It's PACE Time

It is surprising how fast a year goes by. It is time for another PACE conference. This year's show will be in Phoenix, AZ, from 7–10, February 2010. This is the last PACE show for PDCA and SSPC. That being considered, we are working to make it even better than our previous five shows. Look at the advance program that begins on page 63 of this issue (with more to come in the January *JPCL*), and you will see that we have assembled another world-class program.

PACE remains the only coatings show where you can get latest information on new products at our exhibition as well as the technical knowledge and business training in one place and for one price. In these tough economic times, you cannot afford to miss the opportunity of attending nor the educational value you can obtain from this conference. To stay competitive, you need to learn from your peers, other attendees, and especially the exhibitors on how you can save money and increase productivity. Why work harder, when you can work smarter?

SSPC's strong technical program is combined again with PDCA's strong business program, making for a conference loaded with 80 technical presentations and workshops, 49 business track presentations, 16 pre-conference training and certification programs, and five post conference programs. The conference program was developed by an outstanding group of volunteers from the coatings industry and should address the needs of all the demographics that make up the membership of SSPC. The technical program will have a variety of subjects that will address the latest changes in coatings technology, good painting practices, as well as those of general interest. The business track is developed to help those individuals who run their own businesses or who are in key positions in their firm.

The first big conference event is our Annual Meeting on Sunday afternoon. We will give awards to some very deserving members along with outstanding writers who contributed to the *JPCL*. We will also give out our structure awards for outstanding coatings projects during the last year. We are honored and humbled to give the recognition all those people have earned.

On Monday morning our keynote speaker will be Dr. Dale Henry, who was a very popular speaker at SSPC conferences. His talk is very relevant to our current times. It is "When Business is Down, Up Yours!" He has been a teacher, a principal, the Dean of the oldest college in Tennessee, author, and, of course, a speaker. He will demonstrate an approach we can use to increase business in trying economic times. Dr. Dale is not only educational, but his presentation style is quite humorous, and I am sure you will leave with a smile on your face.

Some other highlights of the conference are the MegaRust Follow-up meeting on Tuesday, February 9th, a meeting of the Government Affairs Committee, and the Peer Forums. The MegaRust meeting will consist of presentations from the existing work groups and also an afternoon discussion session.

The Peer Forums will be held again on Wednesday morning. The following groups are scheduled to meet: Chem/Petrochem, DOT, Marine/Offshore, Power, and Water/Wastewater.

I want to thank all the volunteers who assist in putting their association's annual conference together and all of those who will speak at this event. Without their participation and their willingness to share information and sacrifice their personal time, the conference would never take place. I would also like to thank all the sponsors whose support allows us to take what would be a good conference and turn it into a great conference.

I am sure all of you will be able to take advantage of the increased networking opportunities at the social events and hospitality suites and visit the outstanding exhibits in the hall. This is your conference, and the staffs of both SSPC and PDCA will make sure you have a great experience as well as having a sense of accomplishment and fulfillment after you return home. As I mentioned in my first paragraph, this is the last PACE conference. I would like to thank and commend the PDCA staff for their effort and teamwork in working with the SSPC staff in making the previous PACE conferences successful. I have nothing but the upmost respect for that organization.

In closing, I would like to wish all of you the most happy holiday season and the most joyous and prosperous New Year. I have a good golfing buddy who always says on the 18th hole, when we shake hands and get ready to depart, "Stay Healthy." I wish all of you and your families good health in 2010 because as I wrote in my November editorial, that is what really matters.

Bill Shoup
Executive Director, SSPC

PPG Names New Marketing VP

PPG Industries has announced the appointment of Patrick J. Kenny as vice president, corporate marketing, effective Nov. 1. He will continue to be based at the company's global headquarters in Pittsburgh, PA, and will report directly to J. Rich Alexander, PPG senior vice president, performance coatings.

Patrick J. Kenny

Kenny will be responsible for corporate marketing and growth initiatives, government selling programs, market-facing growth initiatives, and marketing/sales competency development. He is currently PPG general manager, corporate marketing and construction markets.

Kenny joined PPG in 1980 and progressed through various project management, sales management, and marketing positions in the flat glass, commercial products, and construction contracting businesses. He moved to Hong Kong in 1989 as managing director for a PPG glass joint venture and was promoted to global marketing manager, flat glass, in 1993.

In 1999, Kenny became global director of marketing, flat glass. In 2003, he was appointed business director of the newly created, cross-business construction market team. He assumed additional responsibility for leading PPG's corporate marketing and growth initiatives in November 2006.

"Pat has helped move our corporate growth agenda forward with specific marketing initiatives, as part of the current growth initiative staff, and he is well qualified to lead this function," Alexander said.

Kenny earned a bachelor's degree in marketing from the Kelley School of Business, Indiana University. He also earned an executive master of business administration degree from the University of Pittsburgh.

PPG is a global supplier of paints, coatings, optical products, specialty materials, chemicals, glass, and fiber glass. The company has more than 140 manufacturing facilities and equity affiliates and operates in more than 60 countries. For more information, visit www.ppg.com.

NACE Executive Director Resigns

Houston, Texas-based NACE International, the Corrosion Society (NACE), has announced that Executive Director Tony Keane has resigned, effective January 8, 2010.

"I am disappointed to learn of Tony's resignation," said Mark Byerley, NACE President. "Under his leadership NACE has experienced dynamic growth and I know that he put NACE in a position to continue to succeed. I speak on behalf of the full Board in observing that the future of NACE is bright as a result of his having been here."

Del Doyle, P.E., NACE Senior Director for Strategic Initiatives, will be the Interim Executive Director while the NACE Board of Directors conducts a global search for a permanent replacement. The Board Search Committee, chaired by Dr. Louis D. Vincent (past president), is being organized in accordance with NACE policies and procedures, and the search will begin immediately. "I look forward to working with our dedicated and committed staff, volunteers, and supporters in strengthening the work of NACE. It is an honor and a privilege to be part of this important transition within NACE," Doyle said.

Doyle is a registered Professional Engineer and has a master's degree in environmental engineering from Purdue University. He has over 35 years of experience in technical and leadership positions for various industrial companies. Most of his career was spent in the air pollution control field, but he has spent the past seven years in leadership positions in corrosion mitigation, coating, and technology development for corrosion control.

Founded in 1943, NACE has over 22,000 members in 110 countries.

DuPont CEO Elected to Chair Board

DuPont (Wilmington, DE) announced that its board of directors has elected CEO Ellen Kullman as chair, effective December 31. She will take over this role when Charles O. Holliday, Jr. retires after 11 years as the chairman.

Ellen Kullman

Kullman became CEO on January 1, 2009, after Holliday served as CEO for 10 years. Holliday continued as chair of DuPont for a brief transitional period.

Holliday says of his successor, "Ellen's innate leadership skills, acute market focus, and strong track record were the basis for the board's decision that she is the right person as its chair. I am confident Ellen will be an outstanding chair and CEO."

Patenaude Named Manager

Christopher Patenaude

Corrosion Products and Equipment, Inc. (Rochester, NY), a coating contractor and an original equipment manufacturer serving the water, wastewater, hydroelectric, and petrochemical industries, has named Christopher Patenaude as the new general manager of the Specialty Service group. He will be responsible for heading the newly created Coatings and Linings division.

Patenaude has 20 years of experience in the industry. He has completed the SSPC Lead Instructor Training for Supervisors and Foreman of Industrial Lead Paint Abatement Projects and the SSPC Successful Coating and Lining of Concrete courses. He is also a NACE Certified Level 1 Inspector. Patenaude is a graduate of Western New England College.

KMT Moves Aqua-Dyne Headquarters

KMT Aqua-Dyne, a company specializing in high-pressure water blasting equipment, has moved its offices from Houston, TX, to Baxter Springs, KS, where KMT Waterjet Systems, Inc. is also located.

For more information on the new location, contact Clayton Burleson at 602-856-6274 or clayton.burleson@aqua-dyne.com. Details on the company can be found at www.aqua-dyne.com.

NIOSH Launches New Respirator Site

Contractors and companies that need unbiased information on respirators can find a new source for it online, thanks to NIOSH.

NIOSH, the federal agency that certifies respirators, has just launched a Respirator Trusted-Source Information Page, which provides detailed information on selecting, buying, fitting, and using respirators. The site, still partially in development, will be organized into three sections: NIOSH-approved respirators, use of NIOSH respirators, and ancillary respirator information.

The Respirator Information Page is available at www.cdc.gov/niosh/npptl/topics/respirators/disp_part/RespSource.html.

AkzoNobel to Buy Dow Powder Coatings

AkzoNobel has announced signing an agreement with The Dow Chemical Company (Dow) to acquire its powder coatings activities. Dow had purchased the powder coatings activities earlier this year as part of its acquisition of Rohm & Haas. The business achieves global sales of several hundred million dollars and employs around 700 people.

The transaction is expected to close during the second quarter of 2010, subject to customary closing conditions.

AkzoNobel is based in Amsterdam, the Netherlands; Dow Chemical is headquartered in Midland, MI, U.S.

Axxiom Receives Safety Award in Texas

The Texas Department of Insurance, Division of Workers' Compensation (TDI-DWC) and the Occupational Safety and Health Administration (OSHA) recently recognized Axxiom Manufacturing (Fresno, TX) for its outstanding safety program. Axxiom, which makes equipment used in coating work, was awarded the Safety and Health Administration Recognition Program (SHARP) award for low incidences of work-related injuries and illnesses and participation in TDI-DWC's Occupational Safety and Health Consultation (OSHCON) program.

Axxiom employs 48 people and manufactures abrasive blasting equipment, moisture separators, air dryers, aftercoolers, and several types of storage and transfer systems. The company has been granted a one-year exemption from programmed OSHA inspections for winning the SHARP award.

For more information on OSHCON and SHARP contact oshcon@tdi.state.tx.us.

BREAKING NEWS:

Lloyd's Register Approves SSPC's Protective Coatings Inspector Program.

For details: www.sspc.org, www.paintsquare.com, and the January 2010 *JPCL.*

How to Handle Exposed Rebar when Repairing Concrete

What is the best approach to cleaning and protecting exposed rebar during repair of structural concrete?

Gary Hall, Sauereisen, Inc.

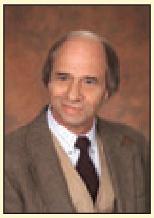
The American Concrete Institute has a proven procedure that should be followed for cleaning and protecting exposed rebar when repairing structural concrete.

The first thing to do is to make sure that all loose or cracked concrete is removed. Do not leave loose pieces behind the rebar. The rebar that is exposed needs to be thoroughly cleaned and repaired, if necessary. Corroded rebar that has lost its temper due to excessive metal loss will not have the same supporting capabilities as the original rebar and must be evaluated by a competent engineer. If a rebar is spliced, either by tie-wire or by welding, the splice must be grouted with a high-strength grout that has very little shrinkage. The grout can be epoxy or portland-based.

Cleaning and profiling the rebar and the existing concrete may well be the most difficult and the most important part of the process. Getting behind and between corroded rebar requires patience and perseverance. High pressure water jetting is a good way to remove rust contaminants and loose concrete. Abrasive blasting is difficult, as it is nearly impossible to direct the abrasive stream onto the hidden faces of the rebar. Hand grinding and chipping are almost always involved, especially behind the rebar and between overlapping rebar. If corrosion products are left in place, the entire process may well be jeopardized. An old rule of thumb is that you need at least one-inch of clearance around and behind rebar to enable placement of repair materials.

Once cleaned, the rebar needs to be protected from excessive rust bloom or flash rusting until covered by new concrete. There are commercial treatments available that work well for this and that also aid in salt removal. Care must be exercised to ensure that construction debris such as mud, grease, or oil does not accumulate on the cleaned rebar or surrounding concrete. Weld splatter and cutting torch debris must also be removed from the rebar and surrounding concrete. If the new concrete placed around the repaired rebar is not going to receive a protective coating, it is important to protect the rebar with at least four inches of concrete to prevent premature corrosion of the repaired rebar.

Coat the rebar with a high-quality, corrosion-resistant coating and bonding compound. Coat the existing concrete with the same bonding compound. There are several epoxy formulations that work well for this application. Choose the repair material carefully, ensuring that it has the correct properties of adhesion, strength, shrinkage compensation, and application characteristics. For maximum protection after the repair material has been applied, the entire concrete structure should be protected with an appropriate coating.



Gary Hall is manager of Organic Technology at Sauereisen, Inc. (Pittsburgh, PA), where he has been employed for 36 years. He is responsible for research and development of the company's organic product line. He is active in SSPC, AICHE, ACS, NACE, and several ASTM committees. A contributing editor for *JPCL*, he has twice been the recipient of the *JPCL* Editor's Award.

Vaughn O'Dea, Tnemec Company, Inc.

It is not uncommon to encounter exposed reinforcing steel (rebar) when rehabilitating structural concrete. Most designs for industrial cast-in-place concrete structures specify the rebar to be placed 1.0–2.0 inches (25.4–50.8 mm) below the concrete surface. Frequently, rebar is damaged by corrosion, contributing to the delamination and spalling of concrete. Reinforcement corrosion has a variety of causes, including chloride or chemical ingress, misplaced reinforcing steel (too shallow), poor quality concrete, and carbonation of the concrete.

To properly repair corroded rebar, it is first necessary to expose it and evaluate its condition. In many cases, the specifier or owner may elect to further protect the exposed rebar with a high-performance protective coating before rehabilitating the concrete. When applied to rebar, a protective coating reduces future reinforcement corrosion and eliminates the halo effect (i.e., anodic ring). The halo effect occurs when the same rebar extends into two distinctly different environments (new repair vs. existing/contaminated/carbonated concrete). This leads to accelerated corrosion by setting up anodic/cathodic conditions along the surfaces of the rebar.

A protective coating is also beneficial in cases where there is lack of concrete cover over the reinforcing steel. In these instances, two-component epoxy barrier coatings are commonly used to iso-

Continued

late the rebar from the detrimental chemical or salt solutions and prevent future reinforcement corrosion.

According to the American Concrete Institute (ACI 546), all weak, spalled, severely cracked, damaged, and easily removable concrete should be chipped away from corroded reinforcement steel. Concrete removal should proceed to create a clear space behind the reinforcing steel of 0.25 in (6 mm), plus the dimension of the maximum size aggregate of the repair material when the rebar has loose rust or corrosion product, or is not well bonded to the surrounding concrete. If reinforcement steel is only partially exposed after all unsound concrete is removed, it may not be necessary to remove additional concrete to expose the full circumference of the reinforcement.

Vaughn O'Dea is director of Sales, Water & Wastewater, for Tnemec Company, Inc. (Kansas City, MO), where he is responsible for strategic sales, marketing, and technical initiatives. He is an SSPC Protective Coating Specialist, a *JPCL* contributing editor, a NACE-certified Coating Inspector level 3, and a NACE-certified Corrosion Technician. He is also active in several technical committees of SSPC and NACE.

Similar to other applications to steel, proper surface preparation of rebar is required to achieve coating adhesion. All exposed surfaces of the reinforcement should be thoroughly cleaned of all loose mortar, rust, and other contaminants. The preferred method is abrasive blasting (SSPC-SP 10/NACE No. 2) or waterjetting (SSPC-SP 12/NACE No. 5, WJ-1, L). Any excess sand and loose debris should be blown from the surface with oil-free compressed air. If water jetting is used, cement and particulate slurry must be removed from the reinforcing steel. The high-performance protective coating should be applied at a thickness less than 12 mils (305 microns) to prevent overbuilding and to minimize loss of bond development at the rebar deformations. Likewise, reinforcing bars that have lost their original shape (deformations) as a result of corrosion and cleaning have less bond development with most repair materials.

Also, care should be taken during the coating process to avoid spillage on the parent concrete. Always consult the coating manufacturer to confirm compatibility of the product with the rebar.

Who Reads Instructions Anyway?

The Case of the Failing Floor Coating

By Rick A. Huntley, Senior Coatings Consultant, KTA-Tator, Inc.
Richard Burgess, KTA-Tator, Inc., Series Editor

Several years ago, an upgrade was slated for the warehouse of a distribution facility. Part of the upgrade included recoating the concrete floor. The specification for the project required the concrete floor to be abrasive blast cleaned or scarified to remove laitance and surface contaminants. Additionally, before applying the coatings, the surface was to be tested to ensure it was free of moisture. The testing followed the plastic sheet method as described in ASTM D 4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

The specification called for a three-coat system: an epoxy primer applied at 150 to 200 sq ft per gallon, a base coat of 100% solids epoxy applied at a thickness of 20 to 30 mils, and a two-component epoxy topcoat applied at a thickness of 20 to 30 mils.

The painting subcontractor submitted an alternate coating system from a different manufacturer as a substitute to the specified system. The alternate system, which was approved and eventually chosen for application to the floor, consisted of a coat of epoxy primer applied at a recommended dry film thickness (dft) of 3–5 mils, a modified polyamine epoxy intermediate coat applied at a recommended dft of 6–12 mils, and a topcoat of a two-component aliphatic polyester polyurethane applied at a recommended dft of 2–3 mils.

During application of the topcoat, the painting subcontractor experienced problems with its adhesion to the intermediate coat. Within weeks after the application was completed, problems also arose with the adhesion of the topcoat, and scratches appeared in the floor coating. The owner of the facility requested an independent evaluation of the floor coating problems.

Fig 1: Most scratches on warehouse floor were parallel to length of aisle.
Photos courtesy of the author

The Site Investigation

A visit was made to the distribution facility to examine the floor.

The floor had been coated with a gray-colored coating material. In various areas, there was also yellow striping on the gray floor. The floor was scratched and marred to various degrees throughout most of the facility. Most of the scratches were aligned in the direction of the forklift traffic flow (Fig. 1). For example, most of the scratches in any particular aisle were parallel to the length of the aisle. There were also areas where it appeared that the wheels of a forklift had spun on top of the floor, and, in some cases, had left a black mark on the surface of the floor coating. In other cases, the wheels appeared to remove the top layer of the coating, uncovering a gray intermediate coat. The degree of marring on the floor varied; the damage was minimal in some of the areas where the coating had been newly applied, while in other areas, the marring was quite extensive.

The floor was also relatively dirty at the time of the inspection. During the inspection, a floor cleaner was used on one area. The floor cleaner removed most of the dirt, but a moderate degree of scratching was still visible.

The topcoat was delaminated in many areas. Although both the topcoat and the intermediate coat were gray, the delamination was clearly visible because the topcoat was generally dirty and therefore darker than the intermediate coat. The delamination generally occurred in small patches.

The floor coating was closely examined in many areas. The degree of hardness of the topcoat varied considerably. According to the product data sheet for the topcoat, the coating was an “extremely hard, chemical-resistant polyurethane floor coating.” During the site investigation, it was found that an impression could be made in the topcoat with a fingernail. In at least one spot, the

Continued

topcoat was slightly tacky and could be removed easily with a fingernail and rolled into small balls. In most of the areas examined, the topcoat could be removed from an intermediate coat by scratching the surface with a fingernail. In a few areas, the coating was harder, and could not be removed with fingernail gouging.

Fig 2: ASTM Tape Test revealed poor coating adhesion

The adhesion of the coating system was assessed in accordance with ASTM D3359, "Measuring Adhesion by Tape Test," Method A (X-cut). This method involves making two intersecting cuts through the coating to the substrate with a sharp blade. The smaller angle of the cuts is between 30 and 45 degrees. A special pressure-sensitive tape is then applied to the X-cut area and rapidly removed.

In many of the areas tested, the coating adhesion was extremely poor (Fig. 2). In some cases, the coating could be removed simply by applying the tape to the uncut topcoat and sharply pulling off the tape. In some other areas, the coating adhesion was rated good (4A), yet the topcoat could be removed by scratching at the surface with a fingernail. In a few areas, the tape adhesion was found to be good and the topcoat could not be removed with fingernail pressure.

In areas where delamination was observed, the topcoat could be removed easily by cutting the surface with a utility knife and slipping the blade of the utility knife under the topcoat. In some cases, by continuing to tug at the coating, large sections could be removed in one piece (Fig. 3).

During the site visit, several coating samples were removed from the floor for laboratory analysis.

The Laboratory Investigation

Visual and microscopic examination of the samples was performed using a stereo zoom microscope with magnification to 45x. The investigation revealed that the samples generally consisted of four coats. The first coat was clear and the backside was dirty. There were three off-white coats applied to the clear coating. The topcoat could be removed from the other three coats in areas on some of the chips.

Fig 3: Large sections of coating delaminated with minimal manipulation.

Infrared spectroscopic analysis was performed with a Fourier transform infrared spectrometer. Sample scrapings were combined with potassium bromide powder and formed into pellets under high pressure. The pellets were then placed in the optical path of the spectrometer and spectra were obtained.

The infrared analysis indicated that the top two coats that were applied to the floor were the urethane topcoat. The primer and the first intermediate coat were determined to be epoxy coatings.

The analysis also revealed that the softer topcoat samples had slightly different spectra than the harder samples of topcoat and a control sample of a properly mixed topcoat. Specifically, one of the bands in the spectra of the soft topcoats was significantly smaller than the same band in the spectra of harder topcoat.

Putting It All Together

The site investigation and the laboratory analysis indicated that the cause of the excessive marring and scratching and of the scattered delamination of the topcoat from the floor in the distribution facility was improper mixing of the urethane topcoat. The topcoat was described as an "extremely hard chemical resistant polyurethane floor coating" in the product data sheet. As noted above, the topcoat on the floor was soft enough in many areas to deform with fingernail pressure. In some other areas, the coating was relatively hard and well adhered.

Laboratory microscopic analysis indicated that there were two layers of topcoat on the samples. When the coating had poor adhesion or had delaminated, it was found that the plane of separation was sometimes between the first layer of topcoat and the epoxy intermediate coat, and sometimes between the two layers of topcoat. The topcoat that separated from the rest of the coating system was found to be soft, regardless of whether it was the first layer or the

Continued

second layer of polyurethane topcoat.

The topcoat applied to the warehouse floor is a two-component coating. Polyol in the second component reacts with the isocyanate in the first component to form a hard film. The two components must be mixed thoroughly and in their proper proportion for the coating to obtain its proper hardness. The laboratory infrared analysis provided strong evidence that the coatings were not consistently mixed in the proper proportions.

When several samples of a properly mixed two-component coating are compared using infrared spectroscopic analysis, there is usually very little difference between the spectra. In this case, the difference was very noticeable. The mix ratio of the coating varied considerably from location to location.

The softer coatings were found to adhere poorly to the underlying harder coatings. In some cases, the underlying coating was the epoxy intermediate coat. In other cases, it was an underlying second layer of the polyurethane topcoat. In all cases, the poorly adhered layer was soft.

Some degree of scratching and marring will occur with any organic floor coating exposed to forklift traffic. The degree of damage to the floor was significantly greater than should be expected for the coating system applied. The excess damage was a result of the softness of the applied topcoat. A floor coating that is soft enough to be scratched with a fingernail cannot be expected to withstand forklift traffic. If the coating had been properly mixed, it is likely the damage would have been significantly reduced and adhesion much improved.

The Fix

In a vast majority of the facility, the primer and the epoxy intermediate coat appeared to be in satisfactory condition. Unfortunately, the topcoat could not be overcoated without great risk of further failure. As a result, all of the topcoat had to be removed. Removal was accomplished using pressurized water and in some areas, a scarifying machine. In areas where the topcoat was removed by pressure washing, the uncovered intermediate coat was thoroughly abraded to break the gloss and roughen the surface. A properly mixed coat of the polyurethane was then applied to the prepared intermediate coat. The contractor had to perform the work—which also included temporary relocation of equipment and storage racks—at no cost to the owner. Additional work caused by improperly mixing the topcoat added more than 50% to the total cost of the job.

A Snapshot of the Railcar Lining Business: A Slow Train Coming?

By Daryl Fleming, Assistant Editor, *JPCL*

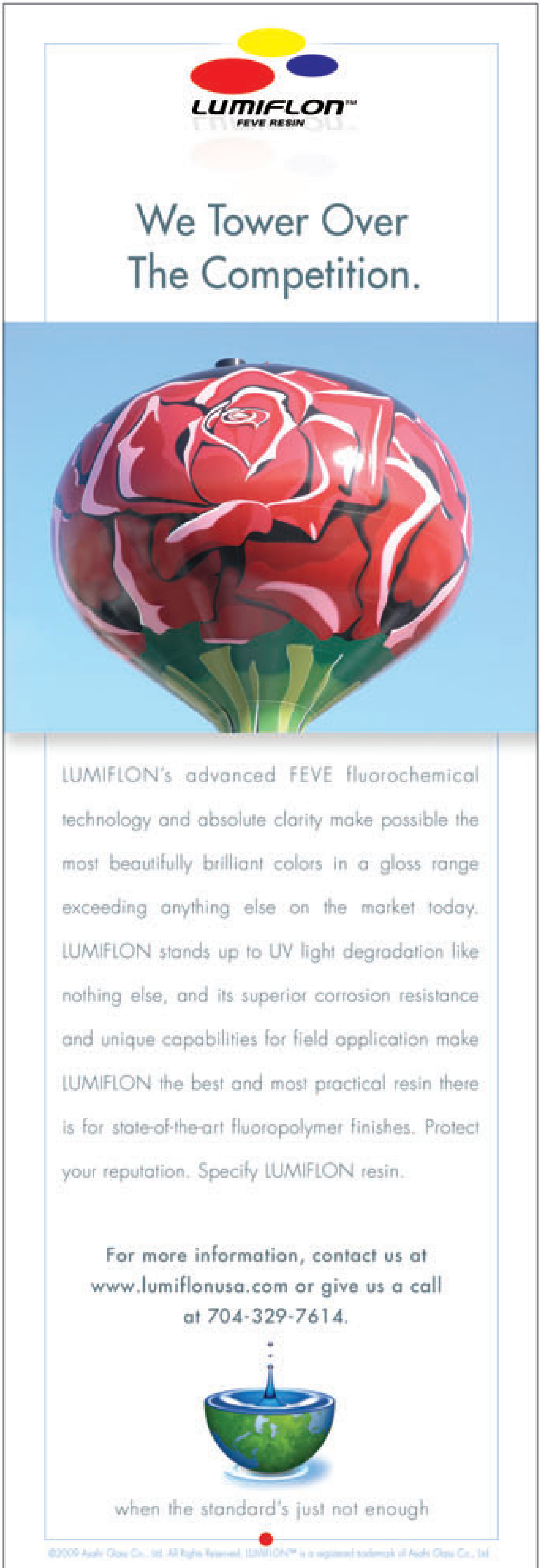
The state of the railcar lining market can be seen as a reflection of the contraction or slow growth of the economy in general. That is, a less-than robust economy can crudely be measured by railcar traffic: fewer goods being produced and sold mean fewer goods are transported by rail, and fewer railcars are needed to move them. And, by definition, fewer new railcars means fewer new linings are applied to new railcars. This is, broadly speaking, the impression gathered by speaking with representatives from several manufacturers of linings for railcars. These same representatives also report few significant developments in the formulation of new coatings for lining railcars, citing the effectiveness of the existing coatings and decreased funds for research and development. This article offers a brief update on the status of the railcar lining business.

According to E.J. Johnson, sales manager at Carboline Company (St. Louis, MO), the number of new railcars manufactured in 2009 is roughly one-third the amount made just three years ago. Carboline makes several coatings, typically epoxies, for a variety of railcar lining applications, including tank car linings for acid and alkali ladings, and linings for open gondola cars carrying such loads as coke coal, gluten (animal feed), and sulfur. As fewer railcars are being manufactured, Johnson reports orders for maintenance lining of existing railcars are also down. One reason behind the decrease in lining maintenance work, Johnson says, is that, instead of applying new linings to existing cars, in-use railcars in need of lining replacement are being swapped out with new or unused railcars that have been sitting idle (but with linings that have service life remaining).

Art Weiss, technical services supervisor at Kansas City, Kansas-based Versaflex, describes the market for maintenance lining of railcars as “at a standstill,” and that, related to this, inspection intervals for linings have lengthened. Versaflex makes polyurea linings for food grade cargoes, as well as linings for hydrocarbons and crude oils. Although the market for railcar linings has suffered, Weiss says the market share of polyureas for railcar lining has increased. One reason for this increase, according to Weiss: polyureas are inher-

Continued

Courtesy of iStock



> **“As fewer railcars are being manufactured, Johnson reports orders for maintenance lining of existing railcars are also down.”**

ently in step with these “green” times—their chemistry is low in volatile organic compounds (VOCs), and no component is restricted by the Environmental Protection Agency or similar regional bodies.

“Dramatically lower business” are the words used by Doug Schmidt of Heresite to describe the railcar lining market. Schmidt is a sales manager for the Manitowoc, WI-based Heresite, which makes heat-cured linings, including epoxies and baked phenolics, for a variety of applications, including the transport of sulfuric acid and sodium hydroxide. According to Schmidt, there was a spike in the production of new railcars in 2005/2006 that he relates to the concurrent growth of the ethanol business (a good also transported by rail). The economy-wide recession has slowed new railcar manufacturing and has had an “adverse effect” on lining maintenance as well, Schmidt says.

Schmidt voices an assessment similar to that of Weiss on railcar lining maintenance: customers (in this case, railcar owners and owners of railcar ladings) are looking to reduce costs, and are thus delaying maintenance and relining work, often performing spot repairs instead of replacing worn linings.

Michael Burkholder commercial manager of Seville, OH-based Blair Rubber Company, also cites a slowdown in the manufacture of new rail cars, but reports that the market for rubber linings for railcars has “stayed somewhat consistent.” Blair manufactures rubber linings for a variety of railcar applications, including tanks and vessels for transporting chemicals such as hydrochloric acid, phosphoric acid, and bleach. Burkholder gives at least two reasons for the stability of his company’s business in the slow economy. First, a majority of his company’s customers lease railcars instead of owning them. According to Burkholder, because the railcar leasing company usually pays for lining replacement or maintenance, the lessee is more likely than an owner to have a railcar lining replaced at predetermined intervals of time (often 10 years), regardless of the condition or viability of the lining. (The lessee often will stipulate for new lining installation before it signs on to lease a railcar; whereas an owner will

Tank car that transports hydrochloric acid as it awaits cleanout and inspection. Photo by Danny Lee. Courtesy of Blair Rubber Company

wait until the end of a lining's service life before replacing it.)

The second reason Burkholder gives for his company's ability to maintain business is related to the hazards of chlorine gas. Burkholder cites several spills and leaks from railcars transporting chlorine gas in the past decade. Because the material is in gaseous form, no lining is used in railcars transporting chlorine gas. But, according to Burkholder, several companies are converting chlorine gas into its liquid form—bleach—for safer transport. The conversion of chlorine gas into bleach has helped the company's sales. Nonetheless, Burkholder finds the railcar lining business, as a whole, to be slower than a year ago.

On the product development front, Schmidt reports his company is working on developing higher solids/lower VOC formulations, with the goal of producing a coating system of fewer coats, but with higher applied dry film thicknesses per coat. But none of the railcar lining company representatives interviewed report significant advances in the chemistry of railcar lining formulations. Burkholder does relate that his company is developing a solvent-free (low-VOC) adhesion system that binds the rubber lining to the interior steel of a tank car.

In an article in the December 2004 *JPCL* (p. 39), Paul Lovett, founder of P.D. Lovett & Company, a marketing and business consultancy, describes the market for railcar coatings and linings as varying cyclically and dependent, in general, on the overall economy. As the economy recovers, new construction of railcars will increase, according to Lovett. Similarly, he adds, the advance of new coatings technology is also "dampened or enhanced" by the economic cycle.

For those in the railcar lining business, there may be hope that this slow train is, indeed, coming around the bend.

JPCL

Dry Film Thickness Measurements: How Many Are Enough?

A Close Look at Four Major International Standards and Requirements

Above: Photo courtesy of Q-Lab Corporation

By Rob Francis, Aurecon Australia Pty Ltd

Dry film thickness (DFT) is probably the single most important measurement made during inspection or quality control of protective coating application. Even the most basic protective coating specification will inevitably require the DFT to be measured. It is considered to be the most important factor determining the durability of a coating system. The thickness of each coating layer in a system and the total system DFT will have to be measured and recorded to show that the specified system will meet the desired durability. The number of measurements that will be made is important to all parties involved in coating works. The contractor and inspector obviously need to know how many measurements to make as part of their inspection or QA work. But the owner and specifier also need to be aware of such requirements because they will greatly influence the cost and time required for inspection. This article looks at the requirements regarding the number of measurements that have to be made as described in recent DFT standards. There are many other important aspects of DFT measurement, including adjustment and calibration of gauges and effect of surface profile on thickness measurements, but this article concentrates on the required number of measurements.

Standards Used for DFT Measurement

Four main standards used for DFT testing are discussed in this article.

• SSPC-PA 2 (Measurement of dry coating thickness with magnetic gages)
• Australian Standard AS 3894.3 (Site testing of protective coatings, Method 3: Determination of dry film thickness)
• International Standard ISO 19840 (Paints and varnishes—Corrosion protection of steel structures by protective paint systems—Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces)
• Although not strictly speaking a standard, the recent International Maritime Organization (IMO) resolution MSC 215(88) on Performance Standards for Protective Coatings (PSPC), which addresses coating quality for ships, especially of ballast tanks.[1] This document has certain requirements regarding coating thickness, which are discussed with the above three standards.

One immediate problem that will arise when inspectors attempt to compare different standards is the different terminology used for identical processes. For the sake of consistency, the following terms are used in this paper.

• Gauge measurement: This is a single measurement obtained by the instrument at a point as defined in SSPC-PA 2.
• Spot measurement: This is the recorded measurement at a point. In SSPC-PA 2, this measurement is the average of three measurements taken in a four-centimeter (1.5-inch) circle. When working to SSPC-PA 2, three gauge measurements must be taken and averaged for each recorded spot measurement. In the other standards, only a single gauge measurement is required, and it is the recorded spot measurement, termed "point reading" in AS 3894.3 and "individual reading" in ISO 19840. The term "gauge reading" is used in PSPC, although not specifically defined. PSPC does require the type of gauge and calibration to be in accordance with SSPC-PA 2, but does not specifically require the three measurements to be averaged. We assume a single measurement is sufficient for PSPC.
• Specified dry film thickness: the term used in SSPC-PA 2 and AS 3894.3 to designate the DFT specified for each coat or for the whole paint system. In ISO 19840 and PSPC, the term used is "nominal dry film thickness."
• For consistency in comparisons of area in this article, square meters are used to describe area measures. To convert square meters (sq m) to square feet (sq ft), multiply sq m by 10: 1 sq m ~ 10 sq ft. Other metric units are converted to imperial units.

The methods are described below. Table 1 (p. 24) summarizes the total number of spot measurements for given areas to be tested according to the various standards.

SSPC-PA 2 Method

The best known scheme for determining the number of DFT measurements is the one described in SSPC-PA 2. In brief, reference areas of about 10 sq m need to be identified. The number of reference areas depends on the overall total area. Within each reference area, five separate spot measurements are taken, arbitrarily spaced over each reference area.
• For structures not exceeding 30 sq m, each 10-square-meter area must be measured.
• For structures not exceeding 100 sq m, three 10-square-meter areas are arbitrarily selected and measured.
• For structures greater than 100 sq m, three 10-square-meter areas within the

Rob Francis is a metallurgist and a corrosion and coatings specialist with engineering consulting company Aurecon (formerly Connell Wagner) in its Materials Technology Group in Melbourne. He has over 30 years experience in metals and materials, especially regarding protective coatings. Dr. Francis has a Ph.D. in corrosion science from the Corrosion and Protection Centre at UMIST, Manchester, UK. He is an Australasian Corrosion Association Corrosion Technologist and Coating Inspector, a NACE Certified Coating Inspector and accredited trainer. He is chairman of Australian Standards committee which produces AS/NZS 2312, Guide to protection of structural steel against atmospheric corrosion by use of protective coatings. He edited a book on inorganic zinc silicate coatings, which was published in 1999.

He can be contacted at FrancisR@ap.aurecongroup.com.

Table 1: Number of Spot DFT Readings Required by Different Standards for Flat Areas

Total Area (Sq M)* to be tested	SSPC-PA 2 Total number of spot measurements	AS 3894.3 Recommended number of spot measurements	ISO 19840 Minimum number of spot measurements	PSPC Minimum number of spot measurements
<1	5	3	5	1
1–3	5	3–9	10	1
3–10	5	9–30	15	1–2
10–20	10	10	20	2–4
20–30	15	15	20	4–6
30–100	15	15	30	6–20
>100	15 plus 5 per each additional 100 square meters	15 plus 5 per each additional 100 square meters	30 plus 10 for each additional 100 square meters	1 for each 5 square meters

*1 sq m ~ 10 sq ft

first 100 sq m are measured, followed by one 10-square-meter area for each additional 100 sq m.

In the main part of the standard, SSPC-PA 2 does not distinguish between flat areas and other geometries such as beams that require DFT measurement. If the specification requirement is simply to carry out the number of tests as specified by SSPC-PA 2, then the inspector would be expected to estimate the total area and use the inspection plan described above. However, an informative appendix (a major addition to the 2004 revision of this standard) presents testing protocols for measuring DFT on beams and girders and other shapes and sizes.[2] A complete description of the protocols is outside the scope of this paper but the more complex shapes require many more than five measurements per 10 sq m. Actual estimating of the required protocol is rather complex. Some of the decisions that have to be established by the inspector to determine the number of measurements are listed below.

- The number of spot measurements at each position on the beam depends on the height of the beam. Spot measurements are required on each of eight surfaces for beams less than 0.91 meters (36 in.) in height, but an extra two are required on the web for higher beams.
- The procedure requires measurements to be taken on the toes where possible. The standard states contracting parties may choose not to measure at this location if the flange thickness is less than 25 mm (1 in.). The standard also notes that measurement on the toes may not be practical on rolled beams, presumably because of the small size or rolled curve.
- The standard gives the option of carrying out a "full DFT determination" of a beam, which is a very thorough inspection, or a "sample DFT determination" with fewer measurements required. For a "full" determination, the beam is divided into five equal sections or surfaces, and the required number of measurements (between 8 and 14 depending on height and if the toe is measured) are made on each surface. For "sample" determination, only 2 or 3 regions are measured per beam, depending on length.

Given the complexity of these supplementary methods, and the fact that it is not a mandatory part of the standard, the inspector would probably benefit by following the better-known "5 readings per 10 square meters" method, unless the 2004 advisory appendix is specifically named.

Australian Standard AS 3894.3 Method

The method given in AS 3894.3 for large areas is nearly identical to the SSPC-PA 2 requirement, although spot measurements are required to be "evenly spaced throughout" rather than "arbitrarily spaced," as required by the SSPC standard. The subtle difference between these two requirements could be important in a legal sense, but unlikely to be given in-depth consideration by the inspector. In AS 3894.3, for flat areas less than 10 sq m, a minimum of three spot measurements per square meter are required.

AS 3894.3 has specific schemes for measuring DFT on beams and pipelines, generally a certain number of measurements per meter length. Unlike SSPC-PA 2, this is a normative part of openings, and other complex items. For "complex areas" (such as large brackets of primary support members), five gauge measurements per square meter are required.

Obligation Level

Each standard also has significant differences in its level of obligation for the inspector to follow the given measurement procedure. Actual interpretation of requirements could require legal opinion, but the differences appear to be as follows:

- The number of measurements given in SSPC-PA 2 "shall" be carried out, unless contracting parties agree to a greater number or the specification allows a different number of measurements. That is, the number given in the standard is a mandatory requirement unless otherwise specified or agreed. It is interesting to note that, in at least one case[5], a contractor successfully sued an inspection company for carrying out more measurements than required by the standard when the job fell behind schedule.
- In the Australian Standard, the number of measurements specified is simply advisory: the specified number of measurements "*should*" be carried out. This language implies that inspectors can carry out more or fewer measurements than described without any approval from the contractor or specifier.
- For the ISO standard, the number of measurements required is the minimum number, which implies that inspectors may carry out more (but not fewer) without approval from other parties. In fact, the standard specifically requires that the "number shall be increased for inspection areas having difficult configuration."
- For the IMO PSPC, the requirement is different again in that the given number of measurements "are to be taken." The word *shall* is not used, which is the term normally employed to denote a mandatory requirement in such a document. The document does say that "additional spot checks are to be taken to verify coating thickness for any area considered by the coating inspector." This language implies that the number of measurements specified is a minimum, and the inspector can take more if considered necessary without approval from other parties.

Examples of the Use of Each Standard

To see the differences between the use of the standards in practice, it is worth having a look at the measurement requirements of two sample areas, a "smaller" 500-square-meter flat area, and a "larger" ship's ballast tank. Table 2 (p. 26) summarizes the requirements for the four standards.

Example for a Smaller Flat Area

The first example looks at the requirements for testing a flat area of 500 sq m, such as the side of a ship or the outside of a tank 16 meters (52 feet) in diameter and 10 meters (33 feet) high. If the work was carried out to the SSPC or Australian Standard method, the area would need to be divided into 5 areas of 100 sq m each. Within the first 100 sq m, three test areas of approximately 10 sq m would be identified, and 5 measurements made in each. For each additional 100 square meter area, one 10-square-meter area would identified, and five measurements would be made in each. Figure 1 (p. 28) shows a typical inspection plan for such work. Assuming that each 10-square-meter region is thoroughly tested, 30%of the first 100 sq m of area is tested, but only 10% of each subsequent region. In all, about 14% of the area is tested using these methods.

If the work were to be carried out to ISO 19840, we again would divide it up into 5 regions of 100 sq m. But in this case, we would carry out a minimum of 30 measurements in the first 100-square-meter area, and 10 measurements in each additional 100-square-meter-area. As well as having more measurements than the above standards, the ISO 19840 measurements can be spread over the entire area, rather than concentrated in 10-square-meter areas (Fig. 2). The measurements could concentrate on edges, weld regions or other areas where low thickness is likely.

The PSPC document is not designed for large flat areas. However, if it were specified for such work, the area would not be divided up into reference areas and it would be simply a matter of one making one measurement for every five sq m. As with the ISO standard, the measurements are spread out over the entire area, giving 100% coverage, although the standard does specifically require extra measurements close to boundaries. A possible scheme for testing to PSPC on for flat areas is given in Fig. 3.

The example shows that for a relatively small area, the number of measurements required by each of the standards is significantly different, with PSPC requiring about 3 times as many measurements as SSPC-PA 2 or AS 3894.3.

Example for a Larger Area

It is also worth looking at the testing requirements for a much larger job, say 300,000 sq m of ballast tanks. In this case, we will also look at the actual number of individual measurements because this will have a significant effect on timing and costs.

If measurements were carried out in accordance with SSPC-PA 2 and AS 3894.3, the area would be divided into approximately 3,000 areas of 100 sq m each. In this case, the extra few measurements for the first 100 sq m become of little consequence. Each 100 sq m would have a 10-square-meter area tested with 5 spot measurements. This gives a total of 15,000 measurements. For SSPC-PA 2, each spot measurement is an average of three gauge measurements, so the total number of gauge measurements is 45,000. For the other standards, only a single gauge measurement is required

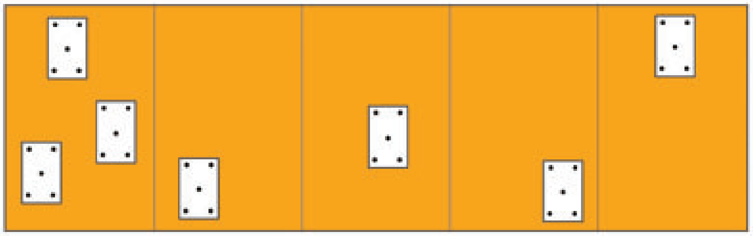


Fig. 1: A suggested inspection plan according to SSPC-PA 2 or AS 3894.3 for 500 square meters of flat surface area. Figures 1–5 courtesy of the author.

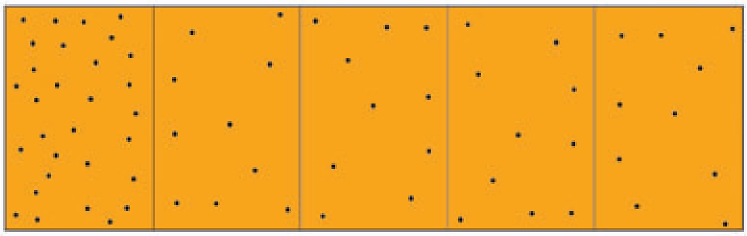


Fig. 2: A suggested inspection plan according to ISO 19840 for 500 square meters of flat surface area

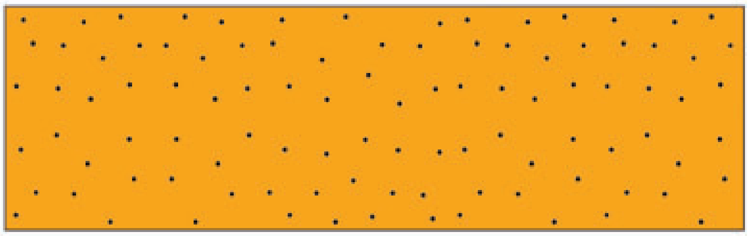


Fig. 3: A suggested inspection plan according to PSPC for 500 square meters of flat surface area

Table 3: DFT Measurements Required for 300,000 Square Meters of Ballast Tanks*

Measurement Type	SSPC-PA 2	AS 3894.3	ISO 19840	PSPC
Number of spot measurements	15,000	15,000	30,000	300,000
Number of gauge readings	45,000	15,000	30,000	300,000

*1 sq m ~ 10 sq ft

for each spot measurement.

ISO 19840 requires roughly 10 measurements per 100 sq m and, again ignoring the first 100 sq m, gives a total of 30,000 measurements.

PSPC is designed for ballast tanks but has a number of protocols for testing, depending on whether flat areas, stiffeners, regions around openings, etc., are tested. This complex scheme makes it hard to estimate the required number of measurements. It requires one measurement for every five sq m of flat areas, through to 5 measurements for every square meter in complex areas. On average, this gives one measurement per square meter. Interestingly, one author[6] calculates an identical number for a very large crude carrier with a total ballast tank area of 300,000 sq m, so this figure seems a reasonable estimate for working to this standard. That is, one measurement per square meter gives a total of 300,000 measurements. Table 3 summarizes these results. The differences between the standards are much greater with the large surface area, with PSPC requiring 20 times as many measurements as SSPC-PA 2 or AS 3894.3 and ten times as many as ISO 19840.

Discussion of the Testing Requirements

It could be argued that the SSPC and Australian Standard methods do not provide for adequate testing of the coating, certainly of the smaller area. An owner would probably expect many more than 35 measurements to be taken over a 500-square-meter structure, even if he or she may be satisfied with 15,000 for ship ballast tanks. On the other hand, perhaps the PSPC approach is the correct one. With modern electronic gauges with statistical functions and the ability to take perhaps one measurement per second, it should be possible to take many more measurements than the SSPC requirement, which was developed when permanent magnet mechanical gauges only were used. The number of measurements required by the PSPC standard would appear to provide the owner with assurance that the coatings paid for have in fact been applied to the specified thickness. But then, perhaps even the one measurement per square meter required by this standard is not sufficient to satisfy a pedantic inspector or owner who insists that the work must be within specification and that there must not be any areas of insufficient thickness. A significant variation in DFT is possible over a square meter, and one measurement may not identify this.

While a complete and accurate picture of the spread of DFT results may be desirable, the costs and delays must be considered if thousands of measurements are required. As mentioned above, one author[6] considered that a typical very large crude carrier would require making 300,000 DFT measurements for coating work of ballast tanks. He noted that this would require 450 A4 sheets of paper at 650 measurements per page for the records if a hard copy was required.

But in addition to the observations in Reference 6, it should be noted that a rate of one measurement per second, a typical figure for modern electronic gauges, would require 83 person-hours or three-and-half days to carry out the work, not allowing for any stops, rework, or repeat measurements. Even carrying out the work to SSPC-PA 2 would require 45,000 measurements (3 gauge measurements per spot measurement) and would take over 12 person-hours, assuming the conversion of individual measurements to spot measurements does not cause delays.

Fig. 4: Coating breakdown at an edge

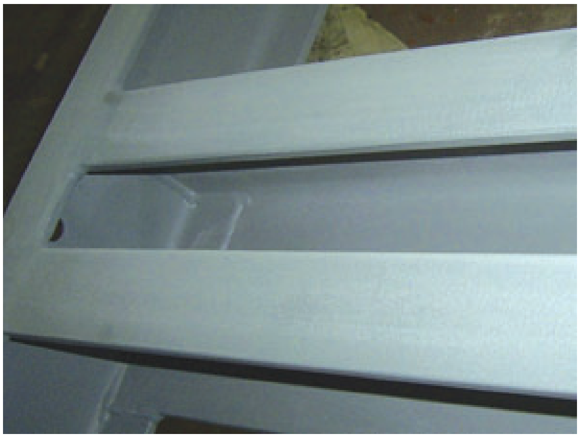


Fig. 5: Difficult-to-access regions are difficult to paint, and DFT is difficult to measure on them.

It is not known whether owners and ship builders are aware of the required investment in time and money to meet the latest standards. Because painting is inevitably one of the final activities in construction, such a requirement is certainly going to cause headaches and arguments.

The time and monetary expense may be justified if it can be guaranteed that the coating system will provide the desired protection. In practice however, it is unlikely that even a substantial number of measurements will detect all regions that may break down prematurely. Experience shows that problems with low coating thickness and premature breakdown are most likely to arise in two regions: first, at welds and edges of beams and sections, and, second, in difficult-to-coat regions. In the former, the usual cause of premature breakdown (Fig. 4) is considered to be that the paint pulls away from the edge as it cures, lowering the thickness, although other factors may be important, such as simply less paint applied, mechanical damage, or lack of adhesion due to minimal profile on the edge.

Older permanent magnetic gauges could measure only within 25 mm (1 in.) of an edge because of the way an edge distorts the magnetic field. But even modern electronic gauges, with their reduced magnetic fields, can measure within only 5 millimeters (0.2 in.) or so of an edge. PSPC recognizes this problem with edges and requires that measurements in ballast tanks be taken "as close as possible to tank boundaries, but not further than 15 mm (0.6 in.) from edges."

But measurements within 15 mm, or even 5 mm, will not necessarily locate areas of weakness at edges and corners. So it is not possible to measure thickness in this critical area, and, regardless of the number of measurements taken, low measurements in such areas will escape detection and the areas will break down well before the flat regions.

In the case of difficult-to-coat regions, such as the inner pockets in Fig. 5, it is hard, if not impossible, for the painter to position the spray gun in such areas. Paint coverage will at best be very uneven. Even brushing or rolling can be difficult. In addition, an inspector will have trouble taking thickness measurements because of the limited access, especially if using an integral probe gauge. It is therefore highly probable that, not only will such regions have a DFT well outside the specification, but also that the inspector will not be able to measure DFT there.

The observations above were substantiated by a presentation at a recent marine corrosion conference.[7]

With regard to ballast tank coatings, the following were evident among the findings.

- Cut edges tend to fail prematurely.
- Welds tend to fail earlier than flat surfaces.
- Flat areas are generally the last to fail by corrosion.

A program requiring thousands of DFT measurements during coating work is not going to guarantee that the coating system will provide the desired durability. In fact, ship owners may be lulled into a false sense of security by believing that such thorough inspection using the latest computerized thickness gauges is covering the entire painted area, when, in fact, the critical regions are not being measured and cannot be inspected, at least by film thickness measurements alone.

It must be recognized that PSPC does not rely on DFT measurements alone to ensure durability; factors such as selection of quality coating systems, edge grinding, stripe coats, and high standards of surface preparation are all part of the new IMO requirements. Coating durability in general should noticeably improve as a result of these initiatives. The concern is that such a large number of measurements with its associated costs and delays is not providing durability improvement commensurate with its cost.

Conclusions

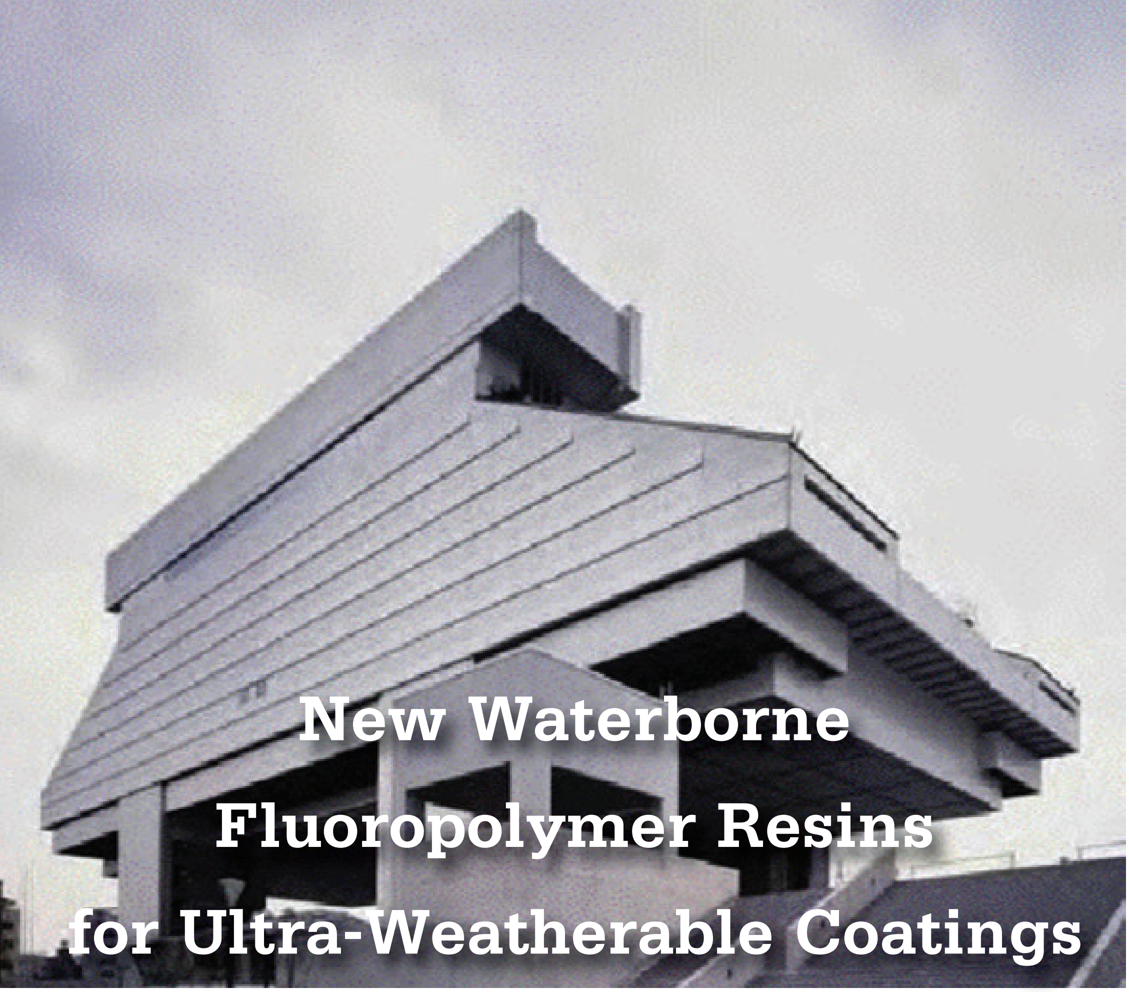
The testing protocols of the various DFT testing standards used around the world are significantly different from one another and have a range of requirements regarding both sampling and the number of measurements that have to be taken. Inspectors need to be aware of these requirements to ensure that the specification has been met.

Owners and specifiers need to be aware that some of the standards may not result in a sufficient level of testing necessary to provide the required assurance that the specified film thickness has been applied over the entire area. On the other hand, specifiers and owners need to be aware that the number of measurements by other standards, while providing better assurance regarding coating thickness, may cause significant delays and costs if carried out by the book.

References

1. T. Lohmann, "Implementing the IMO PSPC for Ballast Water Tanks," *JPCL*, February 2009, pp. 12-20.
2. R. Weaver, "What's New with PA 2," *JPCL*, December 2004, pp. 41-47.
3. ISO 12944-7, Paints and varnishes—Corrosion protection of steel structures by protective paint systems—Part 7: Execution and supervision of paint work.
4. ISO 12944-8, Paints and varnishes—Corrosion protection of steel structures by protective paint systems—Part 8: Development of specifications for new work and maintenance.
5. M. Schilling, "Overzealous Paint Inspection Causes Scheduling Delays," *JPCL*, December 2003, p. 14.
6. J F. Fletcher, "Electronic Inspection Data Management for Salt Water Ballast Tanks," Marine Coatings Conference 2008, Hamburg, Germany, September 24–25, 2008.
7. B. Goldie, "Marine Coatings under the Regulatory Spotlight," *JPCL*, February 2008, pp. 48-52.

JPCL



New Waterborne Fluoropolymer Resins for Ultra-Weatherable Coatings

Winn Darden and Bob Parker, AGC Chemicals Americas; and Naoko Sumi, Isao Kimura, Masakazu Ataku, and Takashige Maekawa, Asahi Glass Co. Ltd.

Editor's Note: This article is based on a paper the authors presented at PACE 2009, the joint conference of SSPC: The Society for Protective Coatings and the Painting and Decorating Contractors of America, held February 15–18, 2009, in New Orleans, LA.

Above: Tokyo Edo Museum, with FEVE coating
Photos courtesy of the authors

Fluoropolymers, introduced in the 1930s, are known for their excellent thermal, chemical, and weather resistance, along with surface properties like water and oil resistance, and optical properties. Because of their properties, fluoropolymers have been used in coatings on a variety of substrates. For example, fluoropolymers for coatings include aqueous dispersions of polytetrafluoroethylene (PTFE), tetrafluoroethylene/hexafluoroethylene copolymers (FEP), and TFE/perfluoroalkyl vinyl ether copolymers (PFA). These materials are used primarily in non-stick and anti-corrosion coatings.

Unfortunately, the use of fluoropolymers in coatings is limited due to their physical properties. Fluoropolymers have poor solubility in traditional solvents used in the coatings industry. Usually, fluoropolymer resins must be heated to temperatures greater than 200 C (392 F) to form a film. In addition, the low surface energy of the resins impedes acceptable adhesion to metals and other substrates, a property needed in primers and direct-to-metal coatings, for instance. Hence, fluoropolymers are not typically used as primers.

Among traditional fluoropolymers, only polyvinylidene fluoride (PVDF) is widely used in coatings. This resin is usually supplied as a dispersion in a high boiling solvent blend, and is used mainly in coil coatings, where it is processed at high temperatures. PVDF is employed primarily in architectural markets due to its exceptional weatherability.

A fluoropolymer resin was developed in the 1980s in an attempt to overcome the difficulties found in using traditional fluoropolymer resins in coatings, while still maintaining their advantages. These resins, known generically as fluoroethylene vinyl ether (FEVE) resins, are solvent soluble, and can be made compatible with water. This article describes solvent-borne as well as two types of waterborne FEVE resins—emulsions, which have been around for some time, and new dispersions—and the potential for uses of the new FEVE dispersion resins in coatings for field application where high weathering properties are needed.

FEVE Resins in Solvent-Borne Coatings

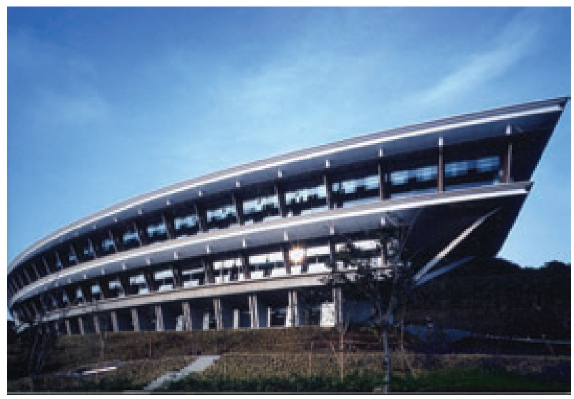
FEVE resins can be synthesized with reactive hydroxyl groups and can be cross-linked with standard aliphatic isocyanates to make fluorourethane coatings. FEVE resins can be used at high temperatures to make coil coatings, or at room temperature for field-applied coatings. This versatility in use substantially broadens the types of applications where FEVE-based fluorourethane coatings can be used.

Fluorourethanes have the same outstanding weatherability as traditional fluoropolymers but offer other advantages, as well. Fluorourethanes can be cured at either room temperature or elevated temperatures, so they can be used as maintenance coatings, applied in the field. Using appropriate additives, FEVE-based coatings can be manufactured in a wide range of gloss, unlike other fluoropolymers used for coatings. As solution polymers, FEVE resins have better compatibility with a wide range of pigments, enabling a broader color palette. And because fluorourethanes are cross-linked polymers, they tend to offer higher hardness and better corrosion resistance than some types of fluoropolymers commonly used in coatings. Yet, fluorourethanes retain enough flexibility and toughness for use as topcoats for military aircraft, where flexibility and adhesion are required at -40 C (-40 F) as well as at higher temperatures.

FEVE-based fluorourethane topcoats can be formulated and applied to yield a coating life exceeding 50 years. Based on work done by several Japanese transportation authorities, engineering organizations, and private parties, these topcoats are required to be used on all bridges in Japan, with an expected life of 100 years in some cases.

FEVE Emulsion Polymers for Coatings

The first waterborne FEVE polymers were aqueous emulsions, manufactured via emulsion polymerization. The resins were developed to enable coating manufacturers to meet VOC and HAPS regulations, which restrict the amount and type of solvents used to formulate coatings.



Institute for Global Environmental Strategies, with FEVE coating

Vinyl ether monomers substituted with polyoxyethylene (EO) units were copolymerized with the fluorinated monomer and other vinyl ethers to obtain stable emulsions and to maintain the structure of the FEVE copolymer. The resulting polymers are high in molecular weight, so they can be used in single-component coatings, or they can be cross-linked with aliphatic isocyanate dispersions. The emulsions have found use in blends with other waterborne resins to improve the weatherability of conventional coatings.

Unfortunately, coating properties obtained from these FEVE emulsions are generally inferior to those obtained from solvent-borne FEVE resins. This inferiority is believed to be due to residual emulsifier from the resin system in the cured FEVE coating, the presence of the EO units in the polymer, and the high molecular weight of the resins. In general, water sensitivity of FEVE emulsions is higher than that of solvent-borne FEVE resins, while weatherability is usually lower.

The shortcomings in performance of the FEVE water emulsions have limited their usefulness as low VOC and low HAPS coatings in the U.S. While solid FEVE resins provide a way to meet such regulations, the resins still require the use of solvents to produce coatings. There thus appears to be a need for a waterborne FEVE resin that offers the same performance as that of solvent-borne FEVE resins. FEVE water dispersion resins, as demonstrated below, yield properties in cross-linked coatings approaching those obtained with solvent-grade FEVE resins.

FEVE Water Dispersion Resins

Preparation of Resins

FEVE water dispersions are derived from FEVE solid resins of varying molecular weight, acid numbers, and hydroxyl numbers. To be useful as a coating raw material, a resin must first be stable enough in storage to impart a reasonable shelf life to the formulated coating. It was found that dispersion stability was influenced by several factors, including molecular weight, particle size, and acid value. The most stable products were derived from lower molecular weight, moderate particle size, moderate acid value polymers.

A FEVE water dispersion with properties shown in Table 1 (p. 34) was prepared and then formulated to make a fluorourethane topcoat.

Preparation of Fluorourethane Coatings for Testing

Coatings were prepared from the selected FEVE water dispersion, a two-part water emulsion FEVE resin, and a solvent-borne FEVE resin. Then, all three types of coatings were applied to chromate-treated steel panels, cured for 14 days, and subjected to a variety of tests.

Comparative Test Results for Physical Properties

The resulting fluorourethane coatings, along with an unreacted FEVE emulsion resin, were subjected to several standard

Table 1: Properties of FEVE Water Dispersion

Property	Value
Appearance	Milky White Liquid
Solids, Wt. %	40% ±2%
pH	7–9
Particle Diameter, nm	50–300
Minimum Film Forming Temperature, °C	27
Acid Value, mg KOH/g-polymer	15
Hydroxyl Value, mg KOH/g-polymer	85
Hydroxyl Equivalent Weight (HEW)	660

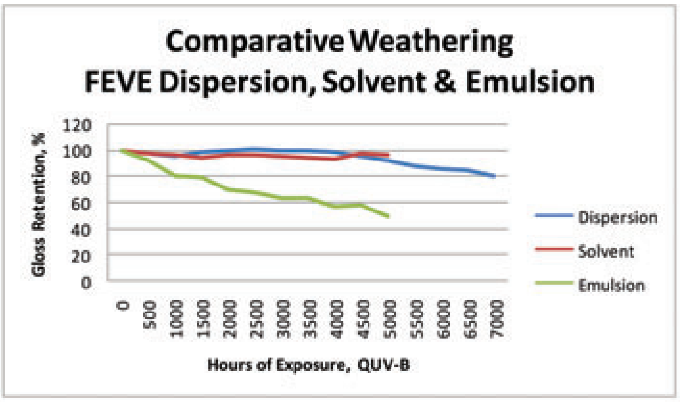


Fig. 1: QUV-B weathering testing of FEVE-based coatings

tests for the coatings' physical properties.

Of the results shown in Table 2, several are noteworthy. First, the gloss of the dispersion-based fluorourethane is close to that of the solvent-grade coating, and higher than that of the cross-linked emulsion coating. Hardness, impact resistance, and adhesion of the three coatings are about the same, although the cross-linked emulsion has slightly lower impact resistance. The FEVE emulsion that is not cross-linked has far lower hardness and impact resistance, and poor adhesion compared to the other three cross-linked coatings. While the emulsion is high enough in molecular weight to form a film using a coalescent, without the isocyanate cross-linker, film properties are poor.

The biggest difference in performance is in the water resistance of the three fluorourethane coatings. The water dispersion and solvent-grade fluorourethanes show excellent water resistance, while the cross-linked emulsion develops blisters during the test. In this battery of tests, the FEVE dispersion offered performance equivalent to that of the solvent-borne coating. This means that zero VOC fluorourethane coatings with excellent properties can be formulated using the FEVE dispersions.

Comparative Weathering

Fluorourethane coatings were tested in the ASTM D 53 accelerated weathering test. Accelerated weathering tests show that the dispersion-based fluorourethane weathers as well as the solvent-borne coating (Fig. 1).

SEM Comparison:
FEVE Dispersion and Emulsion

Scanning electron micrography (SEM) showed that the dispersion formed a uniform, dense film with no surface defects after cross-linking. Thus, water resistance in the dispersion was improved; water could not penetrate the film. In contrast, the cross-linked emulsion had surface defects thought to adversely affect physical properties such as gloss and water resistance. Also, the surface of the emulsion film was irregular, and the coalesced portions of the film could be seen. These imperfections could reduce the performance of the emulsion film.

Application Characteristics of FEVE Dispersions

FEVE dispersions are formulated as two-component systems using water-dispersible isocyanates as cross-linkers. They are combined with pigments and additives for control of flow, gloss, foaming, and other application and physical properties. These systems can be applied with air or airless spray equipment, by

Table 2: Comparative Performance of Various FEVE Coatings

Property	Test	FEVE Dispersion (OHV=85)	FEVE Solvent-Based (OHV=52)	EVE Emulsion (OHV=55)	
Cross-linker (NCO/OH=1)	N/A	Water-dispersible isocyanate	HDI-Based polyisocyanate	Water-dispersible isocyanate	None
Gloss, 60°	ISO 2813	88	90	78	78
Pendulum Hardness	ASTM D 4366	79	80	75	19
DuPont Impact	ASTM D 2794 (D=0.5")	>1.0 m	>1.0 m	1.0 m	0.3 m
Cross-Cut Adhesion*	ASTM D 3359	5B	5B	5B	0B
Water Resistance ISO 2812 40 C, 24 hrs	Adhesion, ASTM D 3359	4B	5B	3B	0B
	Blistering, ASTM D 714	No Blistering	No Blistering	<8, Medium	2, Dense

**Cross-cut adhesion test performed after soaking in hot water for 24 hours.*

Waterborne Fluoropolymers

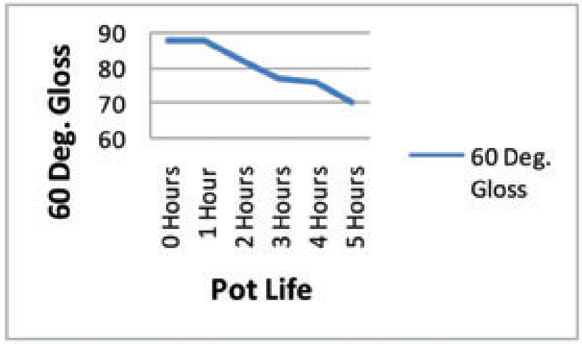


Fig. 2: Charge in 60° gloss versus pot life

roller, or by brush, depending on the environment at the job site.

As with other waterborne coatings, one of the difficulties in using FEVE dispersions is determination of the useful pot life of the blended coating system. Unlike solvent-borne coatings, the blended FEVE dispersion does not increase substantially in viscosity as the end of its pot life approaches. Other measures are used to determine the pot life, namely, a decrease in gloss during application, and a decline in physical properties of the finished coating after a certain pot life is achieved.

The FEVE dispersion was blended with a water-dispersible isocyanate at a NCO/OH ratio of 1.0. Coatings were then applied at one-hour intervals over the estimated pot life of the system. The gloss of the resulting coatings was examined. In addition, the solvent resistance of the cured coatings was examined.

Figure 2 shows the results of the gloss test for different pot lives. After 5 hours, the gloss of the cured coating measurably changed. After 6 hours, the cured coating showed extensive cracking, indicating that the pot life was exceeded. Solvent resistance of the cured coatings began to degrade at 4 hours' pot life. These results indicate that the expected pot life of the FEVE dispersion at 25 C (77 F) is a maximum of 4 hours. For use in the field, on-site testing should be performed, probably using gloss measurements, to ensure that the useful pot life is not exceeded.

Markets for FEVE Dispersions

It is possible to use FEVE dispersions for all applications where solvent-borne products are used today. Because FEVE dispersions can be used without coalescents, which may be considered VOCs, they can be used as industrial maintenance (IM) coatings for structures such as bridges, process plants, and water towers, even in California, where the current VOC limit for IM is 100 g/L. In addition, the dispersions can replace solvent-borne coatings in applications where the smell of solvents can affect occupants of a structure, such as office buildings. Other potential markets for FEVE dispersions include architectural, automotive, and aerospace.

References

1. S. Munekata, "Fluoropolymers as Coating Materials," *Progress in Organic Coatings,"* 16, 113-134 (1994).
2. T. Takayanagi, M. Yamabe, "Progress in Fluoropolymers for Coating Applications: Development of Mineral Spirits Soluble and Aqueous Dispersions," *Progress in Organic Coatings,"* 40, 185-190 (2000).
3. N. Sumi, I. Kimura, M. Ataku, T. Maekawa, "Fluoropolymer Dispersions for Coatings," Presented at the Waterborne Symposium, *Advances in Sustainable Coating Technologies*, January 30—February 1, 2008, New Orleans, LA.
4. A. Asakawa, "Performance of Durable Fluoropolymer Coatings," Presented at the 7th Nurnburg Congress, European Coatings Show, April, 2003, Nurnburg, Germany.
5. P. Greigger and P. Wilson, Industries, "High Performance Fluoropolymer Coatings," Presented at the Construction Specifications Institute Meeting, 2004, Chicago, IL.

6. W. Darden, "Advances in Fluoropolymer Resins for Long-Life Coatings," Presented at the Paint and Coatings Expo PACE 2007, Tampa, FL.

Winn Darden is business manager for AGC Chemicals Americas line of LUMIFLON® fluoropolymer resins. Involved in the sales and marketing of coatings and coating raw materials for over 20 years, he has published widely in the industry and has presented papers for SSPC, NACE, and Mega Rust. He holds 12 U.S. Patents.

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

Masakazu Ataku is a research chemist with Asahi Glass Chemicals at its corporate labs in Chiba, Japan. He was responsible for improving production methods for polymers used in ion exchange membranes. He is now working on the development of new fluoropolymers for the coatings industry.

Naoki Sumi is a research chemist with Asahi Glass Chemicals in Chiba, Japan. She worked to develop new fluoropolymer resins for the semiconductor industry and on the now involved with developing new fluororesins for coatings.

Isao Kimura is currently assigned to the headquarters of Asahi Glass Chemicals in Tokyo, Japan. He was involved in developing and testing waterborne fluoropolymer resins for coatings at the AGC research lab in Chiba.

Takashige Maekawa is R & D manager for Asahi Glass Chemicals in Chiba, Japan. His background is in polymer and surface chemistry.

JPCL

Regulatory Roundup

By Alison B. Kaelin, CQA, KTA-Tator, Inc.

Changes in regulations for protecting the environment and workers on construction jobs could affect the protective coating and lining industry. Outlined below are such recent regulatory actions.

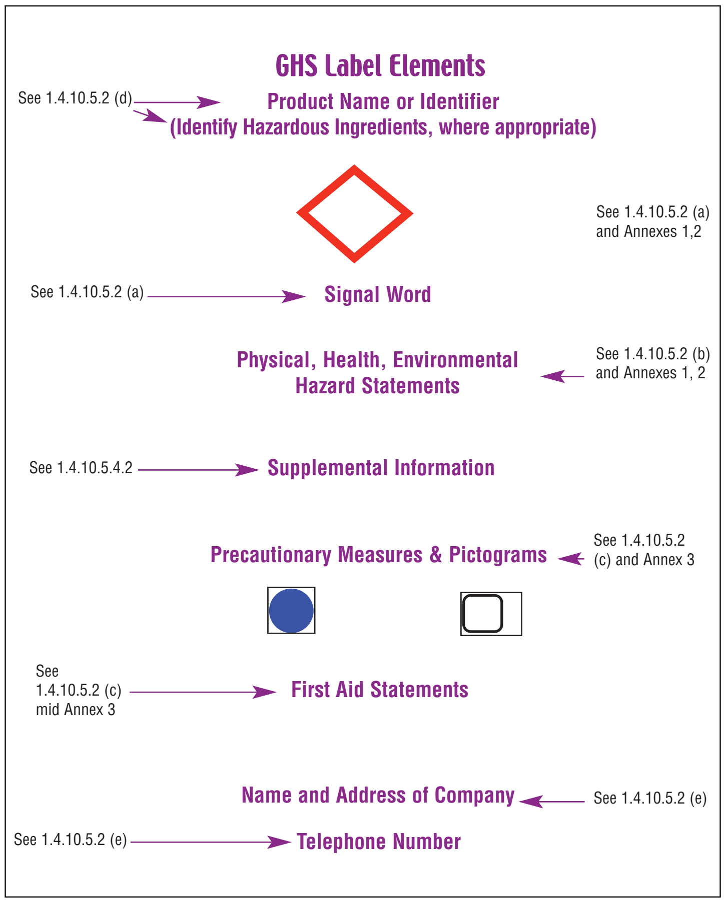


Fig. 1: Label elements of the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Hazard Communications

On September 30, 2009, the Occupational Safety and Health Administration (OSHA) proposed long-awaited changes to the Hazardous Communications Rules for the General Industry, the Construction Industry, and the Maritime Industries. The proposed rule modifies the existing Hazard Communication Standard (HCS) to correspond to the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS). Currently, the European Union, Japan, China, Canada, and other countries have adopted GHS.

The proposed modifications to the standard include revised criteria for classification of chemical hazards; revised labeling provisions; a specified format for safety data sheets; and related revisions to definitions of terms used in the standard.

The proposed revisions apply not only to the Hazard Communications Standard (29 CFR 1910.1200 and 29 CFR 1926.59) but also to many other Construction Industry standards that have labeling, signs, or training requirements. The following OSHA Construction Industry standards are expected to be affected.

- 29 CFR 1926.62, Lead
- 29 CFR 1926.65, Hazardous Waste Operations and Emergency Response
- 29 CFR 1926.152, Flammable Liquids
- 29 CFR 1926 Subpart F—Fire Protection and Prevention
- 29 CFR 1926.155, Definitions
- 29 CFR 1926 Subpart Z–Toxic and Hazardous Substances
- 29 CFR 1926.1101, Asbestos
- 29 CFR 2926.1126, Chromium (VI)
- 29 CFR 1926.1127, Cadmium

Significant changes to the HCS and other standards are described below.

Definition of Flammable Liquid and Classifications

The proposed rule will redefine a flammable liquid as "any liquid having a flashpoint at or below 199.4 degrees Fahrenheit." The previous definition was based on a flashpoint at or below 100 F. Flammable liquids are divided into the following four categories.

- Category 1—flashpoint below 73.4 F and having a boiling point at or below 95 F
- Category 2—flashpoint below 73.4 F and having a boiling point above 95 F
- Category 3—flashpoint at or above 73.4 F and boiling point at or below 140 F
- Category 4—flashpoint at or above 140 F and boiling point at or above 199.4 F

The revision of categories also reduces the boiling point from 100 to 95 F. These proposed changes to the threshold flashpoint and boiling point will likely shift some liquids from Category 1 to Category 2, thus requiring more controls.

As part of the revision, OSHA is proposing removing the term "combustible liquid" from 1926.155 (1926 Subpart F—Fire Protection and Prevention, Definitions).

Material Safety Data Sheets (Renamed Safety Data Sheets)

Proposed changes include requiring that OSHA permissible exposure limits

Continued

(PELs) be included on Safety Data Sheets (SDS), as well as any other exposure limit recommended (e.g., the threshold limit value). SDS were formerly called Material Safety Data Sheets (MSDS).

The current Hazard Communication Standard established a voluntary format for SDSs. The proposed revision establishes a standardized GHS 16-section format for SDSs to provide a consistent sequence for presentation of information. Under the proposed rule, SDSs would include the following sections.

1. Identification of the substance or mixture and of the supplier
2. Hazards identification
3. Composition/information on ingredients
4. First aid measures
5. Firefighting measures
6. Handling and storage
7. Accidental release measures
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transportation information
15. Regulatory information
16. Other information, including information on preparation and revision of the SDS

Language on Signs in Substance-Specific Standards

OSHA has proposed modifying language used on signs and labels related to health-based standards to include use of the words "Danger" or "Warning" and to include specific references to key health effects.

For example, under the proposed rule, signs for lead-contaminated clothing and equipment will be required to read "Danger: Clothing and equipment contaminated with lead. May damage fertility or the unborn child. Causes damage to the central nervous system. Do not eat, drink, or smoke when handling. Do not remove dust by blowing or shaking."

Warning signs (posted at the work area when exposures are above the PEL) must read "Danger: Lead. May damage fertility or the unborn child. Causes damage to the central nervous system. Do not eat, drink, or smoke when handling."

Container Labels

Under the proposed revisions to the Hazardous Communications Rules, all labels would need to be revised by the manufacturer to include a product identifier; a standardized signal word (Warning, Danger, Caution, or Notice); a hazard statement; a pictogram; a precautionary statement; and name and contact information for the manufacturer. For example, see Figure 1 on page 39 (from www.osha.gov/dsg/hazcom/ghs.html).

A major reason for the labeling changes is to make the labels more understandable to non-English-speaking and low-literacy workers. The pictograms especially are expected to improve overall comprehension of hazards.

Employee Training

The proposed rule continues to require development of a hazard communication program that includes employee training and education on labels on containers, Safety Data Sheets, chemical hazards in the workplace, and protective measures to be followed. The proposed changes to the Hazard Communication Rules would require training to be effective within two years of publication.

The effective dates for the proposed rule are expected to be phased in over a three-year period after the final rule is published, with phase-in for the implementation of training and education programs expected within two years of the final rule's publication.

High–Visibility Safety Apparel

On August 5, 2009, OSHA issued a revised Standard Interpretation entitled, “Whether use of high-visibility warning garments by construction workers in highway work zones is required.” The revision withdraws a May 2004 interpretation, which determined that high-visibility apparel was required only when specifically identified by mandatory language (i.e., shall or must) in the Manual on Uniform Traffic Control Devices.

OSHA’s updated interpretation is partially based on the Federal Highway Administration’s (FHWA) November 2008 final rule, Worker Visibility, 23 CFR 634. The rule requires that “all workers within the right-of-way of a Federal-aid highway who are exposed either to traffic (vehicles using the highway for purposes of travel) or to construction equipment within the work area shall wear high-visibility safety apparel.” In the updated interpretation, OSHA concludes that any construction workers in highway/road construction work zones are required to be provided and wear high-visibility safety apparel under the General Duty Clause Section 5(a)(1).

In addition, all employers working in the above situations are cautioned to verify that workers are equipped with high-visibility safety apparel.

Increasing Interest in Silica Producing Operations (Other than Abrasive Blasting)

OSHA has long recognized that silica is a significant health hazard, and, while the agency has fallen short in regulating silica under a comprehensive health standard to date, it has issued multiple enforcement and education initiatives, most recently a National Emphasis Program—Crystalline Silica, in 2008. In the past, OSHA has often focused its silica efforts on silica exposures related to abrasive blast cleaning, while seemingly

Continued

ignoring other silica-exposure producing operations such as concrete demolition, cutting, and grinding.

In 2008–2009 guidance documents, OSHA and the National Institute for Occupational Safety and Health (NIOSH) have apparently shifted their focus from abrasive blast cleaning to other types of construction silica operations. In May 2009, OSHA released Publication 3362, Controlling Silica Exposures in Construction, which does not address abrasive blast cleaning, but includes specific guidance on control of exposures related to stationary and handled masonry saws, hand-operated grinders, tuckpointing/mortar removal, jackhammers, rotary hammers, rock drilling rigs, and drywall finishing. Similarly, in 2008 and 2009, NIOSH issued a series of publications regarding reducing silica dust exposures during non-abrasive blasting operations such as those identified above.

On the regulatory front, in October 2009, OSHA announced proposed penalties of over $38,000 against a concrete restoration contractor for silica-related hazards identified during bridge work. OSHA found that

- employees at the jobsite had been exposed to excess silica levels while jack hammering concrete;
- there were no controls to lower exposure levels;
- there was a failure to evaluate employees' exposure levels;
- the respiratory protection program and training were inadequate; and
- there was no fit-testing of respirators.

Additionally, the local OSHA regional office has affirmed a local enforcement program for target inspections to construction worksites—such as road resurfacing and bridge repair—where silica is generated.

Contractors with potential silica exposures related to abrasive blast cleaning and non-abrasive blast-cleaning operations should evaluate their programs for control of silica hazards.

Alison B. Kaelin, CQA, is the Corporate Quality Assurance Manager of KTA-Tator, Inc., Pittsburgh, PA. She is a Certified Quality Auditor (CQA) and a NACE-certified Coatings Inspector. She has written or co-authored more than 20 papers and articles, has previously co-chaired several SSPC committees, currently co-chairs the task group revising SSPC's QP 2 standard, and teaches widely in the industry. Ms. Kaelin received the SSPC Technical Achievement Award. She can be reached at akaelin@kta.com.

Repair Techniques for Prestressed Concrete Tanks

Simon Bladon, CRL Surveys, Mitcham, UK

Pre-stressed tanks, sometimes referred to as preload or wire wound (concrete) tanks, have been widely used in the UK in the water industry since the early 1950s, primarily as reservoirs. The use of high tensile steel tendons, or cables, to impart compressive forces into the structure confers the benefits of speed of construction, light weight, and low cost. Instances of pre-stressing wire failure, however, have been fairly common. In December 1999, the domed roof of one tank collapsed at Lanner Hill in Cornwall, UK, causing a catastrophic structural failure. Since then, there have been other sudden failures as preload structures continue to deteriorate, presenting significant safety, environmental, and financial risks to their owners.

Against this background a specialist general contractor has developed specific techniques and site procedures for safe investigation, repair, and refurbishment of these structures. This article briefly describes the techniques

Top: Inspecting the tank
Bottom: Final protective coating applied
All photos courtesy of the author

Investigation

The principal investigation techniques used are the desk study of available "as-built" information and maintenance records, with visual inspection and hammer testing, assessments of carbonation, screening for chloride, cover surveys, half cell potential surveys, special metal detection surveys and/or ground probing radar surveys, and internal inspections using a remotely operated vehicle (ROV).

Influenced by knowledge of the specific structure, the initial visual inspection for deterioration, including cracking of the concrete and overlays, and corrosion of the wires, is complemented with hammer testing to detect areas of disbonding, delamination, and voids.

Hammer testing involves tapping the surface with a hammer or drawing it gently across the surface, then assessing the resultant sound(s) to get an indication of hidden defects.

Depths of carbonation are measured in-situ, using a solution of phenolphthalein indicator in ethyl alcohol, sprayed onto freshly broken surfaces,

Continued

which appear pink when not carbonated (pH >9) and colorless when the concrete has lower pH (carbonated).

Screening for chloride is carried out by chemical analysis, generally in a laboratory, on samples of the concrete.

Both the depths of carbonation and the chloride ion contents give a measure of the presence or ingress of the most common agents in, or causes of, the corrosion of encapsulated steel.

Fig. 1: Hydrodemolition to remove gunite overlay on tank walls. Inset: close-up of exposed wires.

The measurement of half-cell potentials can detect corrosion, although care must be taken if galvanized wires have been used. The equipment and methodology, originally described in ASTM C876, has now been incorporated within many of the industry's standard guidance documents.

More detailed information about the concrete sub-structure can be obtained from a survey made with a proprietary portable unit, essentially a metal detector. The unit is a detecting, measuring and mapping device that provides an instant image of the arrangement and position of reinforcement within the survey area and the depth of concrete cover. For more deeply hidden details, a ground probing radar survey is used. Ground probing radar also gives information about the location and detail of the reinforcement, but, in addition, it can locate deeper pre-stressing tendons, major construction features, and the presence of voids or cracks.

Through an ROV fitted with a video link, the concrete surfaces on the inside of the tank can be assessed, without the need for taking the tank out of service, emptying it, and entering it.

Using the methods above, one can

identify areas of deterioration and make recommendations for remedial work.

Repair Techniques

Because the pre-stressing wires and post-tensioning tendons are sensitive, particularly where they may be corroded and damaged, hydro-demolition, rather than pneumatic breaking, is used to remove the gunite overlay on the tendons (Fig. 1).

"De-stressing" is generally carried out sequentially. Before deteriorated wires/tendons are de-stressed, the existing load is reduced by the installation of temporary, post-tensioned tendons (Figs. 2 and 3). The existing wires are then severed and preferably removed before the exposed concrete surfaces are repaired, and remedial tendons are installed and jacked to the required loading (Fig. 4).

Mastic joints are then installed along the junctions between old and new concrete surfaces where relative movements could initiate cracking and cause future problems. Conventional concrete patching materials, in accordance with EN 1504, are used to repair spalling and cracked areas of concrete. Patching is followed by the surface preparation and application of a surface coating to enhance the long-term durability of the structure. **JPCL**

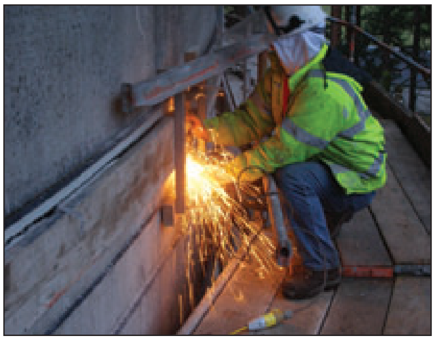


Fig. 2: Installation of temporary tendons will be followed by de-stressing and removal of existing failed wires.

Fig. 3: Temporary tendons installed around the dome band

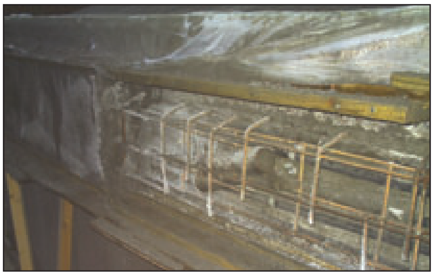


Fig. 4: Conventional concrete repairs and installation of remedial post tensioning tendons

New Standard, Updated Standard Published

On September 1, 2009, SSPC published a new standard and a revised standard.

The new standard, SSPC-AB 4, Recyclable Encapsulated Abrasive Media (in a compressible cellular matrix), provides requirements for selecting and evaluating abrasive media (e.g., steel grit, aluminum oxide) encapsulated in a compressible cellular matrix. This composite abrasive can be used to blast clean steel and other surfaces before applying protective coatings. The standard also includes requirements for quality control of new and recycled media.

The existing SSPC abrasive specifications contain requirements for mineral, slag, and ferrous metallic abrasives. This new standard provides owners and specifiers with requirements for encapsulated media that may be used to reduce dust generation and ricochet damage to adjacent surfaces when blast cleaning.

SSPC has made several major revisions to SSPC-QP 2, Standard for Evaluating Painting Contractors (Hazardous Coating Removal). The requirements of this procedure are intended to supplement the general requirements of SSPC-QP 1, QP 3, QP 6, or QP 8. Some of the changes are described below.

- The scope has been expanded to cover qualification of contractors who perform hazardous coating removal on marine structures.
- The standard has been reorganized. Safety and Health Environmental Compliance requirements have been incorporated into Technical Capabilities Section.
- Some requirements have been clarified, e.g., the classification of documents that must be present at the jobsite and those that may be kept at the contractor's office.
- Requirements for the training of a contractor's Safety Coordinator now require 30 hours of OSHA-approved, construction industry safety training not specific to lead-paint removal in addition to C-3 lead removal competent person training or its equivalent.
- The requirement for approval of design and load analysis of loaded platforms by a licensed professional engineer has been removed.

For more details or to download the new and revised standards, visit www.sspc.org.

NBPI Draws A Crowd

NBPI students in Port Orchard, WA

SSPC's NAVSEA Basic Paint Inspector (NBPI) course was held November 9–13, 2009, in Port Orchard, WA. Twenty-four students attended the class, which was led by instructors Phil Parson and Gordon Kuljian. The course was hosted by QED Systems, which has hosted a total of ten classes for SSPC in 2009.

Training Keeps Rolling through the New Year

SSPC training opportunities begin in early 2010. The Lead Paint Removal Refresher (C-5) course will be held on January 8; it will be hosted by the SSPC Chesapeake (VA) Chapter. On January 16, the SSPC Hampton Roads (VA) Chapter will host the Abrasive Blasting Program (C-7) course. The NAVSEA Basic Paint Inspector (NBPI) course will take place January 18–22, and will be hosted by Midwest Industrial Coatings. DoD funding is still available for the C7 and the NBPI courses; please contact Jennifer Merck, merck@sspc.org, at SSPC for more information on the DoD funding.

For more information, please see the training schedule at www.sspc.org/training/.

Regional SSPC/NACE Groups Sponsor Trade Show

The Empire/Keystone Chapter of SSPC and the Niagara Frontier Section of NACE International will jointly sponsor a T3 event (technical symposium, training, and trade show) at the Turning Stone Resort & Casino on March 4–5, 2010, in Verona, NY.

Featured speakers at the T3 will include Ron Williams of the Syracuse, NY, OSHA office; Matthew McCane of Greenman-Pedersen, Inc.; Robin Frye of NACE; and SSPC Executive Director Bill Shoup.

As part of the training program, NACE will lead a CIP (Coating Inspector Program) One Day Bridge Course on Thursday, March 4, preceding the T3 event. The final agenda will be sent to all attendees one week prior to the event.

Those interested in attending the T3 event must register by February 20, 2010. For registration, contact Ms. Rae Marie Mattis, President, R2M Building Products, Inc.—tel: 585-241-3220; or Bruce Stutz—tel: 716-946-7293, e-mail: bruudii@verizon.net.

Continued

SSPC News

SSPC Individual Member Update

Below is a list of people who joined or renewed their membership in August and September 2009. SSPC Individual Membership benefits include unlimited access to the online collection of SSPC standards, a subscription to *JPCL,* and discounts on SSPC products and services. For information about joining, contact Terri McNeill, mcneill@sspc.org.

- Faustino Abad, Salacedo Village, Makati City, Philippines
- Tuan Adnan Ali, Selangor, Malaysia
- Eric Amos, Shelburne, ON, Canada
- Michael Andersen, Sarnia, ON, Canada
- Mike Andersen Sr., Thorndale, ON, Canada
- Reggie Anderson Herrien, Newport News, VA
- Jeff Appleby, Calamvale, QLD, Australia
- Bunyamin Astama, Englishtown, NJ
- Olawale Bankole, Ifo, Ogun State, Nigeria
- Clinton Barnard, Newport News, VA
- Sahendra Batam, Tanjung, Uncang, Indonesia
- James Besha, Albany, NY
- Craig Boewe, Skiatook, OK
- Robert Bontempo, Annapolis, MD
- Tamara Bradford, Washington, DC
- Ricky Brown, Windsor, VA
- Danny Buchik, Thunder Bay, ON, Canada
- Richard Bueckert, Winnipeg, MB, Canada
- James Bullock, Chesapeake, VA
- Brian Campbell, Cleveland, OH
- Jason Caples, Newport News, VA
- Dale Cich, Buffalo, NY
- Dave Clor, Plymouth, MI
- Frank Dean, Poquoson, VA
- Julie Dean, Atlanta, GA
- Francois Desmarais, Terrebonne, QC, Canada
- Chris Dollarhide, Phoenix, AZ
- Ilich Echeverria, Miami, FL
- Lynne Eckroth, Mandan, ND
- Terry Ellis, Bainbridge, GA
- Jaynard C Enriquez, San Diego, CA

- Lazaro Esparza, Temple, TX
- Cesar Estrada, San Diego, CA
- David Fadden, Groton, CT
- Charles Fitch, Cincinnati, OH
- Eric Foreman, Jacksonville, FL
- Edmond Forte, Oakville, ON, Canada
- Thomas Fox, Newport News, VA
- Don Garrity, Marcus Hook, PA
- Bill Geckler, San Antonio, TX
- Wilmer Ghersi, Caracas Distrito Federal, Venezuela
- Troy Grant, Oneco, CT
- Jason Green, Lewistown, MT
- Dennis Greene, Salisbury, MD
- Kyle Guartafierro, Groton, CT
- Tom Hall, Lakewood, CO
- LaVerne Hicks II, Camden, AR
- Sylvia Hornback, Decatur, TX
- Linda Houk, Hawthorne, FL
- Adam Huesser, Thorofare, NJ
- John Hutchison, Mississauga, ON, Canada
- Brian Kalman, New York, NY
- Brian Keller, Gary, IN
- Allyn Kilsheimer, P.E., Washington, DC
- Parthasarathy Krishnan, Singapore, Singapore
- Christopher Lamontagne, Hudson, QC, Canada
- Craig Land, Newport News, VA
- Glenn LeBlanc, Belle Chasse, LA
- Christophe Lefebvre, Douala, Cameroon
- Tom Lemons, Phoenix, AZ
- James Lewis, Mobile, AL
- Brian Lintecum, Halstead, KS
- Eddie Liu, Huntington Beach, CA
- Robert Mack, Clermont, FL
- Vitus Maduako, Detroit, MI
- Jonathan Martin, Charlotte, NC
- Lovedale Mbagwu, Ogbor Hill, ABA, Nigeria
- James McAlister, Dover, AR
- Timothy McBride, Lima, OH
- D. J. McConville, Cleveland, OH
- William McCune, Arnold, MO
- Jack McDaniel, Silver Creek, MS
- Joe McIntyre, Kent City, MI
- John J. Meade, Trumbull, CT
- Bobby Minneman, Panama City, FL
- John Moe, Lansing, MI
- Joe Molina, Victoria, TX
- Rodolfo Monarrez, Calgary, AB, Canada
- James Morrow, Norfolk, VA
- Igor Muguruza, Miami Beach, FL
- Dan Mundall, P.E., Sumas, WA
- John J. Myers, Rolla, MO
- Johnny Neufeld, Dallas, TX
- Anna O'Connor, Kearny, NJ
- Marvin Parish, Hampton, VA
- Bonifacio Pangan Pateros, Metro Manila, Philippines
- Glenn Patoska, Chesapeake, VA
- Chuck Pease, Tempe, AZ
- Thomas Perez, Moulton, TX
- Lam Pin Min, Singapore, Singapore
- Charles M. Popovich Jr., Jacksonville, FL
- William Price, Newport News, VA
- Melanie Purvis, Mount Pleasant, SC
- Sethuraman Ravichandran, Kolkata, India
- Paul Rosenberry, Wallingford, CT
- Patrick Roy, Katy, TX
- Brian Sawn, Hartford, NY
- Wesley Sillineri, San Pablo, CA
- Jarvis R. Sims, Newport News, VA
- Michael W. Smith, Mobile, AL
- Justin Spoerl, Bergenfield, NJ
- Timothy Stemper, Chesapeake, VA
- Steve Stover, East Peoria, IL
- Peter Sutherland, Waterford, CT
- Michael L. Taylor Jr., Hampton, VA
- Todd Tendler, Winnetka, CA
- Tom Tomovick, Clackamas, OR
- Simon Trevino, Houston, TX
- Stephen Tripi, Buffalo, NY
- Rodger L. Ungerecht, Suffolk, VA
- Michael Vaknin, Nortbrook, IL
- Julio Vargas, Glen Rock, PA
- Craig Wages, Columbiana, AL
- Patrick Chua Wah, Singapore, Singapore
- Vance Walker, Lindon, UT
- Jeff Wallis, Albuquerque, NM
- Roman Wenske Jr., Moulton, TX
- Gregg Whitmer, Strongsville, OH
- Ryan Williamson, Sandy, UT
- Hidetsugu Yawata, Yokohama, Japan
- John Yzenas, Valparaiso, IN
- Arthur Zertuche Corpus Christi, TX

associations

ASTM Updates Immersion Testing Standard

ASTM has updated ASTM D870, Standard Practice for Testing Water Resistance of Coating Using Water Immersion.

Updated in September 2009, ASTM D870 is useful for evaluating single coatings or complete coating systems. Water immersion tests are used for research and development of coatings and substrate treatments, specification acceptance, and quality control in manufacturing. A coating or system is considered to pass if there is no evidence of water-related failure after a specified period of time. Failure in an immersion test may be caused by a number of factors, including a deficiency in the coating itself, contamination of the substrate, or inadequate surface preparation.

For further information, or to download the standard, visit the Standards Center on www.paintsquare.com.

ASTM D-1 and Related Coatings Groups to Meet

Three ASTM International committees that write standards affecting the coatings industry will meet January 17–19, 2010. Sessions will be held at the Embassy Suites Hotel in Ft. Lauderdale, FL, for ASTM Committees D01 on Paint and Related Coatings, Materials, and Applications; E12 on Color and Appearance; and G03 on Weathering and Durability.

ASTM meetings are open to all interested individuals. For more information, visit www.astm.org.

companies

World of Concrete Sets up in Vegas

The World of Concrete will hold its 36th annual international event February 1–5, 2010, at the Las Vegas Convention Center in Las Vegas, NV. This year, more than 1,600 exhibitors are expected, who will display their goods and services to approximately 70,000 industry professionals in attendance from over 100 countries.

The annual show is cosponsored by 19 organizations, including the International Concrete Repair Institute, The American Concrete Institute, and the Portland Cement Association. The intended audience for the event includes architects and engineers; general, repair, and specialty concrete contractors; dealers and distributors; designers and specifiers; and producers of precast or prestressed concrete.

The following preview of the 2010 World of Concrete consists of a list of exhibitors that deal with the surface preparation and coating of concrete, as well descriptions of several seminars relevant to coatings professionals.

For more information, or to register, vist www.worldofconcrete.com.

Courtesy of Las Vegas News Bureau/LVCVA

Seminars

Monday, February 1

• MO14, Concrete Repair Part I: Evaluation and Repair Strategies
8:00 a.m.–11:00 a.m.
This seminar will explain how to evaluate a structure, identify evaluation techniques and tools for testing, and analyze the cost and durability of a repair.

• MO15, Concrete Repair Part II: Surface Preparation, Reinforcement Repair, Material Selection, and Placement Techniques
1:00 p.m.–4:00 p.m.
Participants will learn about selecting specific repair materials and ingredients for repairing deteriorated concrete surfaces. There will be an evaluation of the latest equipment used to perform preparation and placement of repair materials as well as an overview of the proper repair of corroding reinforcing steel.

• MO129, OSHA Fall Protection Standards
10:30 a.m.–Noon
In this session, participants will receive an overview of OSHA's Construction Fall Protection standards (29 CFR 1926 Subpart M) and learn about various fall protection requirements with a focus on hazards typically encountered in the concrete industry.

Tuesday, February 2

• TU16, Concrete Repair Part III: Protection and Waterproofing Systems
8:00 a.m.–11:00 a.m.
This seminar will cover different protection and waterproofing systems available for concrete as well as a review of proper surface preparation and safety issues during installation. Additional topics include strategies for controlling corrosion on new and existing concrete, sealers, coatings, overlays, and cathodic protection systems.

• TU138, Using the Shotcrete Process to Rehabilitate Infrastructure
8:30 a.m.–10:00 a.m.
Information will be provided on the use of shotcrete as an alternative installation method for repair and rehabilitation of infrastructure projects. Examples of why shotcrete would be a preferred installation method will be discussed, along with wet/dry process methods, equipment requirements, demolition-surface preparation, mobilizing, inspection, and curing.

Wednesday, February 3

• WE17, Concrete Repair Part IV: Structural Repairs and Strengthening Techniques
8:00 a.m.–11:00 a.m.
Advanced techniques for structural repairs and strengthening of concrete structures will be covered. Specific issues to be discussed include use of shear collars, supplemental reinforcing/framing, beam and column strengthening and replacement, and composite fiber reinforcing.

• WE130, Overexposure to Respirable

Continued

Silica, What It Is and How to Control It
8:30 a.m.–10:00 a.m.
Attendees will learn about hazards of respirable silica and new technologies that have the ability to trap it. New mandates and compliance with them will be highlighted.

Continued

Exhibitors

As of press time, exhibitors of special interest to the protective coatings industry include the following.

Coatings Companies

- Aquafin Inc S10513
- BASF Construction Chemicals S10015
- Bayer Material Science S13439
- C.I.M Industries Inc C4762
- ChemMasters Inc S11513
- The Comex Group O30131
- Concrete Coatings Inc O40937
- Cortec Corporation S11254
- Crown Polymers S11847
- Denso North America S13046
- Dur-A-Flex Inc S10519
- Epmar Corporation S12539
- The Euclid Chemical Co S10007
- Five Star Products Inc S10147
- Flowcrete North America Inc .S11655
- Fox Industries Inc S11351
- HP Spartacote O40737
- HTC .S12912
- Integument Technologies S13728
- ITW Futura Coatings S12215
- Jarden Zinc Products, LLC . . .S13313
- Key Resin Company S13555
- Pacific Polymers/ITW S13039
- Polycoat Products S11549
- Polyguard Products, Inc S11255
- Polymax/Milamar Coatings LLC S12217
- PROSOCO Inc. S12931, O40845, O40853
- Rhino Linings USA, Inc S12045
- Rust-Oleum Corp S13620
- Sherwin-Williams . . .S11439, O40747
- Soprema, Inc S12944
- Stirling Lloyd Products Inc . . .S13223
- Tennant Co S11219
- Tnemec Company Inc. & Chemprobe Coating Systems S11250
- Tremco Commercial Sealants & Waterproofing O30225
- VersaFlex Inc S11810
- Vexcon Chemicals S11323
- W.R. Meadows, Inc . . .S10407; O30735

Application and Surface Preparation Equipment Companies

- Aqua Blast Corp S12611
- ARAMSCO S11213
- Aurand Manufacturing & Equipment Co S12552
- BlastPro Manufacturing, Inc S10639, S10501
- Blastrac S10027
- CDC Larue S11107, O30717
- DeFelsko Corporation S13311
- Doosan Infracore Portable Power, formerly Ingersoll Rand 30605
- Eco-Shell, Inc S13627
- EDCO-Equipment Development Co., Inc S10139, O30741, O30747
- Goff, Inc S10354
- Graco, Inc S11127
- Jetstream of Houston S10955
- Lignomat, LTD C4066
- MSA .N1210
- Munters Corporation S13526
- NLB Corp S12005, O31443
- Novatek Corporation S10821
- Roadware Inc S12051
- SASE Company Inc S10306
- Sky Climber LLC S12419
- SPE-USA S10507
- Sperian Protection N1037
- Tramex, Ltd. c/o Black Hawk Sales, Inc S13355

• WE131, Fall Protection—What You Need to Know
1:30 p.m.–3:00 p.m.
This course is designed to show the importance of pre-planning for fall protection, training requirements, selecting the right gear, and a plan if a person falls.

Thursday, February 4
• TH57, ICRI Slab Moisture Testing Technician Training
8:00 a.m.–11:00 a.m.
The Slab Moisture Testing Technician Certification Program is aimed to standardize moisture testing in the U.S. The program consists of the training, a written exam (see THCRT), and a field performance exam (see THRPE).
• THCRT ICRI Slab Moisture Written Exam
12:30 p.m.–2:00 p.m.
The written exam is closed book and based on ASTM tests listed in the training seminar, along with general knowledge of moisture issues in concrete slabs.
• THRPE ICRI Slab Moisture Testing Technician Performance Exam
2:30 p.m.–5:00 p.m.
The field performance exam consists of ASTM tests and will be performed on hardened concrete. ICRI will provide the necessary tools and safety equipment.

Friday, February 5
• FR35, How to Avoid and Fix Moisture Problems in Concrete Floors & Flooring
8:00 a.m.–11:00 a.m.
This session will address ways to minimize problems caused by moisture, including using the right concrete mix design, placement methods, finishing techniques, vapor retarders, and curing and drying conditions.

For more information on World of Concrete, check out the January 2010 issue of *JPCL*.

Industrial Scientific Names Global VP

Industrial Scientific (Pittsburgh, PA), a manufacturer of safety equipment, such as portable gas detection units, for use in coatings operations and other industries, has appointed Tom Cunningham as the vice president of global operations.

Cunningham will be responsible for operations, including manufacturing, supply chain, quality, manufacturing engineering, and operational excellence. He will be directly responsible for the Americas operation team and have some responsibility over the EMEA and Asia-Pacific operations teams.

Cunningham has a BA in physics from Hiram College, an MS in electrical engineering from the University of Virginia, and an MBA from the Wharton School at the University of Pennsylvania. He is an ASQ-certified Six Sigma Black Belt and a Project Management Professional (P.M.P).

HippWrap Opens East Coast Center

HippWrap Containment, Inc., headquartered in San Diego, CA, recently opened an East Coast office in Suffolk, VA. The company provides proprietary containment materials and installation of them for painting and related work.

The new office is located at 4424 Hubbard Ave., Suffolk, VA 23435. For further information on the new center, contact Grover Ford at 757-484-6808 or grover@hippwrap.com.

HippWrap also has centers in Fairfield, CA, and Auburn, WA. For information on the company, visit www.hippwrap.com.

Jotun Adds Saudi Paint Plant

Jotun Saudia (Jeddah, Saudi Arabia), part of the Jotun Group, opened a new paint factory in Yanbu, Saudi Arabia. According to the company, this puts Jotun's total capacity for Saudi Arabia to 110 million liters of paint and coatings. The plant will produce only waterborne paints.

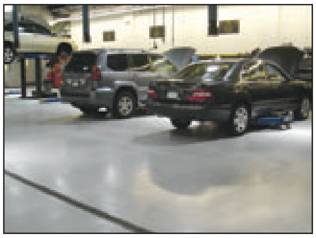
products

Dur-A-Flex Introduces Hybrid Flooring

Dur-A-Flex (East Hartford, CT) has launched Hybri-Flex ES, the company's first smooth-finish hybrid flooring system. The three-step system consists of a $\frac{1}{8}$-inch self-leveling base coat, an epoxy coat, and a wear- and stain-resistant urethane Armor-Top coat.

According to the company, the base coat has good bonding strength to concrete and can tolerate high moisture levels, allowing installation of the system

Continued



as soon as five days after the concrete is poured. The system is available in nine standard colors as well as unlimited custom colors.

For details, visit www.dur-a-flex.com.

Multi-Use Meter for Plural Component

ITW Ransburg (Toledo, OH) has launched RansFlow, an electronic metering system designed to work with automatic and manual paint application systems to precisely meter and mix multi-component materials.

The closed-loop system offers programmable flush and fill cycles for fast color changes, and the microprocessor stores up to 100 different paint recipes, the company says. The system includes an LCD touch screen panel display, built-in USB flash drive interface, and multi-language capabilities.

For details, visit www.itwransburg.com.

IAL's New Title Covers Polyurethane Market

Information on the polyurethane market is now available from IAL Consultants (Ealing, London), which has announced the first edition of *A Global Overview of the Polyurethane Dispersions (PUD) Market*.

According to IAL, the market for PUDs in 2009 has been estimated at 227,350 tonnes and is expected to grow by 5.2% to 292,300 tonnes by 2014. One of the main drivers for this growth is the substitution of solvent-containing products with more environmentally-friendly equivalents.

The slowest growth in the application segments is expected to be the industrial coatings sector at 4.5%. However, in the Americas, PUD production is strongly geared towards industrial coatings, which accounts for 43,000 out of 66,900 tonnes in 2009. Market growth in adhesives and fiber glass sizing is expected to fall within 4.5–6.2% growth, according to IAL.

The new publication states that Europe, the Middle East, and Africa are the most important regions for the production of PUDs, estimating about 103,000 tonnes in 2009.

The IAL report states that overall development of the market has been limited mainly by the fact that PUDs are high-end products and their relatively high price has had a prohibitive effect on their consumption. The report states that this is especially true in the coatings industry where cheaper alternatives are available.

For details, visit www.ialconsultants.com.

Klicos Wins Piscataqua River Bridge Approach Painting Bid

Klicos Painting Company, Inc. (Baltimore, MD) was awarded a contract of $7,537,400 by the New Hampshire Department of Transportation to recoat approximately 476,000 square feet of existing structural steel surfaces on the 19-span, 1,810-foot-long New Hampshire approach to the Piscataqua River Bridge, a 4,503-foot-long cantilevered through arch bridge that connects Portsmouth, NH, to Kittery, ME. The steel will be abrasive blast-cleaned to a Near-White finish (SSPC-SP 10) and coated with a moisture-cured urethane system. The existing coatings contain lead, which will be controlled within a Class 1A containment structure according to SSPC-Guide 6. The contract, which requires SSPC-QP 1 and QP 2 certifications, also includes coating drainpipes and applying an anti-graffiti finish to 72 concrete piers and the south abutment.

Photo courtesy of the New Hampshire DOT

S&K Painting to Recoat Pedestrian Bridge

Photo courtesy of the City of Salem

S&K Painting, Inc. (Clackamas, OR) secured a contract of $1,612,895 from the Oregon Department of Transportation to recoat structural steel surfaces on the Union Street Railroad Bridge. The 5-span, 722-foot-long Pratt through truss vertical lift bridge over the Willamette River, which was built in 1912, was recently converted to a pedestrian and bicycle crossing between two parks. The project includes spot-cleaning severely corroded surfaces and overcoating the structure with a moisture-cured urethane system. The existing lead-bearing coatings will be encapsulated by the new paint system.

Titan Awarded Benedict Bridge Painting Project

Titan Industrial Services, Inc. (Baltimore, MD) won a contract of $2,446,000 from the Maryland State Highway Administration to recoat existing structural steel surfaces on the Benedict Bridge, a 3,343-foot-long by 24-foot-wide bridge over the Patuxent River that features a swing span. The steel will be abrasive blast-cleaned to a Near-White finish (SSPC-SP 10) and coated with an organic zinc-rich primer, an epoxy intermediate, and a urethane finish (MDSHA System C). The contract, which required SSPC-QP 1 and QP 2 certification, includes erecting containment to control the emission of the existing lead-bearing coatings.

Corfu Wins Two Large Tank Rehabilitation Jobs

Corfu Contractors (Vienna, VA) was recently awarded two large contracts for tank rehabilitation work. Corfu secured a contract of $1,587,131 from Charlotte-Mecklenburg Utilities to repair and recoat a 1,276,000-gallon elevated tank and a 137,000-gallon elevated tank. The contract includes interior and exterior surface preparation, lead-abatement, and coatings application. Corfu was also awarded a contract of $1,105,209 from Henrico County, VA, to repair and recoat a 2 MG elevated tank.

Picasso Painting to Refinish Concrete Tanks

Photo courtesy of the City of Cocoa

Picasso Painting Company (Belle Isle, FL) was awarded a contract of $15,600 by the City of Cocoa, FL, to recoat the exterior surfaces of two 1.5 MG concrete water storage tanks. The 95-foot-diameter by 32-foot-high tanks will be pressure-washed and coated with a 100%-acrylic emulsion conditioner and a direct-to-concrete, high-build, waterproof finish.

(As of November 12, 2009)

INDUSTRIAL AFFILIATE MEMBERS

Bayer MaterialScience LLC
Benjamin Moore & Company
Carboline Company
Corrpro Companies, Inc.
Devoe High Performance Coatings
E I Du Pont De Nemours & Company
Greenman Pedersen, Inc./Instrument Sales, Inc.
A GPI Company
ITW Industrial Finishing
International Paint, LLC
KTA-Tator, Inc.
PPG Protective and Marine Coatings
Painters & Allied Trades - LMCI
Sherwin-Williams Company
Tnemec Company, Inc.

COUNCIL OF FACILITY OWNERS

Sustaining Members
BP Pipelines N.A., Inc.
CALTRANS Trans-Lab
ExxonMobil Research & Engineering Co
Force Protection Industries, Inc
MARMC Mid-Atlantic Regional Maint. Center
MTA-New York City Transit Authority
Marine Hydraulics International Inc.
NSWCCD-SSES
Northrop Grumman
Portsmouth Naval Shipyard
Puget Sound Naval Shipyard Shop 71
Sasebo Heavy Industries Company Ltd.
Seaspan International Limited
Tennessee Valley Authority
The Port Authority of NY & NJ
Trident Refit Facility Kings Bay
U S Bureau of Reclamation
U S Coast Guard

COUNCIL OF FACILITY OWNERS

Patron Members
Air Products & Chemicals, Inc.
Associated Naval Architects, Inc.
Atlantic Marine, Inc.
BAE Systems Hawaii Shipyards
BAE Systems Norfolk Ship Repair
Bath Iron Works
Brownsville Marine Products LLC
CPS Energy
Cascade General - Portland
Central AZ Water Conservation Dist.
Chesapeake Shipbuilding Corporation
Chevron Energy and Technology
Chicago Bridge & Iron Company
City Of Virginia Beach
Cives Steel Company
Colonna's Shipyard, Inc.
Continental Maritime of San Diego
Detyens Shipyards, Inc.
Drydocks World-Dubai
Enbridge Energy
Energy Northwest
Federal Highway Administration
General Dynamics/Electric Boat Div.
Golden Gate Bridge Highway
& Transportation District
Granite Mountain Quarries
Grant County Public Utility District
Guam Industrial Services, Inc. Guam Shipyard
Gunderson, Inc.
High Steel Structures, Inc.
Hirschfeld Industries Bridge
Illinois Dept. of Transportation
Kentucky Transportation Cabinet
Louisiana Department of
Transportation & Development
MODOT Maintenance Operations
Maine Department of Transportation
Marinette Marine Corporation
Marisco Ltd
Maryland State Highway Administration
Metro Machine Corporation
Ministry of Transportation Bridge Office
Minnesota Department of Transportation
Monroe County Water Authority
Moving Water Industries (MWI)
NAVSEA
National Steel & Shipbuilding Co.
Naval Facilities Engineering Service Center
Nebraska Department of Roads
New York City Transit Authority (MTA)
New York State Thruway Authority
Norfolk Naval Shipyard Engineering Department
Norfolk Naval Shipyard Production Department
North Carolina DOT
North Florida Shipyards, Inc.
Mayport Naval Station
Ohio Department of Transportation Central Office
Oklahoma Dept. of Transportation
Oshima Shipbuilding Co., Ltd.
PEO CARRIERS PMS 312C
Pacific Gas & Electric Company
Pacific Ship Repair & Fabrication
Pacific Shipyards International
Pearl Harbor Naval Shipyard & IMF
Pearl Harbor Naval Shipyard Design Department
Pennsylvania Department of Transportation
Portsmouth Naval Shipyard
Portsmouth Naval Shipyard Code 250
Puget Sound Naval Shipyard II
Southern Company
Southwest Shipyard L.P.
Steel Service Corporation
Stolt-Tankers BV
Sumitomo Heavy Industries Yokosuka Base Office
Supervisor Shipbuilding Gulf Coast
TXU Power
Termobarranquilla S.A. E.S.P.
Texas Department of Transportation
Textron Marine & Land Systems
Tobyhanna Army Depot
Todd Pacific Shipyards Corp.
Triborough Bridge & Tunnel Authority
Trinity Industries, Inc.
Trinity Marine Products
US Navy-SUBMEPP
Washington Suburban Sanitary Com.
West Virginia DOT Division of Highways
Wisconsin Dept. of Transportation

SUPPORTING MEMBERS

Aluminum Association, Inc.
American Institute of Steel Construction (AISC)
National Paint & Coatings Association
PRA Coatings Technology Centre
Painting & Decorating Contractors of America
(PDCA)

CONTRACTORS/SUPPLIERS/ ENGINEERS/CONSULTANTS

Sustaining Members
Abhe & Svoboda, Inc.
Air Products & Chemicals, Inc.
Allen Blasting & Coatings, Inc.
Atsalis Brothers Painting Co.
Austin Industrial, Inc.
Avalotis Corporation
Bechtel Corporation
Blastech Corporation
Brand Energy Solutions
Cannon Sline Industrial
Carabie Corp.
Certified Coatings Company
Clemco Industries Corp.
Cloverdale Paint, Inc.
Compositech
Dow Chemical Company
Dudick Inc.
Dunkin & Bush, Inc.
Eagle Industries
F.D. Thomas, Inc.
G.C. Zarnas & Company, Inc.
Hames Contracting, Inc.
Hempel USA, Inc.
ITW Futura Coatings
Industrial Coatings Contractors, Inc
Jotun Paints, Inc.
Landmark Structures
Long Painting Company
MARCO
Manta Industrial, Inc.
Martin Specialty Coatings, Inc.
Mid-Atlantic Coatings, Inc.
Mobley Industrial Services, Inc.
Mohawk Northeast, Inc.
Muehlhan Marine, Inc.
Munters Corporation
Naval Coating, Inc.
North American Coatings CL Coatings Division
North Star Painting Co., Inc.
Novocoat Protective Coatings
Odyssey Contracting Corporation
Ostrom Painting & Sandblasting, Inc.
Quality Coatings of Virginia, Inc.

RPI Coating, Inc
Redwood Painting Company, Inc.
Reed Minerals Division Of Harsco Corporation
Rust-Oleum Corporation
Shinko Company Ltd.
SouthBay SandBlasting & Tank Cleaning
StonCor Group Canada Carboline/Plasite Coatings Group
Surface Technologies Corporation
Tank Industry Consultants, Inc.
Termarust Technologies
The Brock Group
Tsuji Heavy Industries Co., Ltd.
Unicorn Construction Enterprises Inc
Universal Painting Corporation
V S E CORPORATION
V.H.P. Enterprises, Inc.
W W Patenaude & Sons, Inc.
Williams Industrial Services, LLC
Williams Specialty Services, LLC

CONTRACTORS/SUPPLIERS/ ENGINEERS/CONSULTANTS

Patron Members

360 Construction Company Inc.
A & B Coatings LLC.
A&E - Anticorrosion Systems
A-1 Coatings Co.
A. Laugeni & Sons, Inc.
A. W. Chesterton Company
AA-1 Services, Inc.
AAA Blast-Cote, Inc.
ABC Applicators, Inc.
ABS - American Bureau of Shipping
ACOTEC nv
AECOM
AIR Systems International
AJC Sandblasting Inc
AM-COAT Painting, Inc.
APC Coatings, LTD
APG, Inc.
Aberfoyle Metal Treaters Ltd.
Abrasive Products & Equipment, LP
Absolute Equipment
Abu Dhabi Construction Company
Advanced Industrial Services, Inc.
Advanced Polymer Coatings, Ltd.
Advanced Protective Coating, Inc.
Advanced Recycling Systems, Inc.
Ahern Painting Contractors, Inc.
AirTech Spray Systems
Ajax TOCCO Magnethermic Corp.
Alabama Painting, Inc.
Alaron Corporation
Alaska Ship & Drydock
All-Safe Industrial Services, Inc.
All-States Painting, Inc.
Allied Painting Inc.
Alpha Painting and Construction Co.
Alpine Painting & Sandblasting Contractors
Amercoat Canada
American Bureau of Shipping
American Industrial Hygiene Assoc.
American Pro Services, Inc.
Americlean
Amstar of Western New York
Anka Painting Company, Inc.
Applied Coatings & Linings
Arena Painting Contractors, Inc. (APC)
Arid Dry by CDIMS
Arizona Coating Applicators, Inc.
Arrow Construction Company, Inc.
Ash Marine Pte Ltd
Astron General Contracting Co., Inc.
Atlantic Design Inc.
Atlantic Painting Co., Inc.
Atlas Painting & Sheeting Corp.
Aulffo Painting, Inc.
Automatic Coating Ltd.
Axxiom Manufacturing Inc
B&B Korea Co. Ltd.
B. R. Flowers & Co., Inc.
BAE Systems Maritime Engineering Services
BARS Company, LTD
BASF Building Systems
BASF Corporation
BGRS, Inc. Blast Grit Recovery Systems
BIS Salamis, Inc.
BYK Additives & Instruments
Barnes Painting
Barnices Valentine C/Provenza s.n.
Barton Mines Company, LLC
Basic Industries of South Texas, LTD.
Bass Rocks Construction Corporation
Bay Decking Company, Inc.
Bayer MaterialScience Trading (Shanghai) Co., Ltd
Baytown Painting, Inc.
Bazan Painting Company
Beach Coatings, Inc.
Beam, Inc.
BioCoatings LLC.
Blastal Coatings Services, Inc.
Blastech Enterprises, Inc.
Blastline Institute (BISP)
Blastrite Pty. Ltd.
Bloomfield Painting Inc
Bridges R Us Painting Co., Inc.
Buckman Laboratories, Inc.
Bulldog Projects
C & K Johnson Industries, Inc.
C & S Services, Inc.
C.W. Beal, Inc.
C3 Industrial Services
CB Tech Services, Inc.
CCS Consulting Service, Inc.
CMP Coatings, Inc.
COMEX-KROMA
CSI Services, Inc.
Cabrillo Enterprises, Inc. DBA-R.W. Little Company
California Engineering Contractors, Inc.
Cambridge Heat Treating Inc.
CanAm Minerals/Kleen Blast Abrasives
Capitol Finishes, Inc.
Cardolite Corporation
Career Marine Engineering & Trading
Caribbean Insulation Services Ltd
Carney's Point Metal Processing, Inc.
Carolina Equipment & Supply Co., Inc
Carolina Painting Company, Inc.
Carr Coatings, LLC
Catamount Environmental, Inc.
Century Drywall, Inc.
Certified Coating Specialists Inc.
Certified Painting Company
Cetek LTD
Changzhou Paint & Coatings Industry Research Institute
Channel Coast Corp.
Chesapeake Coatings & Decks, Inc.
Chicago Area Painting Apprenticeship School
Chlor*Rid International
Church & Dwight Company, Inc.
Cianbro Corporation
Clara Industrial Services Limited
Clark & Pattison (Victoria) Ltd.
Classic Protective Coatings, Inc.
Clemtex, Inc.
Coastal Coatings, Inc.
Coastal Environmental Group
Coating Services, Inc.
Coating Systems, Inc.
Coatings & Painting, LLC
Coatings Unlimited, Inc.
Colonial Processing, Inc.
Colonial Surface Solutions, Inc.
Color Works Painting, Inc.
Commercial Sand Blasting & Painting
Commercial Sandblast Company
Construction Technology Laboratories
Corcon Inc
Cormac Contracting PTY LTD
Corporacion Peruana De Productos Quimicos S.A.
Corporate Painting
Corrocoat USA
Corrosion Control Products Company
Corrosion Control Specialists, Inc.
Corrosion Specialties, Inc.
Crescent Coatings & Services, Inc.
Crossway Coatings
Crown Painting, Inc.
Custom Coating Applicators
DACA LLC
DESCO Manufacturing Company, Inc.
DRYCO, LLC
DUSTNET by EMI International
Dalian YuXiang
Dampney Company, Inc.
Daubert Chemical Company
Davis Boat Works, Inc.
Dawson-Macdonald Company, Inc.
De Koning Groep
DeFelsko Corporation
Dehumidification Technologies, Inc.
Delta Coatings, Inc.
Derrick Company Inc.
Detroit Painting & Maintenance, Inc.
Detroit Tarpaulin, Inc.
Devox S.A.
Diamond Vogel Paint Company
Diversified Container
Dixon Engineering, Inc.
Dunlap, Inc.
Dur-A-Flex, Inc.
Dura-Bond Pipe, LLC
E. B. Miller Contracting, Inc.
E. Caligari & Son, Inc.
E. E. Doerr & Associates, LLC
EDCO-Equipment Development Co., Inc.
EPAcoat, Inc.
EPMAR Corporation
EPS-Materials

Continued

SSPC Organizational Membership

Eagle Industrial Equipment
Eagle Painting & Maintenance Co.
Eagle Specialty Coatings
Earl Industries, LLC
Elcometer Instruments Limited
ElektroPhysik USA, Inc.
Elite Contractors, Inc.
EnDiSys
Endura Manufacturing Company Ltd.
EnviroVantage
Environmental Planning & Management
Envirosafe Stripping Inc.
Era Valdivia Contractors, Inc.
Erie Painting and Maintenance, Inc.
Euronavy International
Evco National Inc.
Exceltech Coating & Applications, LLC
Extreme Coatings, Inc.
F&H Insulation
FCS Group LLC
FTI of DC77
Farr Construction Corporation
Fedco Paints And Contracts
Fine Metal Powders Company
Fine Painting
Finishing Systems of Florida, Inc.
Fischer Technology, Inc.
Five Star Painting Inc.
Flame Control Coatings, LLC
Fletch's Sandblasting & Painting, Inc
Fox Brothers Painting
G & M Painting Enterprises, Inc.
GMA Garnet (USA) Corp.
GTS Inc.
Gaditana de Chorro Y Limpieza, S.L.
Gemstone, LLC
General Dynamics/Information Tech.
George G. Sharp, Inc.
Gibson & Associates, Inc.
Goodman Decorating Co., Inc.
Graco Inc China
Graco Inc.
Greenhorne & O'Mara, Inc.
Guzzler Manufacturing, Inc.
H.I.S. Painting, Inc.
H2M Group
HCI Chemtec Inc.
HCI Industrial & Marine Coatings Inc
HOL-MAC CORPORATION
Hadek Protective Systems Inc
Hall Industrial Contracting, LTD
Hammelmann Corporation
Haraco Services PTE LTD
Harrison Muir, Inc.
Hartman-Walsh Painting Company
Hempel-HaiHong
Hercules Painting Company
Hi-Temp Coatings Technology
High Production, Inc.
Highland International, Inc.
Hiller Systems, Inc.
HippWrap Containment
HoldTight Solutions Inc.
Holt Companies, Inc.
Hong Hua Guan Marine & Engrg. Pte Ltd.
Honolulu Painting Company, Ltd.
Horizon Bros Painting Corp.
Howell & Howell Contractors, Inc.
Huntsman Polyurethanes
Hydro Blasting Services, Inc.
ICI Paints China
IDS Blast Finishing
IMETECO S.A.
ISG dba Universal Inc.
IUPAT, District Council #5
Icarus Industrial Painting & Contracting Company, Inc.
Imms Industrial Coatings, Inc.
Impresa Donelli, S.R.L.
Indian Valley Industries, Inc.
Induron Coatings, Inc.
Industrial Corrosion Control, Inc.
Industrial Marine, Inc.
Industrial Painting Limited, Inc.
Industrial Painting Services, Inc.
Industrial Painting Specialists
Industrial Technical Coatings, Inc.
Industrial Vacuum Equipment Corp.
Insl-X/Coronado Paint Co., Inc.
Insulating Coatings Corporation
Intech Contracting LLC.
Inter-City Contracting, Inc.
Interior Finishes, Inc.
International Flooring & Protective Coatings, Inc.
International Marine and Industrial Applicators LLC
International Protective Coatings China
Iowa Waste Reduction Center University of Northern Iowa
J & K Painting Corporation
J. Goodison Company, Inc.
J. Mori Painting Inc
J.M. Groome , Inc.
J.N.A. Painting and Contracting, Inc.
JAD Equipment Co. Inc.
JTR, INC.
Jal Engineers Pvt. Ltd.
Jamac Painting & Sandblasting Ltd.
Jeffco Painting & Coating, Inc.
Jerry Thompson & Sons, Inc.
Jet De Sable Houle Sandblasting Ltd.
Joaquin Riera Tuebols S.A.
John B. Conomos, Inc.
John W. Egan Company, Inc.
Jotun Coatings China
Jupiter Painting Contracting Co Inc
KENTO CO., LTD.
KM Industrial, Inc.
KMT Aqua-Dyne Inc.
Kane, Inc.
Keene Coatings Corp.
Kelly-Moore Paint Company, Inc.
Kennametal Inc.
Kern Steel Fabrication, Inc.
Kimery Painting, Inc.
Kiska Construction, Inc. (KCI)
Klicos Painting Company, Inc.
Kodiak Infrastructure Solutions, LLC
L & L Painting Company Inc.
L. Calvin Jones
L. F. Clavin & Company, Inc.
Leighton Associates, Inc.
Liberty Maintenance, Inc.
Lindner Painting, Inc.
Line-X Corp.
Liner Technologies
Llamas Coatings
LorRich Enterprise, LTD
Luckinbill, Inc.
Lynx Enterprises, Inc.
M & J Construction Company
M & R Painting, Inc.
M C Painting Corporation
M. Pallonji & Company Pvt. Ltd.
MB Environmental Consulting
MCSA (Mantenimiento & Construcciones,S.A)
MEC Construction, Inc.
MJM Construcution LLC
MST Inc (Modern Safety Techniques)
MacDonald Applicators Ltd.
Madison Chemical Industries Inc.
Maguire Iron, Inc.
Main Industries Inc.
Mandros Painting, Inc.
Manganas Enterprises, Inc.
Mansfield Industrial
Manus Abrasive Systems, Inc.
Marine & Industrial Coatings, LLC
Marine Chemical Research Institute
Marine Specialty Painting
Marinis Bros., Inc.
Mascoat Products
Mason Painting, Inc.
Master Powder Coating, Inc.
Matheson Painting
Matrix Service Inc.
Matsos Contracting Corp
McCormick Industrial Abatement
McCormick Painting Company
McElligott Partners Pty. Ltd.
McINNES COOPER
Merkury Development
Metain S.A.
Meteor Coating
Michelman-Cancelliere Iron Works
Midwest Rake Company LLC
Midwest Tank Services, Inc.
Modern Protective Coatings, Inc.
Mohawk Garnet, Inc.
Monarflex by Siplast
Morris Painting, Inc.
Municipal Tank Coatings
Murphy Industrial Coatings
N A Logan, Inc.
N G Painting, LP
N. I. Spanos Painting, Inc.
NACE International-The Corrosion Society
NAG Marine
NOR-LAG Coatings Ltd.
NUCO Painting Corporation
National Coatings, Inc.
National Surface Treatment Center
Natrium Products, Inc.
Nelson Industrial Services, Inc.
Nelson Service Grp., Inc./NELCO,Inc.
NexTec Inc.
Niagara Coatings Services, Inc.
North American Galvanizing Co.
Northwestern Contractors Inc.
Norton Sandblasting Equipment
O.T. Neighoff & Sons, Inc.
OPT CO
Odle, Inc.
Oesterling Sandblasting & Painting
Olympus & Associates, Inc.
Olympus Painting Contractors, Inc.

SSPC Organizational Membership

Ontario Painting Contractors Association
Opta Minerals, Inc.
Optimiza Protective & Consulting, SL.
Orfanos Contractors, Inc.
P & S Painting Co., Inc.
P & W Painting Contractors Inc.
P S Bruckel Inc
P.C.I. International, Inc.
PCIROADS, LLC.
PEC Ltd.
PPG Industries China
PROINBEL
PT Berger Batam
PT. Sigma Utama
Pacific Painting Co Inc
Pacific Titan, Inc.
Pacific Yacht Refitters Inc.
Paige Decking
Paint Platoon USA
PaintEcuador
Palmer Industrial, Inc.
Panther Industrial Painting, LLC
Paragon Construction Services of America Inc.
Park Derochie Coatings Ltd.
Paul N. Gardner Company, Inc.
Peabody & Associates, Inc.
Pen Gulf, Inc.
Pensa Contractors, Inc.
Performa Inc.
Performance Blasting & Coating
Petric & Associates, Inc.
Phillips Industrial Services Corp.
Planet Inc
Pop's Painting
Poseidon Construction
Postel Industries, Inc.
Precision Industrial Coatings, Inc.
Preferred, Inc.-Fort Wayne
Prime Coatings, Inc.
Pro-Tect Plastic & Supply, Inc.
Professional Application Services, Inc.
Professional Tank Cleaning
Public Utilities Maintenance, Inc.
Purcell P & C, LLC
QED Systems, Inc.
Quality Linings & Painting, Inc.
Quantum Technical Services
Quincy Industrial Painting Co
Quinn Consulting Services, Inc.
R & B Protective Coatings, Inc.
R2M Building Products, Inc.
RBG
RECAL RECUBRIMIENTOS, SA de CV
RML Construction
ROs Precise Painting, Inc.
Rahm Industrial Services, Inc.
Raider Painting & Coatings
Rainbow, Inc.
Raven Lining Systems
Raydar & Associates, Inc.
Raytheon Technical Services
Reglas Painting Company, Inc.
Rhino Linings USA, Inc.
Righter Group, Inc.
Rotha Contracting Company, INC.
Roval USA Corporation
Ryno Tools
S & D Industrial Painting Inc
S & S Bridge Painting, Inc.
S & S Coatings, Inc.
S. David & Company, Inc.
SAFE Systems, Inc.
SAIT Polytechnic
SME Steel Contractors
SVMB
Sabelhaus West
Saffo Contractors, Inc.
Sauereisen
Sayed Hamid Behbehani & Sons Mech. Div.
Schiff Associates
Scott Derr Painting Company
Seaside Painters & Sandblasters
Seaway Coatings, Inc.
Seaway Painting LLC
Secondary Services, Inc.
Seminole Equipment, Inc.
Service Contracting, Inc.
Servicios Tecnicos Industriales y Maritimos, S.A. (SETIMSA)
Shenzhen Asianway Corrosion Protection Eng. Co., Ltd.
Sherwin-Williams Industrial & Marine Coating China
Shield Coatings & Weatherproofing
SigmaKalon China
Skinner Painting & Restoration
Skyline Steel, LLC
Soil & Materials Engineers, Inc.
South Gulf, Inc.
SouthEnd Painting Contractors Inc.
Southern Paint & Waterproofing Co.
Southland Painting Corporation
Spartan Contracting, LLC
Specialty Application Services, Inc.
Specialty Finishes, LLC
Specialty Groups, Inc.
Specialty Polymer Coatings, Inc.
Specialty Products, Inc.
Spensieri Diversified LLC
Sponge-Jet, Inc.
Stanley Consultants, Inc.
Stanley's Marine & Industrial Services LLC.
Steed General Contractors, Inc
Steel Fabricators of Monroe, LLC
Steel Management System, LLC
Stinger Welding, Inc.
Structural Coatings, Inc.
Struthers Metal Service, Inc.
Stuart Dean Company, Inc.
Superior Industrial Maintenance Co.
Surface Prep Supply
Surface Preparation & Coatings, LLC.
Swalling Construction Company, Inc.
Swanson & Youngdale, Inc.
Symmetric LLC
TDA Construction, Inc.
TDJ Group, Inc.
TJC Painting Contractors, Inc.
TMI Coatings, Inc.
TMS Metalizing Systems, Ltd.
Tarpon Industrial, Inc.
Tarps Manufacturing, Inc.
Techno Coatings, Inc.
Tecnico Corporation
Testex
Texas Bridge, Inc.
The Aulson Company, Inc.
The Gateway Company of Utah
The Gombert Organization
The Lusk Group
The Paint Research Association
The Rose Corporation
Theovas, Inc.
Thomarios
Thomas Industrial Coatings, Inc.
Thompson Metal Fab, Inc
Thorburn Industrial Paint
ThyssenKrupp Safway, Inc.
Tioga, Inc.
Titan Industrial Services
Total Blasting
Tower Maintenance Corp.
Tri-State Painting, Inc.
Troy Painting Inc.
Turner Industries Group, LLC
UHP Projects, Inc.
US Coatings, Inc.
US Minerals/Stan Blast
UVOLVE Instant Floor Coatings
Unifab Industries, LTD.
United Coatings Corporation
United Eagle Painting Corporation
United States Corrosion Engineers, Inc.
Universal Minerals, Inc.
Universal Silencer, LLC
Utility Service Company, Inc.
V & A Consulting Engineers
V. V. Mineral
Vanwin Coatings of VA, LLC
Veolia ES Canada Industrial Services, Inc. Canada
Vermillion Painting & Construction
VersaFlex Incorporated
Vimas Painting Co., Inc.
Vulcan Painters, Inc.
Vulcan Pipe & Steel Coatings, Inc.
W Q Watters Company
W S Bunch Company
W W Enroughty & Son, Inc.
WGI Heavy Minerals, Inc.
WIWA LP
Washington Industrial Coatings, Inc.
Wasser High-Tech Coatings, Inc.
Wenrich Painting, Inc.
West Coast Industrial Coatings, Inc.
Western Industrial, Inc.
Western Technology, Inc.
Wheelabrator
Wheelblast, Inc.
White Swan Painting
Woodall's Construction, Sandblasting, & Painting Inc.
Wooster Brush Company
Worldwide Industries, Inc.
Worth Contracting
Wuxi Ding Long Trading Co., Ltd.
YYK Enterprises, Inc.
YungChi Paint & Varnish Mfg
ZRC Worldwide
Ziegler Industries, Inc.