groups provide OH functionality, flexibility and adhesion.

component, water-based coatings, which are predominantly acrylic-based. Extensive lab work has been completed in the testing of topcoats that contain FEVE emulsions. Due to the strict limitations in cost dictated by the current price range of the acrylic-based coatings that have penetrated this market, most of the FEVE emulsion-containing formulations use both FEVE emulsions and acrylic emulsions as the binder portion. Performance improvement has been evident in formulations utilizing 20 to 50 percent FEVE emulsion as the binder, depending on the particular color.

It is prudent to mention the mechanism by which FEVE resins resist degradation by UV radiation. FEVE resins do not absorb the sun's UV radiation. Without absorption, no excitation of the FEVE chemical bonds can occur, and the resin basically remains unchanged. This is the key to the superior durability of FEVE resins. Accordingly, since they do not absorb the light, they cannot block it either. This is an important point to consider when formulating a FEVE-based coating. UV absorbing and light stabilizing additives must be formulated into FEVE resin-based clear coatings to protect any base coating to which it is applied. The most popular additives are the organic UV absorbers and hindered amine light stabilizers available on the market. To expand on this any pigmented FEVE resin-based formulation will also be improved with the use of UV light-stabilizing additives. These additives can extend the lightfastness of pigments, which allows coatings systems to remain robust against UV degradation.

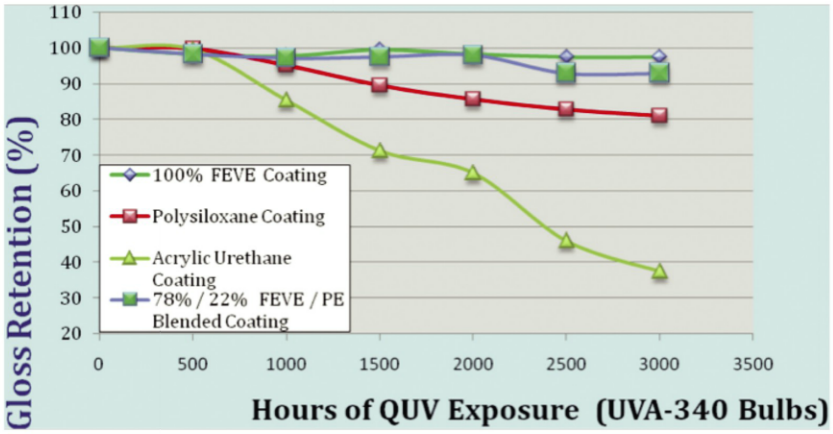


Fig. 4: This graph compares two different FEVE resin-based coatings against two other popular bridge topcoats. The coatings were tested inside of a QUV weatherometer for 3,000 hours, and the two FEVE-based coatings showed significantly better gloss retention percentages than the other coatings tested.

Performance Properties

Both accelerated exposure testing and real-life exposure testing have been performed on coatings using FEVE technology. Figures 4 (p. 40) and 5 show comparisons of FEVE resin-based coatings with different coatings also used as topcoats for bridge coating systems.

The graph in Figure 4 shows two different FEVE resin-based coatings — a 100% FEVE polyol, and a 78% FEVE polyol blended with 22% polyester polyol. FEVE solvent-based resins, like the FEVE emulsions, have a wide range of compatibility with other polyols. Laboratory work is being done to measure the performance capabilities of these blended formulations. Some physical properties of the paint film, such as flexibility, can be improved when non-FEVE polyols become part of the formulation. As this graph shows little change with the 60-degree gloss at 3,000 hours, the exposure is still in progress.

The second test exposure was done at the Equatorial Mount with Mirrors for Acceleration with Water (EMMAQUA) test site in Arizona (Fig. 5). The measurement of UV exposure is in megajoules per square meter (MJ/m^2). Again, the FEVE coating showed the best gloss retention percentage of all the coatings tested.

Certain bridge applications are being monitored for their performance. The The Tokiwa bridge is located in Japan (Fig. 6). This bridge was recoated in 1986, using two coats of an epoxy primer and two coats of a FEVE-based topcoat. The changes in 60-degree gloss and color over 25 years of exposure are shown in Table 1 (p. 44).

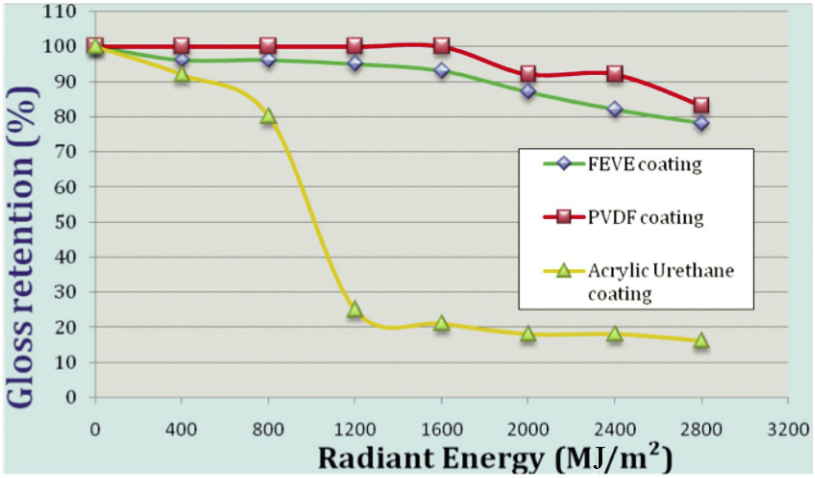


Fig. 5: This graph compares the gloss retention of a FEVE resin-based coating against a PVDF polyurethane coating and a standard acrylic-urethane bridge topcoat. As the exposure to UV light increased, the FEVE coating again displayed the best gloss retention percentage.

Fig. 6: These photos show the Tokiwa Bridge in Japan, which was coated with a FEVE-based topcoat in 1986. The photo on the left was taken in 1988, the middle photo in 1993, and the photo on the right in 2014. Clearly, there has been very little change in the coating's gloss and appearance over the years.

Table 1: Results of FEVE Topcoat Application on Tokiwa Bridge

Initial 60° Gloss	Final 60° Gloss	Gloss Retention (%)	Color Change (Δ^E)
75	69	91	3.5

Additional Considerations

Because the main function of FEVE resin-based coatings is to extend the life of the coating system, it is important to point out other proposals for bridge coating longevity that should to be considered in order to achieve this goal. Some thought has been given to expanding the procedure for coating a bridge so that the critical components of the bridge get the best protection from the coating system. Conversely, the remaining components, which are not prone to early coating failure, can be given a lesser degree of protection. This idea is explained in detail in a *JPCL* article written in 1984 by Clive Hare, entitled "Specific Utility In the Design of Coating Systems for Steel Bridges." Hare states that, "The ever-increasing demands on bridge paint systems (fed by increasing traffic loadings, salt usage, and years of neglect) must be met by the use of heavier duty coating systems applied with great exactitude over better surfaces."

The article goes into detail about specific areas of bridges that have historically experienced premature coating failure resulting in

damaging corrosion of the steel. The seams, edges, bolts and rivets of bridges are most susceptible (Fig. 7). These are the areas that need coating systems that are more functional for corrosion resistance. In many instances, these areas do not receive the level of UV radiation experienced by other parts of the bridge, but the need for recoating is still critical.

Fig. 7: Certain bridge components such as seams, edges, bolts and rivets still present coating and life cycle challenges, even for FEVE-based coatings.

The use of a FEVE resin-based topcoat has demonstrated the ability to resist the penetration of chloride ions through energy-dispersive X-ray microanalysis testing. However, the difficulty of attaining success lies in the morphology of certain bridge components and the challenge of coating application on these components. Although FEVE technology can offer greater longevity of the topcoat on a bridge, the protection of every steel surface, for up to thirty years, is still a significant challenge.

Conclusion

Although FEVE technology has shown itself as a viable alternative to standard topcoats for the three-coat system for bridges, research is continuing on the utilization of this technology in combination with zinc-rich primers or epoxy primers to create an effective two-coat system. The elimination of an entire coat will significantly lower the final cost of the coating project.

As the evolution of coatings for bridges continues, the ultimate goal will always be the most efficient protection of the steel substrate at the most reasonable cost. If we can succeed in prolonging the life of an important part of our nation's infrastructure, much will be gained from this success.

About the Author

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 Bachelor of Science degree in chemistry from Alvernia College. He is currently responsible for technical service for LUMIFLON fluoropolymer resins in the U.S. JPCL

Spot Painting for Bridge Preservation

A University of Kentucky research study provides guidance on materials, means and methods of spot painting to address problems from leaking joints and widespread use of deicing salts.

By Bobby W. Meade, Greenman Pedersen Inc.; Sudhir Palle and Theodore Hopwood II, Kentucky Transportation Center, University of Kentucky

One of the most vexing problems for bridge maintenance personnel is the deterioration of bridge components below leaking joints. The joints may be open or closed, construction or expansion, but all seemingly leak shortly after construction or resealing, sometimes as early as after three to five years of service. The bridge components affected by the leaking joints may be steel or concrete but the end result is the same: deterioration. Due to the extended time of wetness (TOW) and the high levels of contaminants such as deicing chemicals, structural steel coatings and reinforcing steel in concrete consistently fail first at these locations.

Protective coatings for bridges have historically been relegated to liquid-applied coatings used on structural steel but in the future, other barrier technologies may see at least spot use and painting structural concrete may become more important for both new construction and maintenance.

Maintenance Painting Options

Maintenance painting of steel bridges can involve spot painting, zone painting, overcoating or complete removal and replacement of the existing coating. All four alternatives are appropriate for certain situations based on considerations such as the condition of the existing coating, expected remaining service life of the bridge, owner lead abatement policies and funding.

Total coating removal and replacement is usually the lowest cost per surface area and may be the choice for lead abatement. However, this typically involves complicated projects with extensive environmental precautions, worker safety issues, complicated traffic controls and will usually incur the highest total cost. Remove-and-replace painting may approach the cost of bridge replacement if conducted three or more times. With many of today's bridges exceeding their 50-year-design service life and protective coating systems seldom serving more the 20 years, remove and replace is an expensive bridge preservation choice.

Total repainting of bridge steel by overcoating may be a more effective option than remove and replace from a life-cycle cost perspective. However, it also can also involve many of the same complications as remove and replace and, on some structures where significant traffic disruptions cannot be tolerated, it may not be an attractive choice regardless of any cost advantages.

Zone painting will usually be at the intermediate unit cost with an intermediate quantity of surface area being painted, and again, an expensive bridge preservation choice.

Spot Painting as a Stopgap

The good news is that when protective coating systems fail, they typically fail in fairly predictable patterns of very limited surface area. Most zinc-based two- or three-coat paint systems employed over the past two decades will protect more than 95 percent of the bridge steel for much longer than 20 years if properly applied. The failures will typically occur in areas beneath leaking expansion joints or in splash zones where traffic-created aerosols deposit contaminants on painted surfaces. Usually none of the maintenance painting options employ surface preparation methods that sufficiently remove contaminants, such as salts, to permit the maximum possible coating service life to be achieved.

Spot painting is usually performed on limited areas where the existing coating has failed and a less thorough surface preparation process has typically been utilized. Spot painting may have a high unit cost relative to the other maintenance-painting methods but involves very small areas resulting in lower total costs. It is employed as a reactionary tool when and where protective coatings have failed. Many bridge owners are seeking low level-of-effort spot painting with limited service-life expectancy in order to buy time in the

problem locations on bridges. This choice can minimize disruption to the traveling public, minimize environmental issues, may be completed with multi-tasked state crews instead of highly specialized and expensive coating contractors, and will delay the more expensive maintenance painting options for four to five years at each application.

Clearer Roads = More Chloride Contamination

Bridge owners must also address the accelerated deterioration of concrete bridge elements due to the increased use of deicing chemicals. While deterioration of bridge decks due to deicing salts has been recognized for years, the problem extends to other bridge elements including piers, abutments and beam ends under leaking joints (Fig. 1). Evaluations of bridges in central and northern Kentucky in 2002 and 2011 revealed that while the chloride content in bridge decks (at a 2-inch depth) rose from 0.01 percent (chloride to weight of concrete) to 0.14 percent, the chloride content in pier caps and abutments was much higher than for decks at 0.25 to 0.35 percent in 2011. Bridge decks are comprised of denser concrete which is less permeable than concrete in other bridge components and receives additional maintenance actions such as periodic washing or overlays that limit salt intrusion.

Increased chloride contamination in concrete is related to the increased use of deicing chemicals used to implement "Clear Roads" policies adopted by some state governments. Growing concern about black ice has resulted in frequent pretreatment applications of liquid chloride solutions that account for the greater contamination and deterioration of both steel and concrete bridge elements. Owners need specific tools and practices to address this emerging bridge maintenance problem.

The Study

The Kentucky Transportation Center (KTC) at the University of Kentucky is conducting a research study for the Kentucky Transportation Cabinet (KYTC) to provide information and guidance about spot painting and treatments to address problems created by the widespread use of deicing salts. The study includes the evaluation of coatings and coverings for both structural steel and concrete bridge elements. The field application site was established at the Interstate 75/Interstate 64 overpass of U.S. 68 near Lexington, Kentucky. The test site is an elevated roadway that receives frequent deicing treatments.

The bridge has seven continuous spans with a transverse expansion joint at Pier 3. The joint has been replaced twice in the past seven years but has never remained watertight for more than a few months. At the time of field application, the strip seal was missing along most of the joint and deck water runoff saturated steel beam ends, transverse diaphragms, and concrete piers during each precipitation event. Since the diaphragms protected most of the beam ends the decision was made to apply steel coatings and treatments to the diaphragm and protective concrete coatings to the columns.

Steel Coatings

KTC researchers elected to use a low-level-of-effort/low-tech surface preparation method that a DOT field crew could be expected to successfully employ. Rather than restricting coating selection to conventional liquid-applied, thin-film coatings, they also identified "outside-of-the-box" coatings and treatments. Structural steel coatings were evaluated for

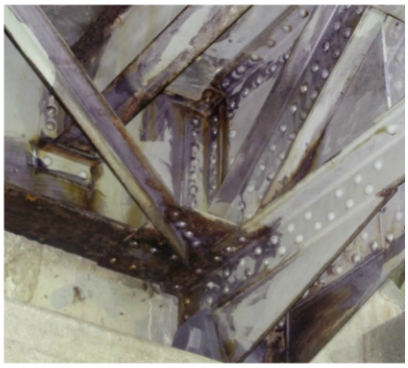


Fig. 1: Failed coating beneath a leaking joint. All photos and figures courtesy of Kentucky Transportation Center, University of Kentucky unless otherwise specified.

user friendliness and performance in field application. SSPC-SP 2 "Hand Tool Cleaning" was performed and the surface preparation process included removal of stratified rust, manual scraping to remove loose materials and rust, hand wire brushing to remove surface deposits and minimize lifted edges and burlap rubbing for final cleaning. Wiping with a white cloth was used to ascertain that an acceptable level of cleanliness was achieved. Cleanliness was determined and documented and cloths were retained and stored in sealed containers.

Table 1: Steel Surface Coating Systems

System	Type	User-Friendly Rating
1	grease	4
2	grease	4
3	grease	6
	tape	6
4	grease	7
	tape	7
5	tape	2
6	tape	5
7	tape	4
8	tape	5
9	paint	5
10	paint	4

The subject bridge was overcoated in 1998. The original coating was a lead alkyd primer with leafing and non-leafing aluminum alkyd topcoat and was still intact except for isolated spots. The overcoat consisted of spot and full coats of aluminum-filled, moisture-cured urethane and a two-component urethane topcoat. The overcoat was performing well except in highly stressed areas such as beneath a leaking joint. After cleaning, representative surface areas to be coated were tested for adhesion as per ASTM D4541, "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers," and SSPC Guide 15, "Field Methods for Extraction and Analysis of Soluble Salts on Steel and Other Nonporous Substrates." The existing coating had good adhesion, averaging about 1,200 psi (Fig. 2, p. 52). The surface chloride levels were relatively high, ranging from 15 to 20 micrograms per square centimeter.

A total of fifteen coating systems including tapes, greases, and paints were acquired for application. Five of the systems were not applied because either the manufacturer did not provide the full system or the coating was a wide tape with a contact element that was difficult to apply properly in the constricted work space. Each system was evaluated by a subjective "user-friendly" system devised by

Table 2: Performance of Laboratory-Applied Concrete Coatings

System	Sample	ADHESION (psi)			COLOR (Δ^e)		GLOSS 60°			SALT PONDING	
		0 hours	1,000 hours	3,000 hours	1,000 hours	3,000 hours	0 hours	1,000 hours	3,000 hours	Total Chlorides @ ½" depth (mS/cm)	Total Chlorides @ 1" depth (mS/cm)
1	1	738	798	1,005	0.32	2.29	20.90	19.87	5.63	0.008	0.006
	2	744	665	975	0.60	2.27	19.03	18.40	5.47		
2	3	1,029	915	860	0.20	0.83	8.80	6.70	4.57	0.027	0.008
	4	NA	597	782	0.37	0.82	10.83	7.40	5.57		
3	5	300	601	576	1.17	0.86	3.60	2.30	2.03	0.127	0.033
	6	288	640	636	1.25	1.25	4.43	2.67	2.10		
5	7	798	697	810	1.78	0.68	4.30	4.17	4.07	0.100	0.020
	8	915	1,055	733	0.38	0.95	3.20	3.13	2.67		
6	9	1,032	638	706	0.95	3.53	7.10	3.17	1.87	0.009	0.007
	10	1,150	723	754	0.77	3.81	6.97	4.00	1.83		
7	11	505	625	767	0.97	0.98	16.37	15.70	7.23	0.081	0.015
	12	446	707	775	2.49	1.27	19.73	14.77	9.47		
8	13	283	255	619	19.27	17.03	49.73	1.30	1.10	0.049	0.009
	14	253	503	558	19.32	17.79	42.10	1.33	1.13		
Salt Ponding Control										0.137	0.035

the KTC team. The system ranged from 0 to 9, nine representing the most user-friendly attributes as far as ease of application, number of components, and number of applications (Table 1, p. 49). The research team applied all coatings out-of-the-box without modifications such as heating greases, which manufacturers recommended in some cases. Ambient temperature ranged between 65 and 69 F. Steel coatings were applied in April of 2013 with performance evaluated periodically over the two following winters.

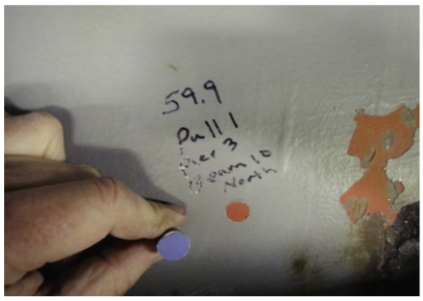


Fig. 2: Adhesion test indicating failure between the original alkyd and the lead primer.

Concrete Coatings in the Field

Concrete coatings are being evaluated for both field and laboratory performance. The pier cap and supporting columns under the leaking joint had deteriorated significantly with spalled concrete and exposed reinforcing steel on the pier cap and several columns. With the damaged joint continuing to allow water and contaminants onto the concrete surface, this site was considered an ideal location to conduct concrete coating evaluation.

The current KYTC standard construction practice is to coat structural concrete with architectural stains and masonry coatings. They often fail by weathering or disbonding in a few years and provide little protection from chloride contamination.

In an effort to select a method that was cost-competitive with what has historically been used, the surface preparation and application process chosen was pressure washing with no filling of bug holes, roller or low-pressure spray application, and selection of coatings which could be applied in a single work period. The concrete surface was prepared for coating application by pressure washing at 4,500 psi with a zero-degree spinner tip at approximately 12 inches stand-off distance. No effort was made to fill bug holes in the concrete surface, however a brush was used to apply coating in large surface cavities (greater than 0.5-inch diameter) and a roller was used to apply the surface coatings (Fig. 3, p. 54).

A total of eight systems were applied in the field. All coatings were roller applied except System 7, which was spray applied at the manufacturer's recommendation. Seven of the systems were either two different products (primer and topcoat) or called for a second application of a single product. Field-applied concrete coatings will be evaluated for chloride transmission (a comparison of concrete chloride content at application and after snow and ice seasons), tensile adhesion, and material weathering using Fourier Transform Infrared Spectroscopy (FTIR).

Concrete Coatings in the Laboratory

Laboratory testing of concrete coatings consisted of accelerated weathering and chloride

transmission (Table 3). Only seven of the field-applied systems were evaluated in the lab. Field System 4 required a 24-hour cure between applications which was deemed impractical and eliminated for further consideration by the research team. Concrete blocks at 12- by 12- by 6-inches with a 1-inch-deep well were cast for chloride transmission testing per AASHTO T259, "Resistance to Chloride Ion Penetration." Concrete panels were cast at

Fig. 3: A brush is used to apply coating to surface cavities greater than 0.5 inches in diameter.

6- by 12- by 0.75-inches per ASTM D1734, "Standard Practice for Making Cementitious Panels for Testing Coatings." Two panels were cast for each system plus an additional panel to serve as a reference. The seven test coatings were roller-applied to the panels to be exposed to weathering testing with no effort to fill bug holes. The reference panel was masked and a strip of each coating was applied. The reference panel was retained in a protected environment for reference testing.

After curing for 28 days, each panel was evaluated for tensile adhesion as per ASTM D4541, "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers," color as per ASTM E308, "Standard Practice for Computing the Colors of Objects by Using the CIE System," and gloss as per ASTM D523-14,"Standard Test Method for Specular Gloss."

Initial adhesion testing was performed on the back sides of the panels with 50 mm test dollies. The test equipment did not have sufficient capacity to pull these dollies. Later adhesion tests used 20 mm dollies and in many cases the tensile strength of the coating exceeded that of the concrete. All adhesion tests performed after weathering testing began are taken on the front (weathered) panel face and test areas were sealed with a silicone caulk.

Table 3: Laboratory-Tested Concrete Coating Systems

System	Type	Coat	WFT	Cure Time
1	Urethane	topcoat	7	
	Epoxy	primer	12	8 hrs
2	Acrylic	topcoat	7	
	Epoxy	primer	9	6 hrs
3	Acrylic	topcoat	15	
	Acrylic	primer	5	2 hrs
5	Acrylic	topcoat	9	
	Acrylic	primer	5	5 hrs
6	Urethane	topcoat	6	
	Epoxy	primer	8	6 hrs
7	Acrylic	topcoat	White	
	Acrylic	primer	Opaque	2 hrs
8	Gypsum	single coat	20	N/A

After initial evaluation, panels were placed in ultraviolet weathering chambers per ASTM D4587, "Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings." Panels were removed from weathering at 1,000-hour intervals for assessment, up to a total test duration of 3,000 hours. In addition to the evaluations listed above, each panel was evaluated by FTIR. Final laboratory performance data is reported in Table 2 (p. 50).

Conclusion

Bridge preservation activities are typically driven by those bridge components or locations on bridges that have historically required the most effort and resources to maintain. Leaking joints combined with the affect of aggressive use of deicing chemicals has caused many bridge decks to develop issues requiring patching, overlays or replacement. Localized repairs can provide protection to the substrate and extend service life of the asset with a minimum level-of-effort, cost, disruption to service and environmental impact.

About the Authors

Bobby Meade retired from the Kentucky Transportation Center (KTC) at the University of Kentucky in 1999 with 29 years of service and accepted a position with the Kentucky Transportation Cabinet. Meade was responsible for the Cabinet's bridge maintenance painting program from which he retired in 2007. Since 2007, he has worked part time for the KTC in the Bridge Preservation Program and part time for Greenman-Pedersen, Inc. providing project development, project management and inspection services for the Cabinet's bridge painting program.

Sudhir Palle is a research engineer at the Kentucky Transportation Center. He holds a Master of Science degree in civil engineering and an MBA from the University of Kentucky. Palle has worked on a wide variety of transportation research topics including coatings development and testing, corrosion analysis and prevention, environmental issues, facilities management, nondestructive testing, maintenance practices and project development. He also helps facilitate meetings of the Midwest Bridge Working group that focuses on assisting state highway agencies and other stakeholders to improve practices related to bridge maintenance and inspection.

Theodore Hopwood II holds a Bachelor of Science degree in mechanical engineering and a Master of Science in metallurgy from the University of Kentucky. He is the program manager for the bridge preservation section at the Kentucky Transportation Center. For over 25 years, Hopwood has conducted research related to bridge maintenance painting. JPCL

© iStockphoto/webphotographeer

SSPC 2015 Update

SSPC 2015 featuring GreenCOAT will take place from Feb. 3 to 6 at the Westgate Las Vegas Resort. The following are updates to the SSPC 2015 Advance Program that were received after publication of the December 2014 *JPCL*. For complete information on the conference, visit sspc2015.com.

SSPC 2015 featuring GREENCOAT
FEBRUARY 3-6, 2015
WESTGATE LAS VEGAS RESORT, LAS VEGAS, NV
www.sspc2015.com

AWARDS

The following awards will be presented at the Annual Business Meeting and Awards Luncheon, which will take place on Tuesday, Feb. 3, from 11:30 a.m. to 1:00 p.m.

SSPC Honorary Life Member
Ken Trimber, president, KTA-Tator, Inc.

John D. Keane Awards of Merit
Lydia Frenzel, Advisory Council; and Alfred D. Beitelman, retired from the U.S. Army Corps of Engineers (USACE).

SSPC Coatings Education Award
Alejandro Exposito, PCS, technical manager, Optimiza Training & Consulting, SL

Women in Coatings Impact Awards
Cynthia L. O'Malley, PCS, consulting and laboratory services manager, KTA-Tator, Inc.; and Deidre L. Dunkin, president, Dunkin & Bush. Inc.

The recipients of the SSPC Outstanding Publication Award, the *JPCL* Editors' Awards, the President's Lecture Series Award, the SSPC Outstanding Chapter Awards, and the SSPC Structure Awards will be announced at the conference.

TECHNICAL PROGRAM

Thursday, Feb. 5
Mid-Morning Session 4,
10:00 a.m. to Noon

• "'In Zinc We Trust?' Zinc-Free Anti-Corrosive Pigments," by Andrew Thorn, Heucotech, Ltd.; 11:00 to 11:30 a.m.
(speaker and title change)

Afternoon Session 2, 3:00 to 5:00 p.m.

• "Time, Money and Tank Linings," by Michelle Eriksen, Jotun A/S; 4:00 to 4:30 p.m.
(speaker change)

Friday, Feb. 6
Mid-Morning Session 2,
10:00 a.m. to Noon

• "Is the Heat and Pressure of Formulating Coatings for the Oil and Gas Market Getting to You? A Simplified Approach to Formulating Coatings for High Temperature and Pressure Applications," by Andrew Recker, BASF; 10:00 to 10:30 a.m.
(speaker and time change)

• "The Futility and Folly of Seeking the Accelerated Corrosion Testing Holy Grail," by Kat Coronado, AkzoNobel; 10:30 to 11:00 a.m.
(speaker and time change)

SSPC Board Seeks Nominees

SSPC is now seeking nominations for three seats on its Board of Governors in the categories of Coating Material Suppliers, where there are two openings, and Coating Contractors, where there is one opening.

The Coating Material Suppliers category is defined in the SSPC bylaws as "individuals who own, are employed by, or represent firms that manufacture or distribute coatings, linings or the raw materials used to manufacture these products."

The Coating 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."

All nominees must be SSPC members and fit the demographics stated above. Self-nominations are not accepted. To nominate a candidate, SSPC asks that individuals submit a brief statement detailing the nominee's qualifications to SSPC, Attn. Bill Shoup, Executive Director, 40 24th Street, 6th Floor, Pittsburgh, Pa., 15222-4656; by fax to 412-281-9992; or by email to shoup@sspc.org. Nominations are due by March 2, 2015.

PCI Program Offered in India, Egypt, Bahrain and Italy

SSPC recently announced that Harvish Technical Services of Chennai, India, and Quality Control Co. of Cairo, Egypt, have been approved as international licensees for SSPC's Protective Coating Inspector (PCI) program.

The PCI program has been noted as a thorough and effective course by students and instructors and is the only coating inspector program on the market that has been independently audited and approved. The program was developed to meet ASTM International standard D3276, "Standard Guide for Painting Inspectors," and PCI Level 2 has been approved by the largest commercial shipping classification societies as equivalent to NACE Coating Inspector Level 2 and FROSIO Inspector Level III in accordance with the IMO Performance Standard for Protective Coatings and IACS CSR. Approving classification societies include the American Bureau of Shipping (ABS), Bureau Veritas, Lloyd's Register and Registro Italiano Navale (RINA).

Harvish Technical Services, authorized to hold PCI courses in India, focuses on skills development pertaining to corrosion and coatings. They train personnel to work in the oil and gas, petrochemical and heavy industrial sectors. Mr. R. Venkatesan, the director and owner of Harvish Technical Services stated, "Harvish Technical Services creates dynamic solutions to inspire student learning, through innovative and cost effective educational services."

Quality Control Co. was founded in 1984 in Cairo, Egypt, and has three branches in France (Hirondelle Quality), Saudi Arabia (Gulf QCCO) and Bahrain (PIC). Their license permits them to hold

Training Roundup

SSPC held its Protective Coating Inspector program from Sept. 22 to Oct. 3, 2014, in Batam, Indonesia. Instructors Muniandi Dewadas and Abdul Quim (Bani) (seated at center) taught the course's 18 students.

Seventeen more students took the PCI course, instructed by Dewadas and Quim (seated at center) in Batam, Indonesia, from Nov. 10 to 20, 2014.

Deawadas and Quim (seated at center) also instructed 11 students during the PCI program in Surabaya, Indonesia, held Oct. 27 to Nov. 1, 2014.

SSPC's Concrete Coating Inspector (CCI) course was held at and sponsored by SSPC's China Chapter in Shanghai from Dec. 1 to 6, 2014. Instructors Randy Glover and Mohamed Elhamalawi (seated at center in red shirts) led the course's 15 students.

PCI classes in Bahrain, Egypt and Italy. Mr. Mohsen Hassanein, the executive of Quality Control Co. stated, "We are here to deliver the best training and certification programs to our candidates in the field of quality control, NDT inspection, welding inspection and painting inspection."

As with all new SSPC licensees, both companies were required to undergo a rigorous review to determine their capability to provide quality SSPC training programs. In this process, qualifications of key personnel were reviewed, along with organizational and procedural systems, to determine the fitness of the training organization to uphold the quality standard of SSPC training. According to Jennifer Merck, SSPC's training and technical program specialist, "The review process is designed to ensure that licensee applicants are highly valued in their particular marketplace, and that their reputation is backed by a solid company built on a solid foundation."

To register for an SSPC class in India through Harvish Technical Services, please contact R. Venkatesan, director/owner, by phone at +91-9176618930 (mobile); +91-44-26251930 or +91-44-42036967 (landline); or by email at ahv999@yahoo.com or harvishts@gmail.com.

To register for an SSPC class in Bahrain, Egypt or Italy through Quality Control Co. please contact Mohsen Hassanein, executive manager, by phone at +20100 900 60 40 or +33 7 79 95 79 75 (cell); +20233456809 (landline); by fax at +20233456037; or by email at mohsen.hassanein@qualitycontrol-egypt.com or mohsen@hirondelleq.fr.

New Self-Powered Dehumidifier Available

A new dehumidifier with a built-in generator is now being offered by Drynamic Inc. of Plymouth, Minn.

The 5,000 CFM desiccant, self-powered dehumidifier is the first in Drynamic's Titan Series. The lightweight aluminum unit offers a self-powering 27 kW built-in generator.

The company says the stackable unit consumes 2.25 gallons of fuel per hour with a 170-gallon capacity. The built-in fuel tanks provide about 72 hours of run time, according to the company. Units are available with auxiliary power and have an internal power source, allowing them to be used worldwide.

According to the company, the unit has been run continuously in testing for more than a month in both southern Louisiana, where ambient temperatures reached 100 F, and northern Minnesota, where ambient temperatures dropped to -20 F. The company says the unit is quiet enough for residential use.

For more information, visit drynamicinc.com.

Drynamic Inc.'s Titan Series 5,000 CFM dehumidifier. Photo courtesy of Drynamic Inc.

Marco Doubles Dust Collector Line

A smaller electric model and a mid-range option have joined Marco's line of Dustmaster dust collection equipment.

The Dustmaster 8,000 CFM Electric Dust Collector and the Dustmaster 18,000 CFM Dust Collector were rolled out this month by the Iowa-based provider of abrasives and blasting and coating equipment.

The new 8,000 CFM model is the first electric dust collector in the Dustmaster line. Marco recommends the unit for work in areas where diesel engines are not allowed.

Marco's Dustmaster 8,000 CFM (top) and Dustmaster 18,000 CFM dust collectors. Photos courtesy of Marco.

Powered with a 24 HP 460 volt motor, the 8,000 "moves more air when compared to other units its size," according to Marco.

The 18,000 CFM unit features a 91 HP Tier III diesel engine, four 20-inch duct hose inlets, six-inch discharge auger system, and a 55-gallon diesel fuel tank. Marco says the unit is suitable for applications where a typical 20,000 CFM dust collector would be used.

Like the 8,000 unit, the 18,000 "moves more air faster than other units its size," says Matt Molumby, director of engineering at Marco, "increasing work site visibility and increasing safety, making the site safer and more efficient."

The new additions are part of Marco's Engineered Systems division and expand the Dustmaster line to four models. Marco also manufactures a 28,000 CFM unit and a 48,000 CFM unit.

For more information, visit marco.us.

JPCL

For more Product News stories, check out *PaintSquare News*, a daily online newsletter. To subscribe, visit paintsquare.com/subscribe.

Project Preview

Photo courtesy of News Radio 710 KEEL.

Jimmie Davis Bridge Contract Awarded, Public Picks Purple Paint

PCL Civil Constructors Inc. (Tampa, Fla.) won a $23,437,790 contract from the Louisiana Department of Transportation and Development (DOTD) that includes cleaning and recoating steel surfaces on the Jimmie Davis Bridge. This 2,822-foot-long steel truss bridge was built in 1968 and connects the cities of Shreveport and Bossier City, La., over the Red River. PCL was the sole bidder on the contract, which was estimated between $15,000,000 and $20,000,000.

The contract includes abrasive blast-cleaning the steel to a Near-White finish (SSPC-SP 10) before recoating the surfaces with a zinc-based three-coat system utilizing an epoxy primer, an epoxy intermediate and a polyurethane or polysiloxane finish. Galvanized steel surfaces requiring painting will be shop-prepared, and hardware will be mechanically galvanized and coated after fabrication. Hardware that is not to be embedded in more than 3 inches of concrete will receive a cold-applied, zinc-rich, organic paint. The contract also calls for the cleaning and repair of any existing reinforcing steel. The existing coatings contain lead, so containment will also be required

The DOTD conducted a "Pick the Paint" poll held from March 7 to May 2, 2014, where citizens could cast a vote for their favorite paint color for the bridge. Possible color choices included blue, purple, brown, green, gold, grey, orange and red. Over 7,000 votes were submitted, and purple was chosen as the winning color to be applied as the bridge's topcoat.

Utility Service Co. Wins $546K Tank Painting Contract

A $546,300 tank cleaning and coating contract was awarded by the city of Clermont, Fla., to Utility Service Co. Inc. of Perry, Ga. The contract includes cleaning and recoating the city's 500,000-gallon Bloxam tank and repainting the city's logo on the 400,000-gallon Eastern Service Area tower. The company was the second-lowest bidder, and bested six other bids that reached as high as $1,403,400. The lowest bidder had submitted a bid of $386,290, but requested that its bid be withdrawn due to mathematical errors.

Photo via City of Clermont specifications, courtesy of Paint BidTracker.

The 96-foot-tall Bloxam tank interior will be abrasive blast-cleaned to a Near-White finish (SSPC-SP 10) and lined with one full coat of aromatic urethane zinc-rich primer, a stripe coat of polyamidoamine epoxy, and two full coats of polyamidoamine epoxy lining systems for use with potable water. Interior pillar surfaces will be abrasive blast-cleaned to a Commercial finish (SSPC-SP 6) and coated with an inorganic hybrid water-based epoxy and a coat of HDP acrylic polymer. The tank

Project Preview

Photo courtesy of News Radio 710 KEEL.

Jimmie Davis Bridge Contract Awarded, Public Picks Purple Paint

PCL Civil Constructors Inc. (Tampa, Fla.) won a $23,437,790 contract from the Louisiana Department of Transportation and Development (DOTD) that includes cleaning and recoating steel surfaces on the Jimmie Davis Bridge. This 2,822-foot-long steel truss bridge was built in 1968 and connects the cities of Shreveport and Bossier City, La., over the Red River. PCL was the sole bidder on the contract, which was estimated between $15,000,000 and $20,000,000.

The contract includes abrasive blast-cleaning the steel to a Near-White finish (SSPC-SP 10) before recoating the surfaces with a zinc-based three-coat system utilizing an epoxy primer, an epoxy intermediate and a polyurethane or polysiloxane finish. Galvanized steel surfaces requiring painting will be shop-prepared, and hardware will be mechanically galvanized and coated after fabrication. Hardware that is not to be embedded in more than 3 inches of concrete will receive a cold-applied, zinc-rich, organic paint. The contract also calls for the cleaning and repair of any existing reinforcing steel. The existing coatings contain lead, so containment will also be required

The DOTD conducted a "Pick the Paint" poll held from March 7 to May 2, 2014, where citizens could cast a vote for their favorite paint color for the bridge. Possible color choices included blue, purple, brown, green, gold, grey, orange and red. Over 7,000 votes were submitted, and purple was chosen as the winning color to be applied as the bridge's topcoat.

Utility Service Co. Wins $546K Tank Painting Contract

A $546,300 tank cleaning and coating contract was awarded by the city of Clermont, Fla., to Utility Service Co. Inc. of Perry, Ga. The contract includes cleaning and recoating the city's 500,000-gallon Bloxam tank and repainting the city's logo on the 400,000-gallon Eastern Service Area tower. The company was the second-lowest bidder, and bested six other bids that reached as high as $1,403,400. The lowest bidder had submitted a bid of $386,290, but requested that its bid be withdrawn due to mathematical errors.

Photo via City of Clermont specifications, courtesy of Paint BidTracker.

The 96-foot-tall Bloxam tank interior will be abrasive blast-cleaned to a Near-White finish (SSPC-SP 10) and lined with one full coat of aromatic urethane zinc-rich primer, a stripe coat of polyamidoamine epoxy, and two full coats of polyamidoamine epoxy lining systems for use with potable water. Interior pillar surfaces will be abrasive blast-cleaned to a Commercial finish (SSPC-SP 6) and coated with an inorganic hybrid water-based epoxy and a coat of HDP acrylic polymer. The tank

exterior will be abrasive blast-cleaned to a Commercial finish (SSPC-SP 6) with a lead-stabilizing abrasive additive and coated with an aromatic urethane zinc-rich primer, an aliphatic acrylic polyurethane intermediate and an advanced thermoset fluoropolymer polyurethane finish. Additional work includes installing a new roof vent, repairing the overflow inlet weir, and installing or repairing miscellaneous tank attachments.

The contractor will coordinate with the owner to obtain confirmation on sizing, orientation, and location of the logo on the 140-foot-tall Eastern Area Service tower. Logo coatings will be the same as the specified topcoat.

DOT Quick Hits

- Monoko, LLC of Tarpon Springs, Fla., SSPC-QP 1- and -QP 2-certified, beat eight other bidders for a $4,327,785 contract from the Vermont Agency of Transportation to clean and recoat structural steel surfaces on 10 bridges. The contract includes lead paint removal, which requires containment.

- A contract valued at $2,684,254 was awarded by the Virginia Department of Transportation to Klicos Painting Company of Baltimore, Md., SSPC-QP 1- and -QP 2-certified, to clean and recoat structural steel surfaces on 18 bridges. Containment is required to capture the existing lead-bearing coatings.

- F.D. Thomas, Inc.of Central Point, Ore., SSPC-QP 1- and -QP 2-certified, won a $1,487,000 contract from the California Department of Transportation to clean and recoat structural steel surfaces on a set of dual bridges over the Truckee River.

- The Washington State Department of Transportation awarded a $1,547,080 contract to Intech Contracting, LLC of Lexington, Ky., to clean and paint the Green River Neely Bridge, located in King County, Wash. Containment is required, as the existing coatings contain lead.

exterior will be abrasive blast-cleaned to a Commercial finish (SSPC-SP 6) with a lead-stabilizing abrasive additive and coated with an aromatic urethane zinc-rich primer, an aliphatic acrylic polyurethane intermediate and an advanced thermoset fluoropolymer polyurethane finish. Additional work includes installing a new roof vent, repairing the overflow inlet weir, and installing or repairing miscellaneous tank attachments.

The contractor will coordinate with the owner to obtain confirmation on sizing, orientation, and location of the logo on the 140-foot-tall Eastern Area Service tower. Logo coatings will be the same as the specified topcoat.

DOT Quick Hits

- Monoko, LLC of Tarpon Springs, Fla., SSPC-QP 1- and -QP 2-certified, beat eight other bidders for a $4,327,785 contract from the Vermont Agency of Transportation to clean and recoat structural steel surfaces on 10 bridges. The contract includes lead paint removal, which requires containment.

- A contract valued at $2,684,254 was awarded by the Virginia Department of Transportation to Klicos Painting Company of Baltimore, Md., SSPC-QP 1- and -QP 2-certified, to clean and recoat structural steel surfaces on 18 bridges. Containment is required to capture the existing lead-bearing coatings.

- F.D. Thomas, Inc.of Central Point, Ore., SSPC-QP 1- and -QP 2-certified, won a $1,487,000 contract from the California Department of Transportation to clean and recoat structural steel surfaces on a set of dual bridges over the Truckee River.

- The Washington State Department of Transportation awarded a $1,547,080 contract to Intech Contracting, LLC of Lexington, Ky., to clean and paint the Green River Neely Bridge, located in King County, Wash. Containment is required, as the existing coatings contain lead.

Index to Advertisers

Free product information is just a few clicks away!

Request more information about the products advertised:
Log on to the convenient Reader Inquiry eCard at www.paintsquare.com/ric.

COMING UP

SSPC 2015 featuring GreenCOAT
Westgate Las Vegas Resort
Feb. 3–6, 2015
sspc2015.com

SSPC Courses

Course information is available at sspc.org
** = Courses held at SSPC 2015 featuring GreenCOAT in Las Vegas*

Feb. 2 Ctg App Spclst (CAS) Refresher*
Feb. 2 Nav Std Item 009-32, Using PA 2*
Feb. 3 Estimating*
Feb. 3–4 ATT Train-the-Trainer, CCB Conc Ctg Basics, C10 Floor Ctg Basics*
Feb. 3–5 Ctg Spec Essentials*
Feb. 3–7 BCI Bridge Ctg Insp Level 1, CCI Conc Ctg Insp, C1 Fundamentals, C2 Plan & Spec, NAVSEA Basic Pt Insp (NBPI), Prot Ctg Insp (PCI) Level 1*
Feb. 3–8 BCI Level 2, CCI, Level 2*
Feb. 4 Contract*
Feb. 4–7 C3 Lead Pt Removal*
Feb. 5–6 Proj Mgmnt, QCS Qual Cntrl Spvr, C12 Spray App*
Feb. 6 C5 Lead Pt Refresher, PCI Workshop*
Feb. 6–7 Insp Plan & Doc*
Feb. 7–8 C7 Abrasive Blast, Bridge Ctg Assess, CCI*
Feb. 8 Prot Ctgs Spclst (PCS) Enrollment*
Feb. 9 CCI Supplement, PCI Level 3*
Feb. 12–13 CCB Conc Ctg Basics, Greensboro, N.C.
Feb. 19 C5 Lead Pt Refresher, Worcester, Mass.
Feb. 19 Using PA 2, San Diego, Calif.
Feb. 20 Nav Std Item 009-32, San Diego, Calif.
Feb. 21–22 C12 Airless Spray, Norfolk, Va.
Feb. 23–27 C1 Fundamentals, Norfolk, Va.
Feb. 23–27 BCI Level 1, Portland, Ore.
Feb. 23–27 NBPI, San Diego, Calif.
Feb. 23–28 BCI Level 2, Portland, Ore.
Feb. 24 Thermal Spray, Kent, Wash.
Feb. 24–25 C7 Abrasive Blast, Portland, Ore.
Feb. 26–27 C12 Airless Spray, Portland, Ore.
Feb. 27 C5 Lead Pt Refresher, Gulfport, Miss.

Conferences and Meetings

Feb. 3–6 World of Concrete 2015, Las Vegas, worldofconcrete.com
Feb. 11–13 ASCE CI Summit, Henderson, Nev., asce.org
Feb. 23–25, SPE Reservoir Simulation Symp, Houston, Texas, spe.org

FOR A LIST OF MORE EVENTS, VISIT WWW.PAINTSQUARE.COM