Another Milestone Achieved

In June 1984, the *Journal of Protective Coatings & Linings* was launched. *JPCL* was the vision of Dr. Harold Hower, who had been an employee of SSPC. He realized that to be a more effective membership organization, SSPC needed a means to communicate with its members. Back then, the internet, e-mail, and other electronic media were not used as they are today. The printed word was the way to get the message out and educate the readership. In 1984, what was Harold's vision became a reality. *JPCL* has been published for 25 years and is still going strong. It set a high standard then and has maintained it through all the years. Harold and his staff are to be congratulated on the silver anniversary of *JPCL*.

In the first issue of the magazine, the feature articles were "Guidelines for Centrifugal Blast Cleaning" by A.W. Mallory, "Michigan's Answer: Total Shop Painting" by Gary Tinklenberg and James D. Culp, and "The Consensus Process: Surface Preparation Specifications" by John D. Keane. The second issue dealt with zinc coatings. Over the years, *JPCL* has discussed many sides of the themes in the initial issues—including coating application, surface preparation, specifications, and coatings technology—along with failure analysis, inspection, maintenance programs, controlling costs, coating concrete, regulations for the industry, protecting workers and the environment, and a host of other matters affecting maintenance coating work.

JPCL remains one of the main educational tools in our industry. It has been publicizing those issues vital to the industry and those in which readers are interested. In the 1980s, *JPCL* reported on the ban of tributyl tin in maritime coatings and the regulations on hazardous and solid wastes. The SSPC Applicator Training Bulletin series, launched in the 1980s and continuing well into the 1990s and 21st century, was as an instructional aid for painters and blasters. In the 1980s, 1990s, and 21st century, the *Journal* published two series by the renowned coating chemist Clive Hare: Anatomy of Paint and Trouble with Paint. These articles and the collected series now sold in book form are cited in many publications throughout the industry. In the 1990s, *JPCL* informed the readers about the worker risks associated with exposure to lead, OSHA's standard for lead in construction (29 CFR 1926.62), and practical and safe ways for painting contractors to do the dangerous work of lead paint abatement. From VOC reductions in architectural and industrial maintenance coatings and performance testing on new coatings, to the painting contractor certification program and changes to hazardous waste regulations, the industry's concerns have been voiced and addressed in the pages of *JPCL*. When people want to know the key events that affect the industry, they turn to *JPCL*.

SSPC has had a long history with the magazine. In fact, since its inception, *JPCL* has been "the voice of the SSPC." Many people think SSPC and *JPCL* are the same organization, but they are not. SSPC is a not-for-profit entity and *JPCL* is part of Technology Publishing/PaintSquare, a private company. In 1990, a long-term agreement was signed between the two organizations formalizing the relationship. The magazine grew under the guidance and leadership of Harold Hower, who has been at the helm since its inception, and from the input of John Keane and Dr. Bernie Appleman, previous Executive Directors of SSPC. SSPC and *JPCL* continue to have a close relationship, and both parties know that to give the members the product they deserve, a relationship must exist that is more than just vendor and customer. Even though we are separate entities, we always try to have the members' and readers' best interests at the forefront. We frequently discuss what is going on in the industry and how it concerns our readers.

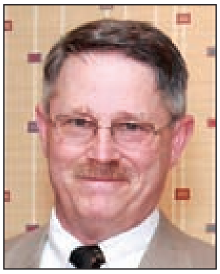
I want to congratulate the staff of *JPCL*—especially Harold; Karen Kapsanis, the editor; Anita Socci, the Directory Manager; and Daryl Fleming, the assistant editor—for achieving such a milestone. I wish the entire staff the best as they march on to achieving more *JPCL* milestones. It is my privilege and honor to work closely with that superb group of people as they produce the most informative and educational magazine in the coatings industry.

Bill

Bill Shoup
Executive Director, SSPC

ASTM Presents Award of Merit

ASTM International has presented the Award of Merit to Gary A. Hayden for his service to ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys. The Award of Merit and its accompanying title of fellow is the highest recognition of individual contributors to ASTM standards activities.



Gary A. Hayden

Hayden joined ASTM International in 1993 and currently serves as the secretary of Committee A01 and Subcommittee A01.06 on Steel Forgings and Billets. He leads several A01 task groups, chairs the editorial subcommittee, and works on Committee E28 on Mechanical Testing.

Hayden earned a bachelor's degree in metallurgical engineering from Lafayette College in Easton, PA, and is currently the chief metallurgist and director of quality assurance at CP Industries (McKeesport, PA), where he has worked since 1988. He is also a licensed professional engineer and a member of the American Society for Metals.

SSPC Seeks Nominations for 2009–2010 Structure Awards

SSPC is accepting nominations from the membership for the annual structure awards. The awards are given to recognize the work of teams of contractors, designers, end users, and coating manufacturers for excellence on particular industrial or commercial coatings projects. The awards will be handed out at the SSPC Annual Business Meeting at the PACE 2010 show in Phoenix, AZ, on Sunday, February 7. The winning structures will also be featured in a photo essay in *JPCL* later in 2010.

SSPC seeks nominations for all types of structures, including bridges, tanks, ships, concrete structures, and industrial or commercial facilities. Note that a representative of the structure's owner must be willing to attend the PACE show to accept the award and give permission for the information to appear in the *JPCL* photo essay.

Except for the Charles G. Munger longevity award, work on the structures must have been completed between July 1, 2008 and June 30, 2009. All nominations are due October 30, 2009.

For more information or a nomination form, contact Terry Sowers, Director of Member Services, at 1-877-281-7772, extension 2219 or e-mail sowers@sspc.org.

The descriptions of the Structure Awards are listed below.

- **Crone Knoy Award:** For outstanding achievement in commercial or industrial coatings work that demonstrates innovation, durability, or utility.

The qualities that may represent outstanding achievement in this area include excellence in craftsmanship or execution of work, use of state-of-the-art techniques or products to creatively solve problems or provide long-term service.

- **Charles G. Munger Award:** For the outstanding industrial or commercial coatings project demonstrating longevity of the original coating.

The structure may have had spot repairs or overcoating with the original coating still intact.

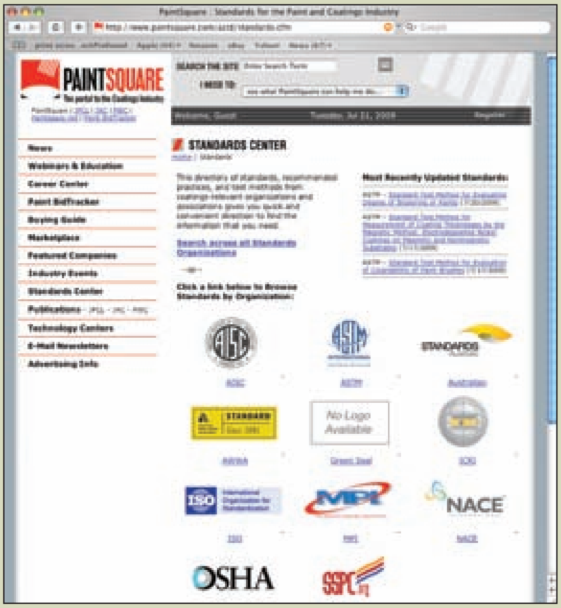
- **William Johnson Award:** For outstanding achievement demonstrating aesthetic merit in industrial or commercial coatings work.

The qualities that are considered for aesthetic merit include color, gloss, or texture. Other criteria considered include the coating on the structure complementing the environment while enhancing the structure itself. Or the coating may represent a theme, an object, or a specific graphic design.

- **George Campbell Award:** For outstanding achievement in the completion of a difficult or complex industrial or commercial coatings project.

The qualities that may represent achievement in a difficult or complex structure include work occurring in harsh or extreme environmental conditions, work completed under strict time constraints, work done with limited access or in high traffic areas, work on a structure with complex structural components, or work on a project that requires coordination with multiple trades or subcontractors.

Online Center for Coatings and Related Standards



From the publisher of *JPCL* comes PaintSquare's Standards Center, an online resource that allows coating users to quickly and conveniently search for standards, recommended practices, and test methods from a variety of associations and agencies that issue documents relavant to coatings and coatings work.

At the Standards Center on www.paintsquare.com, users can search by a variety of criteria, including specific words or phrases in the title or description of the standard; standard number; or issuing organization.

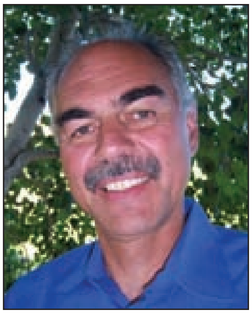
ASTM International (ASTM) standards can be purchased on PaintSquare's Standards Center. Links to standards and related documents from other organizations in the Center take users directly to the organizations' web sites.

In addition to standards from ASTM, PaintSquare's Standards Center can help users find coatings-related standards from SSPC: The Society for Protective Coatings, the American Institute of Steel Construction (AISC), the American Water Works Association (AWWA), Green Seal, the International Concrete Repair Institute (ICRI), the International Organization for Standardization (ISO), the Master Painters Institute (MPI), NACE International, the Occupational Safety & Health Administration (OSHA), and Standards Australia.

The Standards Center can be reached from the navigation bar on the home page of www.paintsquare.com.

ICO Hires National Sales Manager

International Coatings, Inc. (Franklin Park, IL) has hired Angel R. Llanes as the national sales manager. His responsibilities will include further development of certified contractors, distributors, and rep organizations along with associated marketing and business development functions.



Angel R. Llanes

International Coatings, Inc. is a manufacturer of concrete repair materials and resin-based specialized industrial flooring systems.

ASTM Proposing Two New Traffic Standards

ASTM International Subcommittee D01.44 on Traffic Coatings, part of Committee D01 on Paint and Related Coatings, Materials, and Applications, is currently working on two proposed new standards covering the sampling of waterborne traffic paint and glass bead gradation measurement.

Proposed standard ASTM WK22312, Practice for Drum and Tote Sampling of Waterborne Traffic Paint, addresses laboratory sampling issues. Ensuring that traffic paint taken from the field is tested properly in laboratories is a concern. Interested parties are invited to join in the development of the standard and can contact Greg Shay, the chair of Task Group D01.22.02, at shaydg@dow.com.

ASTM WK23758, the proposed standard for Test Method for Measuring Gradation of Glass Beads Using a Flowing Stream Digital Image Analyzer, will help in the production and quality control of glass beads. Glass beads are added to traffic paint during manufacturing to ensure paint retroflectivity, especially at night. Gary Ware, an ASTM D01 committee member, said that all participation is welcome, but the subcommittee especially needs technical people. He can be contacted for more information at gary.ware@swarco.com.

For more information on any of the standards or becoming a member, visit www.astm.org.

Preparing and Lining Salt Storage Bins

What kind of surface preparation and lining specifications are suitable for resisting abrasion presented in the interior of a tall storage bin for salt (depending on whether or not the salt is intended for human consumption)?

Luis F. Granes, Sauereisen Inc.

The interior surfaces of a storage bin for salt must be prepared, no matter if the bin has been in service or is brand new. For bins made of new concrete, the surfaces must be prepared to remove laitance, which interferes with proper adhesion capability and may cause a coating to disbond and fail. For preparing bins previously in service, if the steel reinforcement in the old concrete has been compromised, you must remove, replace, seal, and restore it, replace the concrete, and prepare the surface. Similarly, salt bins with steel surfaces, both those new and previously in service, must be prepared and profiled before coatings application.

The profile on both concrete and steel has to be done right to obtain good coating adhesion. The better the surface profile, the better the adhesion between the surface and the protective lining.

Salts and chlorides must be removed. Their removal is easier to achieve on a steel surface than on concrete.

A penetrating primer will help seal the surface and enhance the bond between the surface and the protective lining. The better the bond between the primer and the substrate, the better the adhesion between the protective lining and the substrate. A solvent-borne, high-solids primer is better for steel; a waterborne primer is much better for concrete, although either primer may be specified for concrete.

If temperature, either high or low, is not an issue, an epoxy coating will be better than vinyl ester products, because it will provide a smooth and solid surface. 100%-solid epoxy primers, coatings, and linings can be applied faster, are easier to apply, and cure faster than solvent-borne products, saving time and money. With 100% solids products, the recommended thickness will be achieved much faster than with solvent-borne coatings and linings.

Soft coatings and linings (e.g., rubber linings and bag liners) have been used in salt storage bin service, but they are eventually penetrated by salt and humidity, which will reach the concrete and damage it. Of bigger concern is that damage to the lining will contaminate the salt. As soon as a hole or penetration develops on a soft lining, it starts to fail and contaminates the salt. The salt then begins to accumulate at the damaged areas, creating clusters and increasing the abrasion and turbulence over the nearby coated area. Thus, instead of soft coatings, those that create smooth, hard surfaces, such as epoxies or even vulcanized rubbers, are better for this service because their surfaces resist impact and abrasion.

If the main lining has a rough finish, the application of a topcoat that enhances the smoothness of the surface will avoid the problem of salt accumulation on the surface. The smoother the lining, the less friction and less abrasion over the lining.

If the salt in the storage bin is for human consumption, the procedure for preparing the surface is the same as the procedure described above, but all linings in contact with the salt must be made of only FDA-approved substances to ensure the salt will not be contaminated by anything leaching from the lining or by direct contact with the lining.

Editor's Note: The question and response above were adapted from SSPC's Coatings Talk Listserve. To register for the Listserve, go to www.sspc.org.

Luis Granes is an international sales manager for Pittsburgh, PA-based Sauereisen Inc. He has worked for the company since 1999 and has accrued nearly 25 years of experience in the corrosion control industry. Mr. Granes graduated from I.U.N.P. Caracas, Venezuela in 1981. A member of NACE since 1987, he is a Past Chairman of the NACE Pittsburgh Chapter and is the Acting Chairman of NACE Corrosion Forum–Internet.

The Fix That Was Worse Than the Problem

By Raymond Tombaugh, Senior Coatings Consultant, KTA-Tator, Inc.
Richard A. Burgess, KTA-Tator, Inc., Series Editor

Catastrophic Disbonding of an "Encapsulating Coating" Applied to Hot-Dip Galvanizing

Protective coating and lining systems used in food processing and beverage facilities are used for product protection, corrosion protection, and ease of decontamination. However, to fulfill these functions, the coating system must remain completely attached to the surfaces to which it was applied. Complete adhesion is particularly important in the food and beverage manufacturing/processing industries because product contamination can adversely impact public health. To this end, the U.S. Food and Drug Administration (FDA) conducts routine inspections to verify that foreign particulate is not contaminating products. In this "Case from the F-Files," a problem with the galvanized steel in a meat processing plant went from bad to worse when the galvanizing was "repaired" with a liquid-applied coating.

Fig. 1: General view of rail system. Photos courtesy of the author

Background

A new hot-dipped galvanized overhead rail system was installed in a refrigerated meat processing facility for transporting sides of beef within the plant (Fig. 1). Shortly after installation, facility operators and management observed particulate dropping from the rail system onto the meat processing area. They attributed the particulate to the galvanizing coming off the support structure. Initial inspections performed by plant maintenance personnel indicated that the problem was widespread and had the potential to contaminate the meat. With the appearance of the particulate, the plant was shut down and repeated inspections from the Food and Drug Administration (FDA) ensued because even a small amount of particulate is unacceptable in a food processing facility.

The facility owner reported the problem to the firm that designed and installed the rail system with the hope that the problem could be corrected with the rail system on site. The firm recommended that a 100% acrylic elastomeric coating be applied to the galvanized steel to "encapsulate" the delaminating galvanizing, thereby eliminating any future contamination from particulate (Fig. 2). The "encapsulation" operations were completed. Within a few months, the elastomeric coating began to delaminate from the structure, and a coating failure investigation firm was called in to determine the cause of the coating delamination.

Fig. 2: Typical structural member coated with the acrylic elastomeric

There was no specification for performing the remediation coating work. However, the facility owner reported that the steel was brought to room temperature and then pressure washed with hot water. The owner believed that a primer had been applied. The elastomeric was applied by spray gun.

The coating manufacturer's product data sheet (PDS) indicated that the recommended coating was a 100% acrylic elastomeric coating specifically designed as a waterproofing for sprayed

Continued

polyurethane insulating foam on roofs and tanks. The PDS also reported that the coating had excellent adhesion to primed metal. The PDS provided no guidance for surface preparation, suitable primers, or coating thickness requirements. The PDS for a similar product manufactured by another coating company indicated a maximum thickness of 12 mils per coat.

Field Investigation

In the field investigation, the coating and the underlying galvanizing layer were examined visually, and adhesion testing was conducted on the coating. Samples of the coating were acquired for laboratory analysis. The galvanized substrate was examined on site and photographed.

Fig. 3: Mechanical damage on the rail support steel

The visual examination in the field revealed a number of existing coating delaminations on the structural steel. The delaminations were typical of mechanical damage (Fig. 3). Blisters were also present in the coating film. When the blister caps were removed, there was no evidence of moisture in the blisters.

Adhesion tests were performed in accordance with ASTM D6677, "Standard Test Method for Measuring Adhesion by Knife." The procedure involves making an X-scribe in the paint film. The knifepoint is then inserted at the intersection of the two scribes and lifted. Adhesion is rated based on the extent of coating removed on a scale of 10 to 0, with 10 being the best. Adhesion tests conducted at random

Fig. 4: ASTM D6677 adhesion tests showed poor adhesion values (0).

locations generally indicated extremely poor adhesion, with a 0 rating (Fig. 4). In many cases, large sheets of coating could be removed. The galvanized substrate underneath the coating was smooth and shiny.

Fig. 5: Excessively thick coating films were commonly found, as exemplified by the "curtain" in this photograph.

In many areas observed, the coating appeared thick (Fig. 5). Runs and sags were prevalent. Overspray was on trolley rails, rail hangers, electric wiring, and the walls adjacent to the rail system. In other areas, elastomeric coating had been deliberately applied to the walls and was disbonding.

Laboratory Investigation

Samples of the coating were removed and transferred to a coating failure investigation laboratory for evaluation, which included generic identification of the coating type and microscopic examination. A number of the samples were analyzed by Fourier transform infrared (FT-IR) spectroscopy. The spectroscopic analysis confirmed that the coating was comprised of an acrylic with urethane modification, indicating that it was an acrylic elastomeric material.

The samples varied in thickness (from 9 to 64 mils) and contained many voids. All but two of the samples were significantly thicker than the typical recommended thickness (10 to 14 mils) for acrylic elastomeric coatings. There was some correlation between thickness and adhesion; that is, the thinner coatings were generally from areas where the coating was more tightly bonded.

Cross-sectional microscopic examination revealed that all but one of the coating samples appeared to have a primer coat. The primer was chemically consistent with the finish coat (acrylic elastomeric). The primer was cracked on all of the samples on which it was found. The back sides of all the samples were smooth and did not replicate a roughened surface.

The Failure Mechanism

The field and laboratory investigations revealed that the coatings applied to the galvanized structural steel rail support system were unusually thick and poorly bonded to the substrate in most of the areas examined. In fact, adhesion was so poor that normal use of the rail system resulted in the many observed failures. The blisters were likely the result of moisture that remained on the

Fig. 6: The blisters probably occurred because moisture was on the surface before coating application.

surface before painting (Fig. 6). Once the moisture vaporized, it caused the coating to lift and blister. When adhesion is poor (as it was on the rail system), only minor amounts of moisture are needed to cause blistering of a coating.

Continued

The cause of the poor adhesion was attributed primarily to the omission of surface preparation before painting. The galvanized steel underneath the coating was very smooth. The backside of the removed coating was equally smooth and did not replicate a surface texture, which is essential for coating adhesion to newly galvanized surfaces.

In fact, there was no visual evidence that any type of surface preparation was performed to promote adhesion of the coating. This finding was supported by the facility owner's rep, who stated that only pressure washing with hot water was performed before coating application.

Water washing alone is inadequate to create the surface texture needed to promote good coating adhesion to newly galvanized surfaces. Typically, a phosphoric acid wash is applied to galvanized surfaces before painting. The acid wash creates a crystalline structure that provides an anchor profile or "tooth" to promote coating adhesion. Absent the acid wash, coatings rarely bond well to newly galvanized surfaces.

Contributing to the loss of coating adhesion on the unprepared galvanizing were the selection of an inappropriate coating for use over galvanized steel and the application of an excessively thick coating film. Acrylic elastomeric coatings are typically applied to more porous substrates like stucco, cement plaster, and polyurethane foam insulation. Acrylic elastomerics typically demonstrate acceptable adhesion to these surfaces because the coatings can penetrate the substrates and bond to them. Acrylic elastomeric coatings are more viscous (thicker in consistency) than plain acrylics, so the elastomerics do not wet out and penetrate surfaces, unlike less viscous coatings. High viscosity limits the use of elastomerics on non-porous substrates such as metal. Even wood, which is significantly more porous than galvanized steel, is not a viable substrate for elastomeric application.

While the product data sheet for the elastomeric coating used on this project indicated that it is appropriate for steel, it stated that a primer was required for proper adhesion. Typically, a penetrating epoxy is used to prime surfaces before application over an acrylic elastomeric topcoat. Based on the microscopic cross-sectional examination of the coating samples, a primer layer was visible, but its chemistry was generically the same as that of the elastomeric material. The primer was applied at a lower thickness than the top layer, but the thinner film did not help adhesion. Regardless of whether the elastomeric coating is applied as a thick film or thin film, it does not flow or penetrate well and will not bond to the underlying galvanizing layer.

The standard thickness for acrylic elastomerics is 10 to 14 mils. The excessively thick application of the elastomeric at the meat processing facility (up to 64 mils) only exacerbated the adhesion problem. When coatings cure, they exert stresses on the underlying surfaces. The stresses generally increase as coating thickness increases. The excessively thick layer imparted high stress to the underlying thinner coat of elastomeric primer. The result was a fractured and loosened primer layer, as evidenced by the preponderance of cracks on the backs of the removed paint samples. Poor coating adhesion resulted. Areas where the top layer was thinner and closer to the recommended thickness generally demonstrated better, but still unacceptable, adhesion.

In addition to the adhesion problem over galvanizing, a significant amount of overspray was on other surfaces, such as the coated steel wall panels, trolley rails and electric wiring. The overspray was poorly bonded in these areas as well because none of the surfaces are compatible with this coating.

The investigator was unable to observe any of the poorly bonded or delaminating galvanizing because, except for areas where the coating had delaminated, the entire rail support system was covered with the thick elastomeric coating that masked galvanizing defects. Investigation of the galvanizing problem, in addition to the coating failure, would have required the removal of large areas of the applied coating. Plant operations prevented this level of investigation. There is no doubt, however that loose and delaminating galvanizing did occur. Typically, delaminating galvanizing is the result of improper surface preparation during the galvanizing process. The problem can affect entire batches of steel. Unless the sur-

Continued

faces are properly repaired, the delaminations will continue to occur.

The Monday Morning Quarterback

The acrylic elastomeric product was selected to overcoat the galvanized surface to encapsulate the delaminating galvanizing. Unfortunately, elastomerics do not bond well to galvanized and other steel. In addition, when the underlying substrate is degrading (as was the galvanizing), encapsulation is not a viable method for preventing future disbonding. The coating will fracture at the sites of galvanizing failure, and the coating as well as the galvanizing will delaminate.

The preferred remedy for poorly bonded galvanizing is to remove all loosely adhering materials and recoat with an organic zinc-rich primer. This operation would have eliminated the potential for continued introduction of particulate to the plant, and would have provided corrosion protection equivalent to the galvanizing.

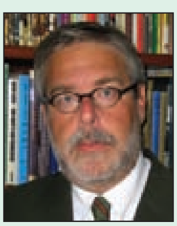
Remediation of the Problem

Because the elastomeric coating would continue to delaminate from the galvanized steel, the only way to completely remediate the coating problem was to remove the elastomeric coating. Removal was accomplished by first scraping to remove all of the poorly bonded coating, followed by high pressure water jetting to remove the remaining coating.

The exposed galvanized surfaces with poor adhesion were repaired by power tool cleaning. Vacuum attachments were used with the power tools to minimize the amount of dust introduced into the meat packing facility. Properly prepared surfaces were touched up with an organic (epoxy) zinc-rich. The galvanized surfaces that were in good condition were treated with phosphoric acid etching, then coated with two coats of 100% acrylic paint. Naturally, these operations dictated plant shutdown until all surface preparation, coating application, and cleanup were completed.

Prevention

First and foremost, the coating failure could have been prevented if a comprehensive receipt inspection was performed on the galvanized rail system at the galvanizing shop. The inspection would likely have revealed a sub-par product, which could have been returned to the supplier. If coating the galvanizing was the preferred option (to avoid installation delays and increased downtime), proper surface preparation of the galvanizing layer before coating application, followed by installation of an appropriate coating material would likely have resulted in a successful system.



Ray Tombaugh provides coatings-related services (including coating failure analysis, condition assessment, specification preparation, and project management) for KTA-Tator, Inc. in various industries. Before joining KTA, Mr. Tombaugh was a senior engineer for the Pennsylvania Power & Light Company, where he was responsible for coatings and corrosion engineering at the Susquehanna Steam Electric Station, PP&L's nuclear power plant. He was also responsible for establishing and maintaining a comprehensive coatings control program, developing coating procedures and specifications, conducting corrosion and metallurgical analyses, performing coatings inspection, and selecting coating systems for use in the plant. He holds a B.S. in chemical engineering from Lehigh University, is a member of SSPC, and is a NACE Certified Coatings Inspector Level 3 (Peer Review).

Overcoating Lead-Based Alkyd Paint on Steel Penstocks: Practical Experience

Fig 1: The rugged terrain for the Bridge River Penstock, BC, Canada. All photos courtesy of Terry McManus.

By Mike O'Donoghue, Ph.D.,
Peter Roberts, and Vijay Datta, MS, Devoe High Performance Coatings, International Paint LLC; and Terry McManus, McManus Inspections Ltd.

While it remains axiomatic that good surface preparation is critical to the success of a coating application, for *overcoating* applications it is equally crucial to select overcoating systems with utmost care, paying particular attention to their chemistry, physical properties, performance history, and intended service environment.

This article describes key technical attributes of an innovative high ratio calcium sulfonate alkyd (HRCSA) overcoat system, and how these attributes allowed for the successful overcoating of a lead-based alkyd paint system on a penstock exterior at a Canadian hydroelectric facility, using only 5,000 psi pressure washing for surface preparation.

The case history provided outlines how the coating system also lent itself well in helping to solve different crevice corrosion issues.

Background on Overcoating

Defined by some as "spot cleaning and priming degraded areas, cleaning intact paint, and applying a lead-free system over the existing system," overcoating has many benefits.[1] This is especially true when the coating systems have been chosen judiciously and applied properly with full-time inspection.

Cost reductions associated with less surface preparation and containment requirements, together with less hazardous waste disposal, are primary driving forces behind

This article is based on a paper given at PACE 2009, held February 15–18 in New Orleans, LA. The paper was the winner of the 2009 SSPC Presidential Lecture Award.

the overcoating of structures previously protected by lead-based paint. In some cases, full-scale refurbishment of existing lead-based paint is undertaken, whereas in other cases, only the most deteriorated areas on a structure are treated. This latter practice is known as zone painting.

To date, overcoating is most commonly associated with bridge painting projects, and numerous examples of such have validated the overcoating approach as a viable option to full-scale abrasive blasting and full containment. However, to ensure success and avoid premature coating failures on less than ideally prepared substrates, the following key requirements must be met.

First, careful scrutiny of candidate overcoating systems is of the utmost importance. Failure to pay sufficient attention to critical coating properties germane to overcoating will make the success of overcoating unpredictable. Coating applications carried out in cold climates can make the odds of success even worse. Second, the structure to be coated and the existing coating system must be rigorously inspected to ensure the suitability of overcoating. Third, definitive specifications must be written. Fourth, when the refurbishment coating application is carried out, proper inspection of the coating work cannot be overemphasized.

Desired Attributes of Overcoating Systems

So what does the received wisdom say are the highest performing overcoat systems? Epoxies? Moisture-cured urethanes? Acrylic latexes? Interestingly, some twenty-five years ago, to ascertain what coating professionals considered the most desirable attributes of prospective overcoat systems (for overcoating lead-based paint), SSPC conducted a survey of 200 coating companies that referenced some 49 coatings in total.[1]

The survey results were intriguing and partially summarized elsewhere.[2] "Epoxies accounted for about half the overcoating systems used. According to the survey, four dominant mechanisms gave good overcoating performance. They were, in order of descending importance: a) tenacious adhesion, b) good ability to wet and/or penetrate the surface, and c) benign influence on the existing coating, including compatibility and imparting minimal stresses from solvent lifting or cure, and d) barrier properties for corrosion protection. Other, less-cited overcoating attributes of coating materials in the survey included flexibility, moisture tolerance, rust tolerance, and rust inhibition."[2]

Today, however, the authors contend that it is an arguably different story because of a fundamental change of perspective. Viewing an overcoating project first and foremost from the standpoint of corrosion resistance of structure critical connections, bearings, and anchor bolts—and then and only then the coating of adjacent flat surfaces on the structure—a revisionist picture emerges of the most desirable overcoating system (Table 1).

Table 1: Characteristics that Assist with Optimum Functioning of an Overcoat System [2]

• Wide compatibility with generically different coatings (especially alkyds)
• Good performance over hand, power tool, and water-jetted surfaces
• Proven long-term flexibility and active chemistry
• Proven long term success in structural connections
• Significant penetration into voids and surface imperfections of the old coating
• Delivery of rust inhibitors into structure critical connections
• Mitigate corrosion frozen bearings
• Penetrant material has sufficiently high pH to neutralize acidity in pack rust
• High degree of wetting, adhesion, and capillary action (low viscosity- notably in crevices)
• High volume solids and, preferably, 100% solids (solvent free) – no lifting of old coating edges
• Good barrier properties
• Penetrant sealer, unpigmented: zero or low shrinkage during cure
• Penetrant sealer remains wet for a prolonged period prior to cure
• Moisture-tolerant and able to displace or react with water; carefully balanced rate of cure
• Flexibility
• Low-temperature cure
• Optimal application (brush, roller and spray) and flow characteristics
• Minimal stress at the substrate-coating interface
• Resistance to hygrothermal stress
• Capability of rust consolidation: rust inhibition
• Low dft
• Ultraviolet resistance
• Applicator and environmental friendliness

$$(R\text{-}Ar - SO_3)_2\ M\ .\ x\ (MA)$$

R = alkyl side chains 12 to 20 carbons
M = Ca^{2+} or Mg^{2+} or Ba^{2+}
A = CO_3^{2-}
x = 10 to 20

Fig. 2: Generalized formula of HRCSA coatings[10]

In many applications, overcoat systems should be low-viscosity and high-wetting systems able to remain flexible, give long-term corrosion mitigation in crevice corroded joints, mitigate corrosion frozen bearings, and provide the normal expectation that they will remain tightly adhered to aged coatings. Hare has also stressed the importance of low-viscosity and high-wetting properties of overcoating systems.[3]

Fig. 3: Deterioration of the original lead-based alkyd paint system

A New Overcoating Paradigm

A new overcoating paradigm is offered here, one in which corrosion control considerations are more prominent than decisions involving coating film attributes per se. This paradigm is especially relevant given the unfortunate spectre of failed bridges, in which the public focus has been turned to structure critical connections. What is the present front-runner in the contest for best overcoating of flat surfaces and for best dealing with severe corrosion in joints and connections?

The answer is HRCSA coatings. To the layman, HRCSA sounds "out there." In reality, its claim to fame is that the technology is "in there." In there—quite literally. How so? Look at an old bridge. The careful eye is drawn invariably to steel plate bent out of shape in a few places (from pressure exerted by pack rust formation) and to the tell tale rust stains and streaks emanating from hundreds of crevice corroded joints where little or no anticorrosive protection is "inside." The observation leads you to wonder just how badly the bridge is compromised and what possible safety ramifications result from substantially weakened structural connections.[4]

Of course, not only bridges have such weighty issues. For instance, the critical zones of ships, cranes, and all manner of hydroelectric infrastructure present engineers and coating professionals with similar challenges and thus highlight the need to evaluate the performance variability of different coating systems.

From a corrosion engineer's vantage point of an overcoating project, an active rather than a passive coating is wanted "in there" in an inaccessible connection, where a well-chosen coating remains indefinitely active, inhibits, and stultifies corrosion, hence preventing pack rust formation (Table 2). The secondary consideration for overcoating selection is a long-lasting and well-adhered anticorrosive overcoat finish compatible with pre-existing coatings on the flat surfaces. Clearly, the dynamics of what transpires in a crevice-corroded joint, as typified by back-to-back plates and rivets, is of critical concern.

Addressing the microenvironment associated with crevice corrosion is therefore of paramount importance.[6] The authors anticipate that this contention will be borne out as new legislation is enacted to deal with deteriorating infrastructure.[7]

Table 2: Viscosity, Inhibition and Flexibility[5]

Generic Coating Type Examples Used	Viscosity in Secs in a Ford #4 Cup	Inhibitor Package and Flexible
Epoxy penetrant	13	no
HRCSA	22	YES
Moisture Cured Urethane	63	no
Epoxy HB thinned	45	no
Methyl Methacrylate	8	no
Water	7	n/a

Fig. 4: Surface preparation—pressure washing at 5,000 psi

There is a particularly helpful caveat emptor question for each specification authority to ask before signing off on an overcoating system. "Are we about to use a coating system that we know from a chemical standpoint cannot work satisfactorily or give long-term performance in corroded joints and connections?"

The HRCSA system used for overcoating is elegantly simple, consisting of a wet-on-wet approach of an easy-to-apply, single-component material. First, care must be taken to remove soluble salts and water from properly cleaned complex geometries such as joints and connections.

Second, a low viscosity and high lubricity, surface-tolerant HRCSA penetrant is applied to those joints and connec-

Fig. 5: View of pressure-washed surface and containment system beneath the penstock

tions. Third, HRCSA finishes are applied to the properly prepared, aged, lead-based alkyd paint on the overall structure.[8]

Overcoating Penstocks at Hydroelectric Facilities

Enter the realm of hydroelectric facilities, where miles and miles of aboveground penstocks painted with gradually deteriorating lead-based paint, or bituminous coatings, abound in British Columbia, Canada. Some penstocks are in remote locations, on steep mountain slopes, and in regions that experience huge temperature variations in both summer and winter and can inflict pronounced hygrothermal stress on a protective coating system.

Overcoating can extend the service life of a penstock while avoiding the costs associated with abrasive blasting and full coating removal. In addition to considering initial and life cycle costs of the coating system to be applied, another critical maintenance issue is worker safety during surface preparation and coating application. In this regard, coatings that are easy to use, environmentally friendly, and save 30–50% on surface preparation costs are very attractive.

Fig. 6: Holding tanks for used water and paint chips

One of many penstocks considered for overcoating is located at Bridge River in British Columbia, Canada. Given the expense of abrasive blasting and full containment of lead-based paint, overcoat system selection became an issue. The overcoating system would need to address the flat surfaces and structure critical connections and to afford a potential 25-year service life.

The Bridge River penstock was approximately 10 ft in diameter and supported on concrete saddles. To accommodate the large amount of expansion and contraction caused by the dramatic temperature variations and the high flow of water in the penstock, asbestos pads impregnated with graphite were used as a buffer between the concrete pads and the steel penstock itself, thereby allowing movement of the steel structure.

A significant head start to the project was gained because the utility owner had been proactive, conducting accelerated in-house laboratory testing of coating systems applied over a variety of aged coatings and abrasive blasted steel. The owner had also field tested an assortment of maintenance coatings and identified the promising ones, including calcium sulfonate alkyds, epoxies, and urethanes.

Significantly, the utility had a well-deserved and first-rate reputation for coating success due to rigorous coating inspection by the in-house coating inspectors. In addition, the utility owners were aware of the good long-term performance of a particular HRCSA that had ranked either in the top decile, or #1, in several independent laboratory tests undertaken by its own laboratories.[9] The same coating also had a known history of success in Canada, either on large-scale overcoating projects or refurbishment projects in which abrasive blasting had been followed by a single-coat application of the HRCSA coating.

Critically, the same HRCSA had performed well for the utility itself, both on its own bridge overcoating project (lead-based paint substrate; overcoat applied two years before) and several earlier

Fig. 7: Truck-mounted filtration units for the supernate from the holding tanks

penstock overcoating projects (coal tar and bituminous coating substrates; overcoats applied almost ten years before). Therefore, armed with good laboratory results, results from a proven track record evaluation, and an innovative five-year "no-exclusions" warranty from the manufacturer for properly prepared and coated crevice corroded joints, the utility owner chose an HRCSA coating system. On the plus side, the ease of use of the single-component material lent itself well to application by the utility's experienced in-house coating crew. But interesting on-site challenges lay ahead.

High Ratio Calcium Sulfonate Alkyd Technology

HRCSA coatings are easy-to-use, single-component coatings that cure by air oxidation, much like regular alkyd paint. However, unlike typical alkyds, HRCSAs and calcium sulfonate alkyds in general are not hard film formers. Rather, HRCSAs are softer films that remain both active and flexible while they continuously release their corrosion inhibitors at the coating/metal interface. In this way, HRCSAs possess both barrier properties against the ingress of corrosive materials and corrosion inhibitive properties.

While the coatings industry is more familiar with other generic types of coatings such as alkyds, latexes, zincs, epoxies, urethanes (2-pack, polyaspartic and moisture-cured) the HRCSA coatings are a rather interesting and somewhat lesser known coatings type. Although HRCSAs have the word "alkyd" in their description, chemically, they are actually much different than alkyds.

As shown in Fig. 2 on p. 19, the essential formula of an HRCSA coating is $(R\text{-}Ar\text{-}SO_3)_2\text{—}M.x\ (MA)$, and the chemistry helps explain the efficacy of the coating type. The coating is made up of a non-polar alkylate (the R group with alkyl side chains containing 12 to 20 carbon atoms); a complex of calcium (M) sulfonate (SO_3) and basic calcium (M) carbonate (A); one or more alkyds with which the sulfonate copolymerizes; drying oils; and an array of additives and anticorrosive pigments. The benzene ring (Ar) attached to the acidic sulfonate group gives the coating considerable polarity and ability to wet out surfaces. The carbonate is basic and inhibits corrosion. Platelets of the complex sulfonate-

Table 3: HRCSA Coating Performance

Anodic Inhibition
Passivation – High pH
O_2 Seavenging Oil
Water Displacement
A High Ratio Sulfonate
Active not Passive
Flexible – Minimizes Stress on Aged Coating

carbonate crystals present a more tortuous path for the ingress of corrosive materials and also confer extra film strength (Fig. 8).[10, 11] How's that for beauty and simplicity in action!

As with any formulation, the nature of the ingredients and how they are assembled determines the level of in-service performance. On the one hand, the presence of calcium carbonate as hexagonal plate-like calcite crystals in an artificially grown sulfonate-carbonate lattice gives the HRCSA coating substantially better performance than a sulfonate-low cost amorphous calcium carbonate admixture in a non-HRCSA. On the other hand, the selection of the non-polar alkylate is extremely important to the performance of the final coating.

What does the designation "high ratio" mean? It refers to the formulation having a high percentage of active sulfonate balanced with the right amount and type of artificially grown basic calcium carbonate. The ratio of active sulfonate to the Total Base Number basic carbonate (total base number TBN) is very important. For optimum performance, the ratio should be between 90 and 105 TBN (Total Base Number) and a minimum 9.5 to 11% active sulfonate. Calcium sulfonate alkyd coatings with lower active sulfonate percentages (3–5%) , or high TBN numbers (200–300) are markedly lower in performance characteristics.[12]

Engineered correctly, the result is a

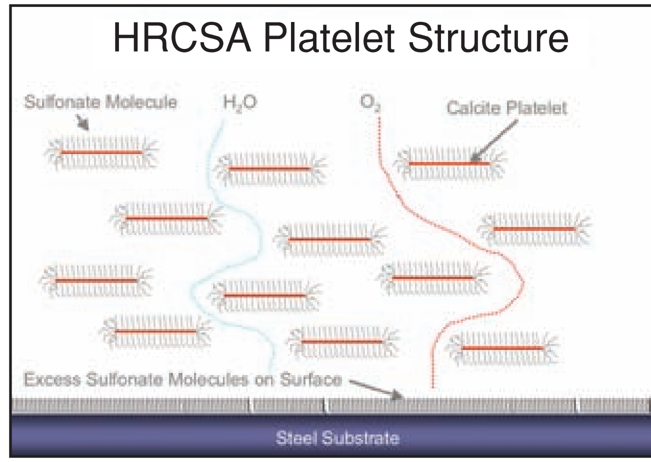


Fig. 8: HRCSA platelet structure

Fig. 9: View of lead-based alkyd primer after pressure washing

very flexible coating that possesses an active chemistry for the control of corrosion, especially crevice corrosion, where differential oxygen concentration cells exist. Importantly, the HRCSA coatings exert minimal shrinkage stress, a beneficial attribute because cold weather can impart substantial hygrothermal stresses to overcoat systems, and, in turn, the deleterious stresses can then be imparted to underlying coatings.

The lower tensile strength of HRCSA coatings is highly advantageous. For instance, even at −10 C (+14 F), the HRCSA used in this work has an adhesion value of 100–300 psi and does not disbond in overcoat scenarios, whereas high-build epoxies with tensile strengths close to 1,000 psi might disbond under similar conditions. Similar to certain high-quality penetrating sealer epoxies used for overcoating purposes, HRCSA coatings have the added ability to displace moisture.

The environmental and cost advantages associated with HRCSA coatings make them rather attractive. For example, from a toxicity standpoint, the *higher* the LC50-96h of a coating (i.e., the lethal concentration to kill 50% fish in a 96 hour duration), the *less* toxic is the coating. While many zinc coatings have an LC50-96h of approximately 10 ppm, and many epoxies have values of about 300–600 ppm, the HRCSA used in the project described below had an LC50-96h of approximately 42,000 ppm.

As useful as HRCSA technology is, the disadvantages of all coating types must be taken into account when selecting a coating for a given project. The most obvious disadvantage that may be important is the initially soft nature of the coating film and its early susceptibility to high dirt retention during the early stages of cure (during the first few days after application). The fact that the coating is softer than two-part polyurethane and epoxy overcoat systems also means that it is more prone to mechanical damage. Furthermore, while HRCSA coatings can be produced in any color, like epoxies, they do not possess high gloss. Unlike epoxies, but similar to urethanes, however, HRCSAs do not chalk or fade and provide good color stability.

Bridge River Penstock Project

The application of the HRCSA coating system was carried out between the months of June and early October 2008 while the temperature range and humid-

Fig. 10: Stripe coating with finish coat of HRCSA

Fig. 11: Full coat of HRCSA adjacent to Dresser coupling

ity varied considerably. Each "can" of the penstock was prepared with low-pressure water cleaning at 3,500 to 5,000 psi (24 to 34 MPa). Figure 1 on p. 18 shows the penstock on the concrete saddles and Fig. 3 on p. 20 shows typical areas where considerable coating degradation was found. Each can of the penstock sat on saddles, and the crevice corroded joints and connections were cleaned at around 5,000 psi using a zero degree rotating tip (turbo nozzle) at a maximum of a four-inch standoff distance (Figs. 4 and 5, pp. 20 and 22).

The joints between gaps and between the metal and concrete at the saddles were carefully cleaned to ensure total removal of contaminants such as moss, loose paint, loose rust, and soluble salts. In this way, an SSPC-SP 12 WJ4 standard was achieved, and moss, loose paint, and loose rust were removed. Areas of accessible corrosion were power tool cleaned to bare metal (SSPC-SP 11), and in those areas, edges of intact paint were feathered back to provide smooth transitions. Edges of intact paint also were feathered where the existing coating had been challenged by the 5,000 psi water washing process used to remove areas of poorly adhered original finish from the underlying lead-based primer.

A geotextile was used throughout the surface preparation, and the lead-contaminated water and removed coatings were collected and disposed of. The water from the pressure washing operation first went into large settling containers (around 500 U.S. gallons) in which the particulates settled out and were subsequently disposed of (Fig. 6, p. 22). The supernate (i.e., the clean liquid on top of the settled particulates) was

Fig. 12: Spray application of HRCSA finish coat

pumped out and passed through an activated carbon filtration unit; the clean water was then released back into the environment (Fig. 7, p. 23). According to the U.S. Environmental Protection Agency's (EPA) Toxicity Characteristic Leaching Procedure, if >5 ppm leachable lead is found in the waste material tested, then the latter must be treated and disposed of in accordance with EPA requirements under U.S. Code of Federal Regulations (CFR) Title 40, Parts 261, 262 and 263. This was carried out in this project.

Only the lower portions of the penstock displayed poor bonding between the pre-existing finish and primer, whereas the upper portions exhibited a tightly adhered original finish, one that could not be removed with a dull putty knife. The marked contrast between coating adhesion in the upper and lower penstock was thought to be caused by the moisture that formed on the lower portions and remained there throughout the year. The bare areas were then primed with the HRCSA self-priming finish.

Interestingly, the greatest degradation of the old coating system was not on the exposed side—the side most subjected to sunlight and possible photodegradation—but on the side subject to lower light intensity, where the aged coating system experienced the longest "wet time." In fact, the coating degradation was evidenced mainly around the spring line (mid point)—areas of high algae growth, wind flow, and dirt accumulation. Figure 9 on p. 25 shows the greater level of exposed lead-based alkyd paint in this region after the pressure washing was complete.

Prepared surfaces were then tested for soluble salts; the upper limit for chlorides had been set at 10 $\mu g/cm^2$. Surfaces were not coated with the HRCSA coating system until they had chloride levels below 10 $\mu g/cm^2$.

The HRCSA coating was considered to be a "one-coat" system—but with multiple steps and two materials: the HRCSA penetrant sealer and the HRCSA self-priming finish coat. At the ends of the penstock cans, where they exited the concrete housing, each painting step was completed one after the other, wet on wet, with no waiting time

Fig. 13: Overview of coating work in progress

between application of the materials. The first step was to spot prime with the self-priming finish any bare, rusted, and residual lead-based paint (Fig. 10, p. 25). The second step was the immediate application of the self-priming finish coat as shown adjacent to a Dresser coupling in Fig. 11 on p. 26.

In the early phase of the work, the HRCSA penetrant was applied liberally to all joints and connections, including the areas around bolts, nuts, and rivets where gaps existed. In the case of the saddles, copious amounts of penetrant sealer were sprayed into the inaccessible areas to displace any trapped water not purged by the compressed air and to consolidate any rust residues. Excess penetrant was then brushed out. In later work, a flexible polysulfide caulk was selected for these areas.

Although the joints and connections appeared dry at the concrete saddles, they were blown dry with clean, dry, oil-free, high-pressure (100 psi) compressed air. In this overcoat project, as with any other, it was crucial that the coating film thicknesses were within the ranges specified (in this instance, one coat at approximately 7 mils dft). Intercoat contamination was not allowed to occur, and recoat intervals were within the HRCSA manufacturers' acceptable limit. As soon as the HRCSA penetrant had been used for crevices, stripe "caulk coats" of the self-priming HRCSA finish coat were applied at a minimum wet film thickness of 14–18 mils to the same crevices. Then an overall prime coat was applied to all prepared areas where the steel was bare or where residual lead-based paint was visible. The aim was to increase the minimum dft to 10 mils.

Finally, a full coat of the HRCSA self-priming finish was applied to all surfaces to give a dft of 7–8 mils. This was effectively completed in one constant application, wet on wet. All that was required of the spray equipment operator was to apply the self-priming finish in stages, i.e., to apply a stripe/caulk coat, the prime coat, and then the final finish (Fig. 12, p. 27).

Thus, although it may seem that an HRCSA system stretches the meaning of the term "one-coat system," it *is* actually a three-step, wet-on-wet, single-coat process: the first step is to penetrate the connections, the second step is to caulk the joint and spot prime the bare metal, and the third step is all wet-on-wet to overcoat everything. There is no need to come back later after a drying period for second and third coats.

Areas where the existing finish remained were overcoated with one coat of the HRCSA finish as shown in Fig. 13 on p. 27. The spray application of the green-colored, single-component HRCSA

Fig. 14: Containment enclosure to keep drums of HRCSA cool

Fig. 15: Inside containment enclosure

finish proceeded well, except for one period of time when the ambient temperature was in the 90–100 F range and the HRCSA finish temporarily exhibited poor flow-out (i.e., uneven sheen). A combination of high coatings temperature, high ambient temperature, and high substrate temperature meant that the solvent required for even wetting was flashing before it had reached the substrate. As expected, the simple remedial action was to cool the drums of HRCSA finish before spray application (Figs. 14 and 15). The paint crew effectively created an air conditioned enclosure on the back of the truck used that day or the airless pump and drums used that day.

Conclusions

The primary determinant of success in most overcoating applications is associated with the judicious selection of the coating for structure critical connections.

HRCSA coatings possess the best attributes for successful overcoating projects.

For cost, safety, and environmental reasons, HRCSA coatings are routinely used for overcoating lead-based paint on bridges. This article illustrates their usefulness when applied to hydroelectric facilities such as penstocks, dam gates, gate housings, miscellaneous dam structures, and substations.

HRCSA penetrant sealers and HRCSA finishes were applied as a wet-on-wet, one-coat, multi-step system to a hydroelectric penstock previously coated with lead-based paint.

The life expectancy for the HRCSA overcoating system is approximately 25 years when the surface preparation is an SSPC-SP 12 WJ4 carried out with third-party independent inspection.

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JPCL

Tips for Maintenance Coating Work on Offshore Oil and Gas Rigs

By Michael Babiarz, Line-X Protective Coatings

"All accidents can be prevented, and the goal is zero injuries."

Most oil and gas companies in the North Sea are working from the premise above because on July 6, 1988, on the oil rig Piper Alpha in the North Sea, a gas leak was accidentally ignited, leading to a big explosion, which in turn was followed by an intense fire. The platform slipped into the sea 22 minutes later, and 167 men died.

The accident was instrumental in creating safety regulations for offshore installations. A top lawyer, Lord Cullen, was given the unenviable task of answering the tough questions of how and why the disaster happened. He needed almost two years to complete his investigation, which was submitted in December 1990 and published as the "Lord Cullen Report from 1990." The Report came with suggestions and regulations to improve safety and health on offshore platforms, and much of the work of developing safety regulations has been based on Lord Cullen's investigation. In fact, the conclusions in the Report have resulted in most oil operating companies examining and altering their safety systems and have led to the biggest block of safety reforms in the North Sea oil industry. The Report made a great impact on how jobs are carried out so contractors can enjoy a safe workplace. Learning from the experiences in the North Sea, oil and gas companies elsewhere are following similar safety reforms.

The present article gives tips on planning for safe, effective maintenance coating work on offshore oil and gas rigs.

Fig. 1: Offshore platforms are in remote locations and must have supplies shipped in. © BP p.l.c.

Plan, Plan, Plan, and Then Plan

Proper planning for any project is critical, but offshore projects create special planning needs. Due to the remote location of rigs (Fig. 1), all items must be ordered in advance and sent to the shipping base before they are ferried out to the rig (Fig. 2). Proper planning will affect safety, equipment, personnel, shipping, and more.

Fig. 2: Order all maintenance equipment and materials in advance and send them to the shipping base. Courtesy of the author

Planning for Safety First

To be able to properly perform an offshore application, project planners must carefully review and evaluate all safety aspects of an upcoming oil rig maintenance job. Safety meetings should be held before all jobs. All personnel involved in the affected areas will need to know about key issues, including the following.

- Escape routes are crucial. You must plan your work and placement of equipment so that you don't block an escape route.
- Be aware of any other changes to the work area that will be caused by the work performed, and make sure no changes will interfere with worker safety.
- All materials to be used need to be reviewed—MSDS, handling, instructions, etc.
- Learn what training will be provided by the company that owns the rig and plan to take advantage of it.
- Find out if there are any safety concerns specific to the platform for which the work is planned.

As seen in the Piper Alpha tragedy, explosive areas require special attention. ATEX is an acronym derived from the French "Atmospheres Explosibles." ATEX section 137 is the directive for workplace safety. The main concern in the ATEX directive is "hot zones." Employers must classify into "zones" all areas where hazardous explosive atmospheres may be found. The classification given to a particular zone, including its size and location, depends on the likelihood of an explosive atmosphere occurring and its persistence if it does.

Any equipment used in a hot zone must be ATEX rated. The most common types of equipment that fall under this category are angle grinders, abrasive blasting equipment, and welding equipment. In simple terms, ATEX-rated equipment is manufactured so it does

Continued

not create any sparking that could ignite a flammable source.

Once you have the whole picture of safety and health issues relevant to working on the project, determine what safety equipment and PPE are needed for the site.

Planning for Surface Preparation and Application

Due to the limitations of the work environment, different steps may be needed to achieve customary surface preparation. In addition to its sparking risks, abrasive is very heavy and needs to be shipped, recovered, and shipped back to shore for disposal. Ultra-high-pressure (UHP) water jetting is often preferred because the process creates significantly less waste than abrasive blasting. UHP water jetting also reduces sparking risks on a project.

• Know the application properties of the material chosen. Are there application temperature limitations? Should you consider applying by roller or brush if possible? What are the cure times?

• Due to the demands of the service environment and weather conditions, consider thick-film coatings and linings, which are gaining acceptance in the offshore arena. Reasons include the quick curing time of VOC-free polyurethanes and polyureas, which minimizes downtime, and the ability to apply 125 mils or more, which provides longer lifecycles in severe service. For instance, laydown areas, helipads, tank linings, and walkways are now regular thick-film coating applications.

Don't forget to plan for the types of inclement weather possible and their effects on surface preparation and coating work. Wind and weather may create demands on proper application of coatings and linings. Wind can create overspray on problematic areas. Rain and snow can cause additional preparation work and scheduling delays.

Manpower and Transportation

While transporting personnel is relatively easy, getting equipment to the site is more challenging. Personnel will usually fly to the site by helicopter, arriving in hours. Shipping equipment must be planned differently than normal.

• Most equipment must be staged at a shipping location. Because most equipment will be shipped to the jobsite, a contractor must be prepared to be without that equipment for a much longer time. Make sure this does not affect other job schedules. Because shipping delays are common, plan an extended time to be without the equipment.

Fig. 3: Include extra parts and maintenance items for equipment in your planning to save time and money. Courtesy of the author

• Spare parts may be needed, and they may not be easy to get. It is very expensive to fly something to the jobsite. Plan for all occurrences with extra parts and maintenance items for equipment (Fig. 3). Make sure the equipment is in top-working condition before shipping.

• Plan on accounting for extra time for manpower. Know they will be occupied with safety training, weather delays, rework, waiting on permits, etc. It is best to include these time delays in your plans and quotations.

• Since the demands are strict, make sure you have your very best workers onsite (Fig. 4). They will need to be trusted to follow safety procedures properly, interact with rig management, and be able to recognize any application problems that may arise.

Fig. 4: Make sure you have your very best workers onsite. Courtesy of the author

Planning Doesn't End When the Job Begins

When the time comes for the actual work, here are a few rules to live by.

- Always pay attention to the weather report for the day.
- Check humidity throughout the process.
- Only begin work that you know can be completed by day's end.

A Final Word of Warning

In all of your planning and work, remember—rework on an offshore rig is *very* expensive.

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Radical Change:

The Past 25 Years in the Coatings Industry

By David Boyd,
Vulcan Painters, Inc.

As an industrial painting contractor, like contractors in other trades, I've seen and responded to numerous radical changes in my industry and in general business conditions during the past 25 years. It's been a roller coaster ride and continues to be, so much so that it's hard to have any perspective. But, at the invitation of *JPCL*, I've tried to describe the major changes I've seen and some of the impacts they've had.

GPS system: Courtesy of Nextar Inc.

Information Technology

Computers, cell phones, and other electronic devices have radically changed all our lives in the past 25 years. GPS (global positioning system software), for instance, now has the ability to draw a virtual wall around your project, area, or neighborhood, and can alert management when a worker drives outside the approved area.

General contractors have stopped "lending" plans and specifications to subcontractors and instead expect subs to do takeoffs and estimates online. Scanners and computers have completely done away with the old triangle, scales, and pencil. More payments are coming wired to your account with an e-mail advising you. BIM (Business Information Modelling) is just materializing.

Software and data programs have changed safety reporting, equipment maintenance, and even RFI (Radio Frequency Identification) tags to alert us when inventory gets low or equipment changes from one location to another. A whole book could be written about getting product information over the Internet rather than from the local salesperson, which is both a good and bad change.

Changes in Business Conditions

First, there is the fall of capitalism as we know it in the U.S. Who would have thought that in 2009, large banks and financial institutions would be bankrupt and small painting contractors would be looking for small community banks to insure the safety of their deposits? Who would have thought that insurance companies, bonding companies, and pension and benefit companies would be so shaky that we would be asking them for financial assurance to fulfill our fiduciary responsibility?

Who would have thought that our little firms needed to worry about pollution policies that are backed by AIG and whether AIG will leave us holding the bag? (Most pollution policies for lead jobs are multi-year and require payment in advance.)

All of us over 55 were probably wondering how all those "rich" couples could afford million dollar houses. "Both must be doctors" was the usual answer. Little did we know that people were buying without down payments, and that there were mortgages that required only interest payments. Now who knows how our children and grandchildren will be able to pay the trillions of dollars for loans that the government has borrowed in their names?

A second major change in business conditions is the movement of manufacturing from the U.S. to other countries. How many painting contractors depended upon the auto industry for large yearly painting programs? Hundreds of painters and thousands of gallons of paint were mobilized yearly for GM and Chrysler projects.

When I was calling on customers in the pulp and paper indus-


Early model laptop computer

try, we had a rule of thumb about the size of the business. A typical mill would spend over $150,000 per paper machine per year. Much of this business has gone offshore.

In fact, except for refineries, all of the large manufacturing jobs are going to non-U.S. firms. Even the Federal government's stimulus package can't enforce its "buy American" clauses.

Several years ago, I put my foot down. "We will buy no more computers that come with a "made in China" stamp." But I found out that no computers were actually assembled in the U.S. anymore, or if they were U.S.-made, their parts came from outside the U.S. Friends remind me this is why I can afford my laptop, notebook, and mini-Acer computer. But still, a little voice keeps whispering in my ear, "you don't paint any plants in China."

Changes to Labor Conditions

Finding qualified workers in the field has become very difficult in the past 25 years. In 1985, we would regularly bid new construction and maintenance work up to 1000 miles from our home office without having to question where we would get the workers for the project. Today, the question arises even 75 miles from home. We can debate the reasons this is so, but the problem has to be addressed on every project.

One reason is the decline of unions. Union membership has declined dramatically since 1985, and this has made a huge difference in the way all painting firms do business.

Additionally, niches have developed that bypass the normal union membership route of acquiring workers. In our area, these niches include paperhanging, sheetrock taping, floor stripping, reglazing of windows, and faux finishing. This work is now priced by the linear foot, square foot, piece, roll, etc., and the people who do this will work nights, weekends, and holidays at a regular rate of pay.

The Hispanic workforce has also created a dramatic change. Here is a group of people who came to America to work. They work hard and send money home to their families. They do not complain about working conditions, and they work safely and steadily. Their values are similar to the values you find in local churches in the South. One problem is communication—how to train them and how to understand their culture. Another problem is that our government needs to make clear, commonsense laws that businesses can follow in dealing with immigrant labor.

Proving Your Qualifications

Twenty-five years ago you could sell your painting services to an engineer and never worry that he might find out you had not done similar jobs before. Today, customers demand to see your SSPC QP or ISO 9000 series certifications. They want to know if your technicians have received certification from SSPC on the use of plural component pumps.

Certification goes on and on—OSHA 10, OSHA 30, scaffolding competent person, respirator fit testing, drug testing, criminal background reports, abrasive blasting certification, MSHA (Mine Safety & Health Administration) certifications, and our own internal training requirements. Our training catalog has over 100 normal training classes that individuals must try to complete.

New Cleaning and Coating Technologies

There have been innumerable changes to coatings formulations and types and to the equipment that contractors use. Here are a few that stand out.

Soft media (sponge) Blasting: Years ago I called a vendor and gave him a unique problem. How can I wash surfaces of steel 60 feet in the air, and do so without using a rag and detergent? The vendor told me he had learned about sponge blasting at a recent conference, invented by a guy named Bill Lynn. While this invention has still not reached its full potential, its ability to clean steel, concrete, glass, wood, and other substrates without an expen-


Plural-component spray application: Courtesy of Graco Inc.

sive containment structure will make it a "green" surface preparation method of choice in the future.

Plural-Component Pumps: Today, volatile organic compound (VOC) and hazardous air pollutants (HAPS) regulations have taken the solvents out of the coatings. Thank goodness! In my opinion, the smartest developments in our business involve heat curing and getting the viscosity correct on super high-performance coatings so that these catalyzed materials can be applied with plural-component pumps. Twenty-five years ago, we could buy an airless pump for $3500; today, plural-component rigs start at $10,000 and can go as high as $200,000 with trailers, special heated lines, spare parts, and other accessories.

Fluoropolymer Urethanes: And it will hold its color and gloss for how many years? 10...20...30? Twenty-five years ago, no painter would have believed this.

Epilogue

This past year, a local grammar school in my area asked a painting contractor to come out and blast clean a small entrance canopy. The firm loaded a six-bag pot, went and did the cleaning, and billed the school for $3500. It was then discovered that the steel canopy had been coated with lead-based paint, and the blast debris containing the lead got into the library and cafeteria as well as all over the school's grounds. After $90,000 worth of remediation and the closing of the school for 3 months, the project was finally completed. Has any industry changed as much as ours?

David R. Boyd is the president of Vulcan Painters, Inc., an ISO 9001-certified painting contracting business founded in 1952 that serves customers in the Southeast. The business specializes in industrial and commercial painting projects, blasting and coating structural steel and sewer pipe. Mr. Boyd is Co-Chair of the DC 77 Training Fund, serves on the board of directors of Paintsquare and Axxiom Manufacturing Co., and is a past chairman of the Industrial Painting Committee and past president of the PDCA Southeastern Council. In 2007 he was recognized by SSPC for his exceptional contributions to the coatings industry in education.

JPCL

JPCL Salutes 25 Years of Top Leaders and Thinkers

By Harold Hower, Technology Publishing/PaintSquare

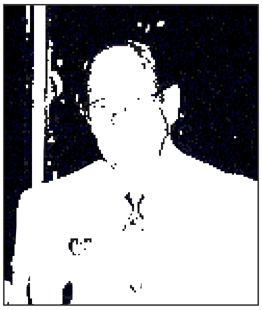
The protective and marine coatings industry has been blessed with many great leaders and thinkers during the past 25 years, coatings specialists who have contributed their talents not only to their own companies but also to the advancement of the entire industry.

The 25 coatings specialists named here, for instance, have contributed to the governance of SSPC, have served loyally on or chaired important technical committees, have written important books and papers, and have instigated significant changes in the industry. Some have done all these things; some have focused on one or two of these activities.

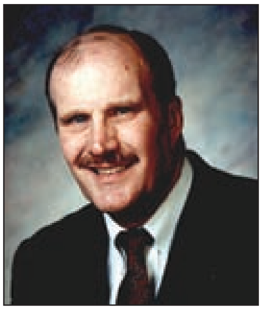
At the same time they were contributing to the industry, these professionals had great careers as business owners, engineers, consultants, company executives, facility owner painting program managers, and association executives.

Finally, all of these coating specialists have received honors from SSPC—Honorary Life Member, John D. Keane Award of Merit, Outstanding Publication Award, and others.

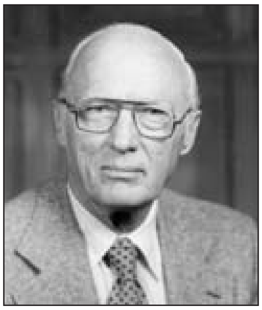
The top 25 coating specialists are named and, for the most part, pictured below; and in each case there is a description of the individual's highest SSPC honor, his main employer during his tenure, and a brief description of significant contributions. The order is from earliest to latest, in terms of when the person was honored by SSPC.



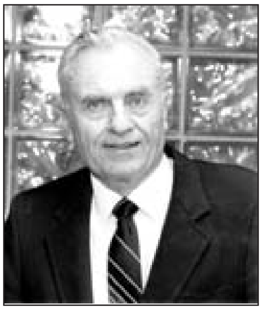
Arthur W. "Duke" Mallory (deceased)
Winner, 1984: John D. Keane Award of Merit
Employer: Wheelabrator Corporation
Significant Contributions: Participated in and led the SSPC Surface Preparation Committee; wrote for *JPCL* and SSPC, including the monograph, "Guidelines for Centrifugal Blast Cleaning" and the chapter, "Mechanical Surface Preparation" in *Good Painting Practice*



Kenneth B. Tator
Winner, 1985: John D. Keane Award of Merit
Employer: KTA-Tator, Inc. (owner)
Significant Contributions: Chairman of the SSPC Research Committee and numerous other SSPC and NACE committees; President of SSPC; Director of NACE; writer for *JPCL*, SSPC, NACE, and ASM



Charles G. Munger (deceased)
Winner, 1986: John D. Keane Award of Merit; Winner, 1994: SSPC Honorary Life Member
Employer: Ameron
Significant Contributions: President, Ameron; developer of zinc-rich coating technology; President of NACE; writer for *JPCL* and SSPC, author of the book *Corrosion Prevention by Organic Coatings*



Dr. Richard W. Drisko
Winner, 1987: John D. Keane Award of Merit; Winner, 1996: SSPC Honorary Life Member
Employer: Naval Civil Engineering Laboratory
Significant Contributions: Conducted research on coatings performance; writer and editor for *JPCL;* writer for SSPC and developer of SSPC training programs

Dr. A. H. Roebuck (deceased)

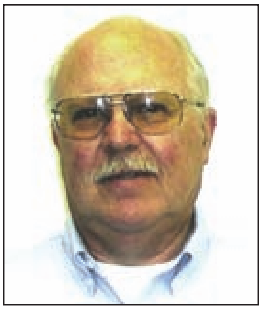
Winner, 1987: John D. Keane Award of Merit
Employer: Fluor Corporation
Significant Contributions: Writer and editor for *JPCL*; developer of methodology for and writer about computing coating costs (with Gordon Brevoort); technical committee participant on coatings for the power and petrochemical industries

Raymond J. Connor
Winner, 1988: John D. Keane Award of Merit
Employer: National Paint & Coatings Association
Significant Contributions: Represented coatings industry positions to regulatory bodies such as the EPA

Charles Peshek (deceased)
Winner, 1989: John D. Keane Award of Merit
Employer: American Institute of Steel Construction
Significant Contributions: President of SSPC, 1986-1989, the final multi-year tenure as President of SSPC by an AISC official

Kenneth A. Trimber
Winner, 1990: John D. Keane Award of Merit; 1990: Coating Specialist of the Decade; Winner, 1996: SSPC Coatings Education Award
Employer: KTA-Tator, Inc.
Significant Contributions: SSPC President; co-author, *Industrial Lead Paint Removal Handbook*; Chairman, SSPC Surface Preparation Committee; Chairman, ASTM Committee D 1 on Paints and Coatings

Thomas I. Aldinger



Winner, 1991: John D. Keane Award of Merit
Employer: Bechtel Corp.
Significant Contributions: SSPC Concrete Coatings Committee, founder and participant; Vice-Chair, ASTM Committee D 33; *JPCL* writer and Contributing Editor

John C. Hauck (deceased)
Winner, 1992: John D. Keane Award of Merit
Employer: Bayer MaterialScience
Significant Contributions: SSPC President; proposed, with Eric Kline, development of the SSPC's Painting Contractor Ceertification Program

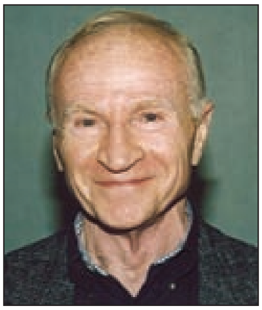
Dean M. Berger (deceased)

Winner, 1993: SSPC Honorary Life Member (the first)
Employer: Gilbert Commonwealth
Significant Contributions: Member of SSPC Board of Governors; Chair of SSPC technical committees on epoxies and on research; participant on ASTM Committees D 1 and D 33; NACE T-6 committee member; writer for *JPCL* and SSPC

Clive Hare
Winner, 1994: SSPC Technical Achievement Award; Winner, 2003: SSPC Outstanding Publication Award
Employer: Clive H. Hare, Inc. (owner)
Significant Contributions: Authored *JPCL*'s Anatomy of Paint and Trouble with Paint Series, later printed as collections in *Protective Coatings: Fundamentals of Chemistry and Composition* and *Paint Film Degradation: Mechanisms and Control*; foremost coatings formulation consultant in the U.S.

William C. Johnson (deceased)
Winner, 1995: SSPC Honorary Life Member
Employer: KTA-Tator, Inc.
Significant Contributions: Authored SSPC paint specifications; formulated coatings; conducted coatings research; wrote extensively about the effect of soluble salts on coatings performance in *JPCL* and other journals

Marcel Gaschké



Winner, 1995: John D. Keane Award of Merit
Employer: Ciba Geigy
Significant Contributions: Member of the SSPC Board of Governors; participant on SSPC coatings committees; introduced new resins to the coatings industry

John F. Montle
Winner, 1998: SSPC Honorary Life Member
Employer: Carboline Company
Significant Contributions: President of SSPC; active participant on NACE and SSPC technical committees; developed the first epoxy mastic coating

1984

E. Crone Knoy (deceased)
Winner, 2000: SSPC Honorary Life Member
Employer: Tank Industry Consultants (owner)
Significant Contributions: Engineering expertise in the water storage industry; SSPC Board of Governors Member, 1992-2000; SSPC Outstanding Educator Award in 1991; also active in NACE International, the American Water Works Association, and the Steel Plate Fabricators Association

Dr. Bernard R. Appleman
Winner, 2001: John D. Keane Award of Merit
Employer: SSPC (Executive Director)
Significant Contributions: Modernized SSPC membership structure, governance, and regulatory advocacy; led the industry during its response to lead paint removal problems

Michael J. Masciale
Winner, 2001: SSPC Honorary Life Member
Employer: Valspar Corporation
Significant Contributions: President of SSPC; member of the SSPC Board of Governors; Chair of ASTM Committee D33

William M. Medford
Winner, 2002: SSPC Honorary Life Member
Employer: North Carolina Department of Transportation
Significant Contributions: President of SSPC; Member of SSPC Board of Governors and SSPC technical committees; conducted extensive field research on bridge coatings' performance

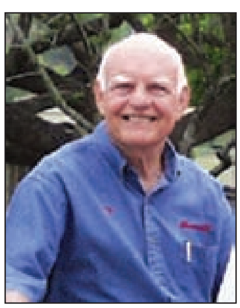
Eric Kline
Winner, 2003: John D. Keane Award of Merit; Winner, 2008: SSPC Honorary Life Member
Employer: KTA-Tator, Inc.
Significant Contributions: Instigated development (with John Hauck) of SSPC's Painting Contractor Certification Program; developed the Rapid Deployment method of bridge painting; conducted research on single-coat painting systems; chaired SSPC's program committee for the national conference

Charles H. Wyatt
Winner, 2003: SSPC Honorary Life Member
Employer: Wyatt Development Group (owner)
Significant Contributions: President, SSPC; member of the SSPC Board of Governors and numerous technical committees; instigator (with Jeff Theo and Richard Lavergne) of SSPC's national painter competitions held in the early 1990s

Robert Crawford
Winner, 2004: SSPC Honorary Life Member
Employer: International Paper
Significant Contributions: Developer and Chair of the Ark-La-Tex Chapter of SSPC

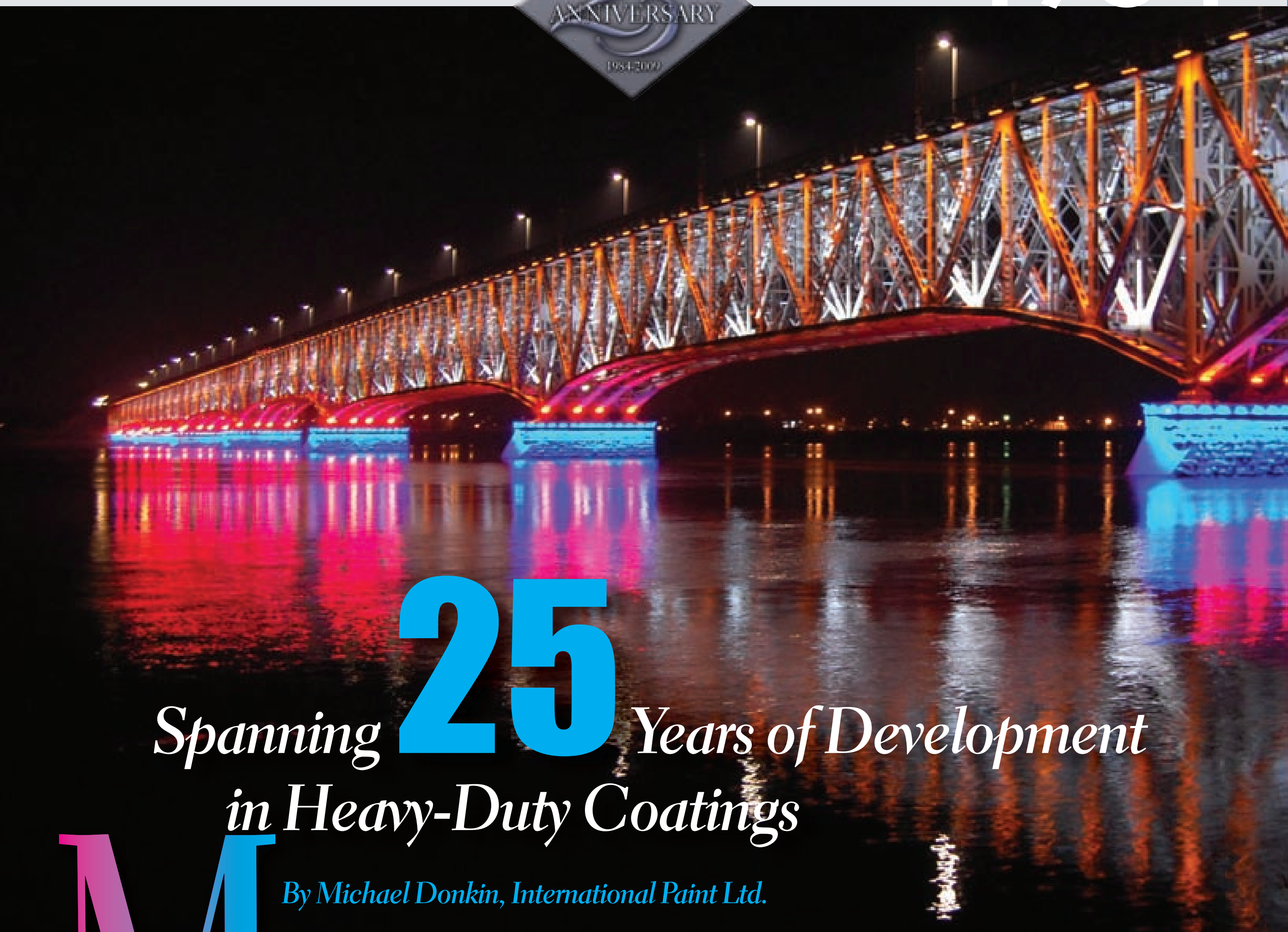
Ralph A. Trallo
Winner, 2004: John D. Keane Award of Merit
Employer: Cannon Sline
Significant Contributions: SSPC President and member of the Board of Governors; chaired the committee that developed the SSPC's Painting Contractor Certification Program; chaired the PCCP Advisory Committee

Jerrold "Jerry" Brock
Winner, 2007: SSPC Honorary Life Member
Employer: Brock Enterprises (owner)
Significant Contributions: Member of the SSPC Board of Governors, SSPC technical committees, and the Industrial Painting Committee (IPC); developed the largest painting contractor firm in the country



Mike O'Donoghue, Ph.D.
Winner, 2009: PACE 2009 President's Lecture Series (Co-author)
Employer: Devoe High Performance Coatings, International Paint LLC
Significant Contributions: Co-author and author of many technical papers and articles that advanced industry knowledge, including several articles winning SSPC Outstanding Paper and *JPCL* Editors' Awards

JPCL



Spanning 25 Years of Development in Heavy-Duty Coatings

By Michael Donkin, International Paint Ltd.

Massive changes have occurred in coating formulation for the heavy-duty market in the past 25 years. This article aims to explain the reasons for the changes and the results of them.

In the marine and protective coatings market, there have been two key drivers for change:

- increasing levels of legislation and regulation to protect the environment from air pollution by reducing volatile organic compound (VOC) emissions from coatings, and to remove from coatings any raw materials that may pose risks to worker health and safety and the environment (HSE); and
- higher customer expectations for coating performance and the need to increase the lifetime of the assets being coated.

Conforming to these drivers has led to advances in existing technologies and the introduction of new technologies such as polysiloxanes. Testing methodology for coating performance has also changed significantly over the past 25 years. For instance, the industry has moved from the use of constant hot salt spray to more meaningful cyclic tests that have much better correlation with real life conditions. Changes in testing have improved the ability to benchmark and accurately assess a product's performance in the field.

The Influence of Regulations on Product Development

In the mid-1980s, most coatings in the heavy-duty market were single-component products, with alkyds, vinyls, and chlorinated rubbers dominating. The main drawback of the thermoplastic coatings was their very high VOC levels, which meant that they were never going to be sustainable when VOC regulations started to be introduced. Also in the 1980s, formulators were starting to

Michael Donkin is the senior technology manager for International Paint Ltd. in the UK.

All photos courtesy of International Paint Ltd.

understand how two-pack products (for example, epoxies and polyurethanes) could be exploited and the potential improvements in performance they could offer. By the mid-1990s, two-component materials started to dominate the market purely on performance—at that time, VOC legislation was in only the early stages of development.

The major challenge to the coatings industry and particularly the formulating chemist has been to continue to improve and, at times, maintain the performance of the two-pack coatings, while reducing the level of VOCs—not an easy task.

Increasing the volume solids of most coatings leads to a range of problems, including slower drying with softer films, higher viscosity, and application challenges. Problems arise especially with finish coats where low dry film thickness (dft) is required but at decreasing wet film thicknesses (wft). In effect, the wft range decreases as the solids increase. For example, a polyurethane finish at 50% solids requires a closed film at a wft of 100 microns to obtain a dft of 50 microns (2 mils), which by spray is relatively easy to achieve. However, at 80% solids, the same 50-micron dft will require a 62.5-micron (2.5-mil) wft, which is considerably more difficult to achieve due to the reduction in solvent. Achieving desired dfts with higher solids coatings remains one of the key challenges for today's formulators.

A Brief History of VOC Regulations

- 1980s: There were very few VOC regulations. Some California air quality management districts in the U.S. began to introduce architectural and industrial maintenance (AIM) coatings rules. Because California has a climate that supports the build-up of low level ozone and smog from the state's many cars, industries, coatings, and other products, districts in California took actions to control the build-up of ozone precursors such as VOCs. [*Editor's note: See "Regulations and Coatings Work: Key Developments over 25 Years," pp. 72–77.*] In Europe, some countries had VOC rules that limited the VOC content of certain paint products, but the limits were high and certainly not restrictive.
- 1990s: In the U.S., the 1990 revision of the Clean Air Act (CAA) resulted in national VOC rules, one of which was a national rule for AIM protective coatings. As the 1990s progressed, revision of the VOC limits in the already established California districts' rules began.
- 2000 to the present: In 2006, California's South Coast Air Quality District set the strictest limit yet for industrial maintenance coatings—100 g/L.

In October 2005, the first restrictions of the European Union's (EU) solvent emissions directive (SED) began to apply, although the SED had been issued back in 1999 in the newly formed EU.

Since 2007, many other countries such as South Korea, Hong Kong, and Taiwan have started to develop their own VOC rules and regulations.

The Choice of Raw Materials

The second key driver for change has been the number of raw materials that have come under scrutiny due to HSE concerns. Typical examples include

- lead pigments,
- coal tars,
- chromate pigments,
- pthalate plasticizers from acrylic emulsions, and
- sensitizing epoxies.

Thankfully for the formulator, as any coatings publication shows, there is a constant stream of new products from the coatings industry. Some are replacements for current materials, and others are totally new technologies offering brand new solutions. The challenge to the formulator is to replace potentially toxic or hazardous raw materials while either matching or indeed improving the performance of the new or reformulated coating. The formulators' work is never done.

High Solids (>80% by Volume)

The biggest shift in the heavy-duty coatings industry was to fully explore epoxy amine chemistry. Twenty-five years ago, many epoxy amine products were on the market, but chemists were just starting to find out how to better exploit this technology with, for example, new curing agents. When formulators realized that the performance obtained from epoxies was significantly better than that of the majority of single-pack analogues, the 80s saw a rush of formulations to market. Anti-corrosive primers, high-build epoxy barrier coatings, and chemical-resistant finishes and tank linings were among the new formulations, and all demonstrated

Direct-to metal polyaspartics can be formulated below 250 g/L and can give corrosion resistance in C3 environments similar to that of a combination of epoxy and polyurethane.

improved mechanical properties and corrosion resistance compared to single-component products. By the end of the 1990s in the heavy-duty market, the majority of single-pack products had been replaced by two-component coatings.

Epoxies have provided the bulk of the high-solids coatings. One key advance has been the move to faster curing systems. The lower solids products were mainly formulated with solid epoxy resins and had the added advantage of lacquer drying. As solids levels in coatings increased, it became more difficult to formulate with solid resins because of the higher application viscosities, so liquid resins, which have lower viscosities, had to be used. Liquid resins present their own problems, with reduced flexibility being one of the most important. Thermal cycling of epoxies to determine resistance to cracking, particularly at higher than standard dfts, has become a key test for the formulator.

The introduction of new amine technologies has also seen big changes for the industry, and formulating chemists have been quick to exploit them. The use of phenalkamines has significantly improved the cure speed and dry times of high-solids epoxies and allowed them to be used down to 0 C (32 F) in many situations. Phenalkamine technology was a massive improvement over traditional polyamide curing agents and was used to speed production in new construction and in shipbuilding in emerging areas such as Korea.

The push for lower VOC finishes has continued, with polyurethanes being formulated below 420 g/L. New technologies that contain no free isocyanate emerged with new curing mechanisms. Acid epoxy systems have been formulated below 340 g/L. Higher solids polyurethanes can be formulated in the U.S. with the use of VOC-exempt solvents, but, in general, it has proved difficult to cost effectively reduce the VOC of polyurethanes to 250 g/L and below.

A recently developed technology that offers a route to coatings that are above 80% solids is polyurea chemistry. One specific type of the chemistry is polyaspartic. Polyaspartics are based on the reaction of an aliphatic polyisocyanate and a polyaspartic ester, which is a sterically hindered aliphatic diamine. The major advantages of this technology are that it can be formulated to be applied as a direct-to-metal (dtm) coating and that it offers fast cure, corrosion resistance, and durability in a single coat.

In an effort to reduce VOC levels and costs, there has been a move to use fewer coats in a specification. One way to reduce the number of coats is to use a coating that has both primer and finish properties, a primer/finish. This type of coating, which can be applied dtm, offers corrosion protection and aesthetics in a single formulation, often leading to the replacement of many two-coat systems in ISO 12944 (C3) environments of medium aggressiveness. Primer/finishes have been either epoxies, when toughness and resistance to mechanical damage are required, or polyurethanes, when better durability and color retention are needed.

In more aggressive environments, the move to reduce the number of coats must be taken with care, especially offshore, where the standard three-coat systems have occasionally been replaced with two coats. The problem with using two-coat systems in aggressive environments is that there is a lack of control of film thickness, and coatings on complex steel configurations can have many thin spots, leading to corrosion problems. Until the introduction of polyaspartics, no products have quite been able to provide good corrosion resistance and excellent aesthetics with gloss and color retention.

Research has shown that polyaspartics can be formulated

Replacing standard three-coat systems with two-coat systems in aggressive environments has been done occasionally, but such a move must be taken with great care.

below 250 g/L, which gives dtm corrosion resistance in C3 environments and properties similar to those of a combination of epoxy and polyurethane.

As the solids levels have increased, application equipment has also had to adapt over the years from standard airless spray to plural-component. Although at the time of this writing, the majority of high-solids coatings are still applied by airless spray, the use of plural-component spray is starting to rise and will become a more important application method over the next ten years.

Waterborne Coatings

One effective way to reduce VOCs is to use waterborne coatings. Twenty-five years ago, the main waterborne technologies available were largely limited to single-pack emulsions, which were not ideally suited to new construction situations, where fast drying, early hardness, and block resistance (so that items can be stacked on each other without distorting the coating) are key properties. Emulsions also had a low tolerance for film formation at low temperatures and adhered poorly to minimally or improperly prepared substrates. At first, the use of waterborne coatings was slow and restricted to customers with heated paint shops and good control of the substrate, such as in original equipment manufacturing (OEM). By the early 1990s, the number of waterborne technologies multiplied to include not only new single-pack materials but also a number of two-pack products, such as epoxies and polyurethanes. With an understanding of the key issues, such as minimum film forming temperature (MFFT) and tolerance to compromised substrates, formulators could more easily target the final product for an appropriate end use. The development of two-component epoxies with performance similar to their solvent-borne analogues is now a reality.

Solvent-borne zinc silicates can be formulated down to a VOC level of 340 g/L, but getting below that level has proved difficult because of stability issues with the binder. However, there is a waterborne solution, usually based on using metal alkali silicates such as potassium silicate, which can give zero-VOC coatings. The waterborne zinc silicates have the added advantage of excellent cure at low relative humidity (RH) compared to the solvent-borne analogues, which often have poor cure below 30% RH.

The technologies now available for waterborne coatings are constantly improving. Many two-component systems can now offer performance equivalent to, or better than, that of their solvent-borne counterparts. In the next 25 years, there is likely to be a more even split of waterborne versus high-solids in the heavy-duty market.

High-Performance Coatings

Zinc-rich primers are still among the top-performing heavy-duty coatings. The past 25 years have witnessed only the

One major advance in technology and one of the most exciting areas for the formulating chemist is the emergence of polysiloxanes.

change between zinc silicates and zinc epoxies, with each coating type dominating the other at different times. Zinc silicates offer outstanding corrosion protection but are more difficult to use because they must usually be tie coated to prevent pinholing in a high-build topcoat. These three-coat systems are still the preferred option for extreme environments, so there has been little change in the types of specifications.

The emergence of polysiloxanes is one major advance in technology and one of the most exciting areas for the formulating chemist. This technology marked the introduction of inorganic hybrid formulations based on blends of inorganic polysiloxane polymers and a compatible organic constituent. The glass-like quality of the polysiloxane confers excellent UV durability due to the bond strength of the Si-O compared to C-C bonds. Polysiloxane technology can offer both corrosion resistance (barrier protection) and better performance than the traditional polyurethanes. Careful formulation of the blend of resins could significantly alter the resulting properties. By the end of the 1990s, there were a few products utilizing this technology on the market. Many of them were patent protected, which is unusual in the heavy-duty market.

Moisture-cured, single-pack polysiloxanes have now been developed and are available. They are ideal for the maintenance and repair sectors. They have shown durability far exceeding all of the conventional single-component technologies and most two-pack technologies.

In certain markets, fluoropolymers are also used as highly durable finishes, although their use is not as widespread as the polysiloxanes, generally because of the fluoropolymers' high raw material costs and the requirement of isocyanates for curing. The typical solids of these materials is 40%, but newer developments are allowing up to 60%, and there are waterborne options.

New Product Test Methods

The drive toward higher product performance and longer coating lifetime to improve the durability of owners' assets has led to improvements in how new products are tested. The standard tests for an anti-corrosive primer developed 25 years ago consisted mainly of simple constant exposure tests such as hot salt spray (ISO 7253, ASTM B117), cold salt spray (BS 3900:F4, ambient temperature), condensation (ISO 6270), and exterior exposure in the type of environment for which the coating was intended. As coatings moved to higher solids and waterborne technologies, it has been necessary to introduce new test methods because the mode of failure in high-solids and waterbornes is often not the same as that in traditional lower solids products.

With any new technology comes the development of new tests that are able to reproduce, as accurately as possible, the failure modes observed in the field. For example, high-solids epoxies based on liquid epoxy resins are not as crack resistant as the conventional lower solids alternatives based on solid epoxy resins. There was a need to develop tests such as a thermal cyclic method with temperatures ranging from -20 C to +60 C (-4 F to +140 F) to evaluate coatings for cracking on welds, especially on high film thickness applications. This test method has shown great benefits in selecting formulations, especially in ballast coating development.

In the late 1990s, a set of corrosion standards known as the Norsok cycle was developed by the Norwegian petroleum industry. This new corrosion test attempted to mimic real life exposure for marine environments on offshore platforms, with salt spray, ultraviolet light (UV) exposure, freeze, thaw, and dry-out phases. The correlation with real time exposure

Sea Changes: 25 Years of Development in Marine Coatings

By Brian Goldie, JPCL

As in the protective coatings market, there have been changes in the marine coatings market over the past 25 years. Although there have been far fewer developments, the changes have been major and have had a significant effect on the market.

The changes have been in antifouling hull coatings technology and in coatings for dedicated seawater ballast tanks. The drivers have been environmental and safety concerns, respectively.

Twenty-five years ago, hull antifouling coatings were based on the use of toxic biocides, in particular, tin compounds. However, the harmful effects of tin-containing biocides on the marine ecosystem were recognized, and the recognition led to the International Maritime Organization's (IMO) regulation banning the use of tin compounds in antifoulings. Paint companies had to look to alternative antifouling technologies utilizing copper compounds and to technologies for low energy coatings, as foul release systems.

Also during the past 25 years, several vessels were lost at sea due to structural failure that was identified as being (partly) the result of corrosion in dedicated seawater ballast tanks. The best corrosion protection of the steelwork in seawater ballast tanks had been afforded by epoxy coal tar coatings, but for the most part, protection was rudimentary, and epoxy coal tars were not was found to be better than that of the 'old' salt spray tests, and the Norsok cycle readily became accepted as one of the cyclic corrosion standards. New cyclic tests such as ISO 20340 and ASTM D5894 (an onshore cyclic test) have changed the face of product testing and improved the selection of systems used.

It is interesting to note that the need to pass 'external' accelerated performance tests can now determine the path of product development. For example, a coating system that will withstand many years of exposure in a particular environment could be rejected because it does not 'qualify' with certain cyclic accelerated tests.

Test methods for waterborne coatings have been developed with many methods remaining 'in-house.' Often the old standard tests such as hot salt spray were not accurate predictors of service life. Single-component waterborne coatings generally perform quite badly in tests such as constant hot salt spray.

always used. Many seawater ballast tanks in vessels were protected with "soft" coatings, which gave very basic protection, and many in fact had no coatings at all.

The classification societies slowly began to accept that the use of good corrosion protection systems could help to prevent these losses at sea, and, as a first step, the document, "Guidelines for the Selection, Application and Maintenance of Corrosion Protection Systems of Dedicated Seawater Ballast Tanks," was adopted in 1995 under the Solas Convention (Safety of Life at Sea) as Regulation II-1/14-1. The regulation took effect in 1998. The main recommendations in II-1/14-1 were that only hard (fully cured) systems, such as epoxies, should be used; stripe coats should be applied to give extra protection at edges; and coatings should be light colored to aid inspection.

Increased efforts have since been taken to encourage better surface preparation and better application to improve performance and service life. These efforts culminated in 2008 in the introduction of the "IMO Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in all Types of Ships and Double-Side Skin Spaces at Bulk Carriers" (IMO PSPC). The IMO PSPC is a detailed regulation on the selection and application of coatings, including, for the first time, a mandate that experienced coating inspectors must be used to monitor all aspects of coating ballast tanks.

Conversely, there has been little change in the methodology used to determine the ‘durability’ of coatings. The standard durability tests of 25 years ago, such as accelerated UV weathering and exterior exposure, are still some of the key tests performed in product development. The only improvements have been the actual cabinets themselves, which are now capable of giving much more reproducible results. A test developed in the 1960s concentrated natural sunlight up to eight times the power of the sun with the use of mirrors that tracked the sun in the sky. This test can also be directly correlated with Florida external exposure, thus giving a ‘natural’ accelerated test for all coating types.

The Next 25 Years

What does the future hold? Where will we be in another 25 years? If current trends are to be believed, then zero VOCs will be the norm, whether the coatings are solvent-free (100% solids) or waterborne. For the formulator, the race is on to develop a range of coatings that will meet stringent VOC requirements, remain carbon neutral, and maintain or improve current levels of performance.

As natural resources diminish, there will be an increasingly important need to use environmentally sustainable raw materials. Already on the market are environmentally sustainable products based, for example, on castor oil and derivatives that could be used as polyols in high-performance finishes. Epoxies from natural plant sources are available.

‘Smart’ coatings will also make it to the market. A smart coating can be defined as one that detects and responds to changes in its environment in a functional and predictable manner. Truly smart coatings are those that are capable of dynamically adapting their properties to an external stimulus, such as self-healing systems that can self-repair scratches and cracks. Other smart coatings may be responsive to temperature, corrosion, light, stress, atmospheric pressure, and biological growth.

There are many new technologies on the horizon to challenge the formulator. One thing is certain: the next 25 years will be interesting and challenging times for formulators.

JPCL

Surface Preparation:

Practices, Equipment, and Standards through 25 Years

By Daryl Fleming and Jodi Temyer, *JPCL*

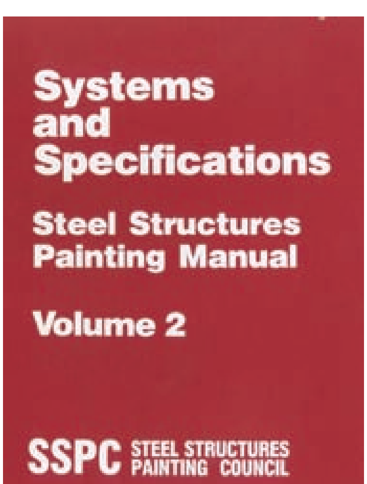
In 1985, SSPC's print edition of *Systems and Specifications (Steel Structures Painting Manual, Volume 2)* covered 8 SSPC surface preparation standards, 1 commentary on surface preparation, and 2 guides to visual standards for surface preparation of steel—a total of 11 standards and guides. Now, in 2009, SSPC's online MarketPlace (www.sspc.org) holds 27 standards and guides—13 surface preparation standards for steel and concrete, 1 commentary on surface preparation, 3 abrasive specifications, 3 guides for managing debris generated during surface preparation, 2 technical reports on cleaning methods, and 5 sets of visual standards and reference photographs for preparation of steel. What happened?

As surface preparation practices, regulations, and equipment changed, so did SSPC's standards. This article looks at the changing world of surface preparation through the lens of SSPC's ever-evolving standards. The article is not intended to be comprehensive.

Abrasive Blasting and Its Continuing Impact

In the premiere issue of *JPCL* (June 1984, p. 31), John D. Keane wrote a feature on the process of developing surface preparation specifications. In the article, he wrote, "Surface preparation is the first component in the painting system concept, which has come to mean a union of the principal elements in a protective coating scheme." At the time of the article, four abrasive blasting standards were available, and by 2009, not only had these standards been updated and reconciled with their counterpart documents from NACE International, but a fifth was added to the list.

In 1985, SSPC-SP 5, White Metal Blast Cleaning, was used when the highest degree of blast cleaning was required. This degree of cleaning left no visible matter on the surface. In 2009, the standard has the same expectations, but became a joint standard with NACE in 1994, making its full title SSPC-SP 5/NACE No. 1, White Metal Blast Cleaning.



Above: 1985 edition
Opposite page: A portion of the list of SSPC surface preparation standards available in 2009. Courtesy of SSPC.

Commercial Blast Cleaning, known as SSPC-SP 6 in 1985, produced a surface with no visible foreign matter except for staining, which was limited to 33% of each square inch of surface. It was also permissible for slight residues of rust and paint to be left on the bottoms of pits if the original surface was pitted. Since 1994, the standard has become a joint effort, titled SSPC-SP 6/NACE No. 3. As of 2009, the staining is still acceptable at 33%, but the area covered is now 9 square inches. In addition, residues of rust or paint are no longer permitted in the bottoms of pits. Added to the specification is, "The presence of toxic metals in abrasives or coating being removed may place restriction on the methods of cleaning permitted. The chosen method shall comply with all applicable regulations."

SSPC-SP 7 (called SSPC-SP 7/NACE No. 4 since 1994), Brush-Off Blast Cleaning, allows tightly adherent mill scale, rust, and paint to remain on the surface if they cannot be removed with a dull putty knife. The recent online version adds that surface imperfections must be removed before and after cleaning based on the requirements in procurement documents. Also, toxic materials in the abrasives or coatings removed may place restrictions on the methods of cleaning permitted.

Near-White Blast Cleaning, SSPC-SP 10 in 1985 and SSPC-SP 10/NACE No. 2 after 1994, allows no visible foreign matter, with the exception of some staining. In 1985, the staining was limited to 5% of each square inch. In 2009, the standard limits staining to 5% of each unit area, which is defined as 9 square inches. This standard also added that toxic materials might restrict the cleaning methods permitted.

In 1998, SSPC and NACE formed a new joint standard—SSPC-SP 14/NACE No. 8, Industrial Blast Cleaning. There was a need for a degree of cleaning between commercial and brush off that would remove most, but not all, of the paint and mill scale. An industrial blast cleaned surface allows tightly adherent mill scale, coating, and rust to remain on less than 10% of each unit area. The presence of some discoloration from previously applied coatings or stains is acceptable.

A new standard nearing completion addresses brush-off blast cleaning of non-ferrous metal surfaces. The standard is needed for the cleaning and roughening before painting of metals such as stainless steel, aluminum, and galvanizing.

In the 1980s, many concerns about surface preparation centered on fine-tuning the available standards, but as the industry became increasingly aware of the risks of abrasive blasting, protection of workers and the environment drove much of the product development in the early 90s. An article in the June 1992 *JPCL* (p. 5) stated that 80 out of the 140 products included in the Buyer's Guide Review were for surface preparation. Again in June 1993, a *JPCL* article noted that 86 out of the 134 products introduced in the New Product Review were for surface preparation (p. 6). Plastic media blasting machines were offered, touting soft particles that could be recycled. Machines for abrasive blasting now offered a vacuum system as well to remove and collect dust and loose abrasive to protect the environment and the workers' breathing zone. Companies pushed to develop the machine that could clean the largest amount of surface area in the least amount of time with reduced risks to workers. In 1996, there were blasting machines that could hold 27 tons of steel abrasive and others that could operate three nozzles simultaneously. In 1998, robotic blasting equipment operated by remote controls was introduced (*JPCL,* June 1996, p. 32; Jan. 1998, p. 102; Sept. 1998, p. 96). Efforts continue in the 21st century to improve abrasive blasting equipment (see, for example, *JPCL*, May 2005, p. 22).

A Profile of Standards for Abrasives

When *JPCL* launched in 1984, SSPC did not have standards for abrasives. Now the industry has three guides with a fourth on the way. The standards were necessary because the industry needed a way to control the quality of abrasives being provided, the cleanliness of recycled abrasives, and the use of recycled ferrous abrasives when removing lead paint.

SSPC-AB 1, Mineral and Slag Abrasives, defines the requirements for selecting and evaluating mineral and slag abrasives intended for one-time use without recycling. The guide categorizes the abrasives into two types, three classes, and five grades, specifying physical and safety requirements.

Cleanliness of Recycled Ferrous Metallic Abrasives is covered in SSPC-AB 2. Recycled ferrous metallic abrasives are valued for their ability to be reused, but debris needs to be removed prior to each reuse, and precautions need to be taken when working with lead and other hazardous materials. The SSPC standard defines the necessary testing procedures.

The third standard for abrasives, SSPC-AB 3, Ferrous Metallic Abrasive, defines previously unused ferrous metallic abrasives. It divides the materials into two shapes (round or angular) and two classes (steel or iron). Physical and chemical properties, test methods, and acceptance criteria are defined.

A fourth abrasive standard currently in its final stages of development will cover abrasives encapsulated in a compressible open-cell (sponge-like) material—a novel abrasive material that did not exist in 1985.

Sand continued to be used for blast cleaning in the U.S., with protection added for workers and the environment, but mineral abrasives, mainly from naturally occurring sources, or slags produced as by-products of refining or smelting operations, gained market share (*JPCL*, Nov. 1984, p. 34), as did recyclable steel abrasives, as evidenced by SSPC-AB 2 and AB 3. *[Editor's Note: On the need for protection from any abrasive, sand or other, containing free silica, see "Regulations and Coatings Work: Developments over 25 Years," pp. 72-77.]* In 1985, the Navy used walnut shells as an abrasive to remove layers of spent antifouling paint while leaving the underlying sound anticorrosion system intact (*JPCL*, March 1985, p. 6). Plastic abrasives were promoted in the late 80s, with claims of little dust and the ability to be recycled at least ten times. During the 90s, dry ice and sponge media garnered attention in the industry, as these methods offered innovative ways to increase portability and perform a "softer" cleaning.

1984

The Expanding Standards for Power Tool Cleaning

Two and a half decades ago, only one standard for power tool cleaning existed. SSPC-SP 3, simply titled "Power Tool Cleaning," defined the practice as a method of preparing steel surfaces by the use of power-assisted hand tools to remove loose mill scale, loose rust, loose paint, and other detrimental foreign matter, but not adherent matter. The methods listed in the standard were rotary or impact power tools for the removal of rust scale, and power wire brushing, power abrading, and other power rotary tools for the removal of mill scale, rust, and paint.

Since the 80s, SP 3 has not changed much, but it has been revised to require nonvisible surface contaminants to be treated as agreed upon in procurement documents and to add points of reference from new SSPC Visual Standards, as well as others.

Power Tool Cleaning to Bare Metal, SSPC-SP 11, was added in 1987, prompted by a request from the nuclear industry to provide a degree of cleaning and roughening similar to abrasive blast, but with power tools. Power tools were preferred because the dust generated by blast cleaning could not be tolerated within the primary containment of a nuclear power plant.

SP 11 requires the removal of all rust, mill scale, and paint, and producing or retaining a surface profile of a minimum of one mil. Tools that can be used under this standard are identified as surface cleaning or profile producing. Surface cleaning media include a non-woven synthetic fiber web material impregnated with an abrasive grit, and coated abrasive discs, coated abrasive flap wheels, and coated abrasive bands. Profile-producing media include rotary impact flap assemblies, needle guns, cutter bundles, and hammer assemblies.

Differing slightly from SP 11 is SSPC-SP 15, Commercial Grade Power Tool Cleaning. It still requires a surface profile of at least one mil, but allows stains of rust, paint, or mill scale to remain on the surface. It provides a much higher degree of surface cleanliness than is required by SP 3, but not the extreme cleaning mandated by SP 11. The acceptable tools and media are the same as allowed in SP 11.

SP 15 was developed when the industry started dealing with lead, and the use of vacuum shrouded tools became more commonplace for localized paint removal. SP 11 was extremely costly to achieve on large surfaces such as top flanges of bridge beams when a deck was replaced, so a degree of cleaning with power tools that approached SP 11 but was more practical to achieve in the field was needed.

As the desire for alternatives to abrasive blast cleaning grew, so did the product line for power tools. New orbital sander disc pads became available with different diameters and constructed out of materials like uniform action urethane foam with a fiberglass/epoxy backing (*JPCL*, Nov. 1990, p. 149). The Sept. 1992

JPCL described a project that specified a dustless power tool system with three shrouded needle guns attached to a vacuum to remove lead-based paint from portions of several bridges (p. 83). In this decade, new, smaller tools have been developed such as a power tool, or suction blast tool, that uses compressed air, hoses, and conventional abrasive media to clean small surfaces where standard (large) abrasive blasting equipment is not practical (*JPCL*, July 2006, p. 17). Another new product is a rotary bristle tool with heat-treated steel wires operating at around 2,500 rpm (*JPCL*, Jan. 2009, p. 67).

Water Jetting: The Pressures Mount

Although dry abrasive blasting of carbon steel substrates dominated the surface preparation industry for decades, environmental and worker health regulations related to the hazardous waste generated by blasting prompted the pursuit of alternatives. Water jetting, one such alternative, reduced worker and environmental exposure to lead dust and particulate emissions, and initially gained a foothold in the marine industry.

Water jetting does not produce an anchor pattern/profile—it is primarily used for surfaces where a profile already exists, particularly those surfaces on which abrasive blasting will not remove all contaminants, such as those found at the bottom of pits of corroded metal. Respiratory exposure and work area air quality requirements for water jetting can be less stringent than those for abrasive blasting because water jetting creates less dust, although exposures still exist.

In 1985, no standard for the use of water jetting had been published. In the first issue of *JPCL*, June 1984 (p. 53), there is a brief product announcement for a "water blaster" that operated at 20,000 psi and could achieve an SSPC-SP 5 White Metal finish. To see how much water jetting technology advanced since 1984, jump ahead 17 years, to the May 2001 issue (p. 22), where an ultra-high-pressure (UHP) water jet product is described that operates at 55,000 psi, developed "for the removal of tenacious coatings such as anti-skid coatings on aircraft carriers."

To help make water jetting practices uniform, and because water jetted surfaces exhibit flash rust, leaving a surface with an appearance different than that created by abrasive blasting, a joint standard was approved in 1995: SSPC-SP 12/NACE No. 5, "Surface Preparation and Cleaning of Metals by Water-jetting Prior to Recoating." The standard was revised July 2002.

Requirements of the standard include the end condition of substrate and the materials and procedures necessary to verify the end condition. Table 1 of SP 12 shows a unique characteristic of this standard. Rather than SP 12 defining a single grade of cleaning, it encompasses four different definitions of surface cleanliness in terms of visible appearance: WJ-1, Clean to Bare Substrate; WJ-2, Very Thorough or Substantial Cleaning; WJ-3, Thorough Cleaning; WJ-4, Light Cleaning. To properly utilize SP 12, the specifier must invoke both SP 12 and WJ-1, 2, 3, or 4. To make the water jetting standard consistent with the other surface preparation specifications, SP 12 is currently being split into four new separate standards, based on these four grades of cleanliness; these new standards are near completion. Each grade of cleaning will then be assigned its own SP number.

Other advances include hand-held and robotic UHP units; developments in UHP pumps, nozzles, and lances that increase productivity; and, as described in the Aug. 2005 *JPCL* (p. 14), reverse osmosis circuits that desalinate water used in UHP operations, thus improving water quality, which helps maintain the performance of the plunger pumps used in UHP equipment.

Wet Abrasive Blasting: The Blast of Both Worlds?

Wet abrasive blasting equipment, methods, and standards have advanced in a parallel fashion to those aspects of water jetting. An SSPC technical report (TR) was published in May 1998, revised in November 2004, and is currently undergoing another revision. At the time of *JPCL*'s debut, however, no standard existed for the use of wet abrasive blasting; as of 2009, SSPC reports that one is nearing completion.

SSPC-TR 2/NACE 6G198, "Wet Abrasive Blast Cleaning," is a joint technical report that covers procedures, equipment, and materials used in a variety of air/water/abrasive, water/abrasive, and water-pressurized abrasive blast cleaning systems.

Revisions to the technical report and forthcoming standard are in response to the increased use of this technique, which provides degrees of surface cleanliness comparable to dry abrasive blasting while controlling the associated dust. As with water jetting, wet abrasive blasting creates flash rust, which entails a surface appearance different than that of dry abrasive blasting, and therefore a different standard for evaluation.

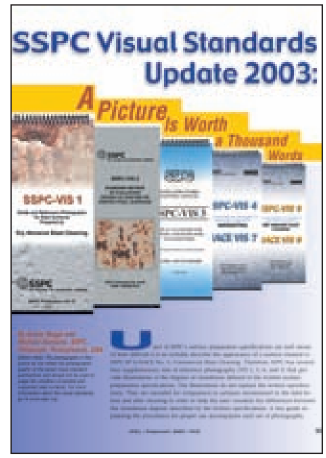
Generally, wet abrasive blasting can be used on any substrate for which the use of abrasive is appropriate. The water and abrasive function remove contaminants, while the abrasive creates the profile. The technical report discusses wet abrasive blasting equipment; the selection of abrasives; the use of rust inhibitors; equipment operation; and safety guidelines. The draft standard defines surface cleanliness according to the five grades of dry abrasive blast cleaning, three levels of flash rusting, and requirements before and after cleaning.

Visual Standards Help Users See Eye to Eye

As *JPCL's* Harold Hower noted in the March 1994 *JPCL* (p. 70), there is "sufficient ambiguity in the end condition definitions" contained in specifications for the many forms of surface preparation—and visual standards are therefore useful. In the 25 years since the first issue of *JPCL*, SSPC has developed the following four visual standards for surface preparation. These standards, consisting of photos and directions laminated on heavy stock paper, are products available from SSPC.

- SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
- SSPC-VIS 3, Guide and Reference Photographs for Steel Surfaces Prepared by Power- and Hand-Tool Cleaning
- SSPC-VIS 4/NACE VIS 7, Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting
- SSPC-VIS 5/NACE VIS 9, Guide and Reference Photographs for Steel Surfaces Prepared by Wet Abrasive Blast Cleaning

The history of the development of VIS 1 reaches even further back in time. The original SSPC definitions of blast cleaning, dated 1952, were *written*, and the emphasis was on the rate of cleaning; in 1963, the definitions were revised to focus on the thoroughness of the cleaning. Also in 1963, Swedish Standards (SIS 05 59 00-1962) were published for use as a pictorial reference for the appearance of blast-cleaned steel.



The Swedish Standards were in use internationally for the next 20 years, but in the early 1980s, concerns mounted that the Swedish photographs, particularly BSa2, contradicted the SSPC written definitions of the same purported conditions. Meanwhile, the Swedish Standards were in the process of being approved by the ISO as international standards, and the disparity was not being addressed. SSPC therefore set out to develop its own visual standards, the first of which, VIS 1, was published in Sept. 1989.

For VIS 1, in fact for all SSPC visual standards, the photographs are supplemental, used as a visual aid in making judgments, and the written specification takes precedence.

VIS 3 was issued in 1993 and revised in 2003; its development can be credited to several factors, including the increased use of power tool cleaning and new environmental regulations.

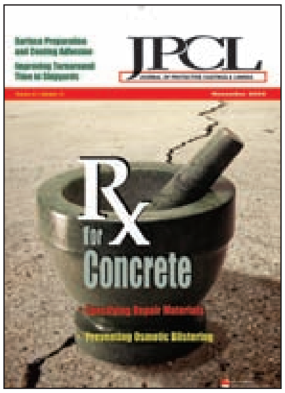
SSPC and NACE jointly introduced SSPC-SP 12/NACE No. 5, the water jetting standard, in 2002. Visual standard SSPC-VIS 4/NACE VIS 7 shortly followed to depict the four cleanliness conditions described in SP 12. The three levels of flash rusting defined in SP 12 are also depicted in VIS 4.

The year 2002 also saw the publication of VIS 5, which was developed to visually correspond to the written standards SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning, and SSPC-SP 10/NACE No. 2, Near-White Blast Cleaning, when created by wet abrasive blast cleaning. The three levels of flash rusting are also shown over each cleanliness level.

Coating Concrete? Be Prepared

Structural steel is not the only substrate in industrial facilities that benefits from the use of protective coatings. Concrete, the most common material of construction in the world and one that is widely used in industrial settings, also benefits from the use of coatings. Consensus standards for preparing and coating concrete have trailed those for structural steel, however, with one of the major issues being the very definition of concrete. Unlike steel, what comprises concrete is so variable that its appearance cannot be defined.

No standard for preparing concrete existed in 1985. SSPC-SP 13/NACE No. 6, "Surface Preparation of Concrete" was approved in 1997 and reaffirmed in March 2003. The standard states, "This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust…" Table 1 in the standard provides "Suggested Acceptance Criteria for Concrete Surfaces After Surface Preparation." These criteria include surface tensile strength,



profile, cleanliness, residual contaminants, pH, and moisture content.

In an Aug. 1997 *JPCL* article (p. 48), Fred Gelfant, then the chair of SSPC/NACE Joint Task Groups on concrete, says that increasing federal and state regulations on secondary containment were responsible for growing interest in and, thus, development of consensus documents on the protection of concrete.

There have been countless developments in the equipment and methods used to prepare concrete for coating. A May 1989 *JPCL* Maintenance Tip article (p. 25) breaks down concrete preparation into six basic methods: cleaning and etching, abrasive blasting, scabbling, scarifying, shot blasting, and UHP water jetting. Many of the developments in the gear used to perform these tasks involve capturing or containing the dust generated, and making the equipment more ergonomically designed. For example, the June 2008 *JPCL* (p. 64) describes an edge grinder that allows the user to grind in an upright position, helping to reduce fatigue, backaches, and jobsite injuries. Another example of advances in the preparation of concrete is described in the Dec. 2002 *JPCL* (p. 71): controlled permeability formwork (CPF), which consists of liners applied to conventional formwork. The CPF liner reportedly retains cement fines during compaction, while allowing water and air to escape from the interface of the concrete and the formwork, thus eliminating most common surface blemishes. This creates a surface that is said to only require cleaning, thus bypassing the need for mechanical or other preparation techniques.

Conclusion

All SSPC standards are available through sspc.org. SSPC members can download standards at no cost.

Acknowledgments

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JPCL

Top Product Developments, 1984 to the Present

By Harold Hower,
Technology Publishing/PaintSquare

The past 25 years will likely be seen as the Golden Age of information technology, when revolutionary advances were made in the storage, manipulation, and distribution of data, and the miniaturization of devices used for these purposes. So we now have a computer/TV/movie screen/telephone/radio/camera that we can hold in our hand, with applications too numerous to describe. It's mind-boggling when you compare the state of information technology in 1984 with this technology today.

In the protective and marine coatings industry, as in similar industries, we have made great strides in product development, as well, although not as dramatically as information technology. There is no doubt, however, that information technology aided in our industry's product development and is incorporated into many products' features.

What follows is a generic description of top new products introduced since *JPCL* began publishing. The selection of these products was made by Brian Goldie, *JPCL*'s Technical Editor; by several of *JPCL*'s Contributing Editors; and by readers who responded to a survey about top products. The 10 product types most frequently mentioned and described by our editors and readers are featured here, as well as a number that rated as Honorable Mentions.

The Top Products

UHP Waterjetting Systems

Ultra-high pressure (UHP) waterjetting, conducted at 40,000 psi (170 Mpa, 1700 bar) or higher, has given the protective and marine coatings industry an effective secondary surface preparation method to remove coatings, rust, and debris from steel and concrete. It is considered "secondary" because it does not impart a profile to new steel and concrete; it is normally used, therefore, in maintenance operations rather than in new construction.

Waterjetting: Courtesy of NLB (JPCL, *February 2004, p. 23)*

UHP waterjetting has many advantages, including reduction in the waste generated during surface preparation, elimination of dust and sparks, and the removal of soluble salts (chloride nests) from the pits of rusted steel surfaces.

UHP waterjetting is especially useful on offshore oil platforms because it avoids the need to transport vast amounts of abrasive to and from the platform; protects the sea from abrasive residue; removes chlorides deposited by the salt-laden air; and eliminates the sparking of abrasive blasting that might lead to fire and explosion.

Plural-Component Spray Equipment

Plural-component spray allows the application of high or 100% solids coatings that cure immediately upon catalyzing. These

Plural-component system: Courtesy of Graco Inc.

coatings thereby become another avenue for achieving VOC compliance at very low levels, while at the same time, they eliminate some of the dangers of solvent toxicity.

Plural-component spray equipment has proportioning pumps that allow metering and delivery of each coating component so that a fixed, predetermined ratio of the materials reaches the spray gun, which has an impingement mixing device to combine the components before they are sprayed onto the surface being coated. Key to the equipment is accuracy and consistency of proportioning, since "off-ratio" materials will generally fail prematurely. Much progress has been made in the development of this equipment so that it is now more reliable and easier to use.

Polyureas

Polyureas are very high to 100% solids materials that have contributed to lowering the VOCs of coating materials while providing very strong performance capabilities. The main advantages of polyureas are excellent mechanical properties; weatherability, even in extreme environments; fast cure, relatively unaffected by humidity and temperature; and excellent adhesion and flexibility, even at low temperatures.

Applying polyurea: Courtesy of DeNeef Technologies
(JPCL, *February 2005, p. 18)*

This technology, developed in the late 1980s, is a two-component coating consisting of an aliphatic isocyanate prepolymer and a primary amine-terminated resin and chain extenders. So-called "pure" polyureas have no polyols, as polyurethanes, their cousin, do. If polyols are present in polyureas, they are called "hybrid," not "pure" polyureas.

Sponge Blasting

Sponge blasting is carried out in air abrasive blasting systems modified to use sponge as the abrasive. The sponge is a polymer matrix that, in some cases, has abrasive particles, such as garnet, embedded into it.

Without the embedded abrasive, sponge blasting is effective in cleaning applications, for instance, in cleaning a surface that has been blackened by smoke in a fire. When abrasive is embedded,

Sponge blasting: Courtesy of Todd Pacific Shipyard (JPCL, November 2005, p. 12)

sponge blasting can cut steel sufficiently to create a profile and can be effective in coatings removal.

Sponge blasting reduces the amount of dust generated by abrasive blast cleaning operations when conventional abrasives are used.

Certification Programs

SSPC has developed and operated a Painting Contractor Certification Program (PCCP) since 1985 to elevate the quality of paint contracting operations and to diminish the negative impact of low bidding, incompetent contractors, especially in public works jobs, where the work often has to be awarded to the low bidder.

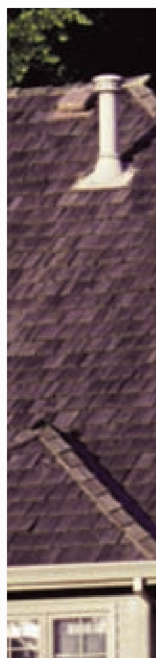
This successful program requires field audits of contractors' operations to assure they have the appropriate levels of quality, administrative controls, and safety.

NACE has operated a coatings inspector training and certification program since the early 1980s. This program has increased the awareness of coatings inspection and its value in assuring the quality of coatings' work. The program establishes a process for improving the knowledge and professionalism of coatings inspectors. In recent years, SSPC has also established inspector training and certification programs.

Polyaspartics

Polyaspartics can be considered a new or specialized class of aliphatic polyureas. They are based on the reaction of polyaspartic ester compounds (a type of secondary aliphatic amine) with polyisocyanates. These form moderately fast-curing coatings with good outdoor weathering, long pot life, and good abrasion and corrosion resistance.

The unique structure of the polyaspartic ester allows for a



MCU zinc/polyasparatic: Courtesy of Sherwin-Williams (JPCL, October 2006, p. 46)

range of products to be formed with differing reactivities, gel times, and, thus, application windows. Similar to polyureas, polyaspartic technology can be combined with polyurethanes to form hybrid coatings that can yield a range of properties to suit differing applications.

Fluoropolymers

Fluoropolymer coatings were originally used as factory-applied, heat-cured finishes for architectural metal such as aluminum. More recently, however, fluoropolymers and their blends with other resins such as polyurethanes have become available for field application with conventional equipment.

Fluoropolymer coating: Courtesy of Dai Nippon Toryo Paint and AGC Chemicals

These coatings provide superior weathering durability and exhibit excellent color and gloss. They are therefore very useful in high-end topcoat markets. Very recently, waterborne versions of fluoropolymers have emerged so that these coatings can be used where very low VOC materials are required.

Epoxy Technology

High solids, 100 percent solids, and waterborne versions of epoxies, developed during the past 25 years, have maintained the technology as the workhorse generic type in protective and marine coatings markets in the face of ever diminishing VOC limits. Throughout the past 25 years, epoxy technology has developed steadily and surely, with a focus on new curing agent types to impart better and specialized properties. Epoxies are very effective tank linings, in applications from drinking water tanks on land to ballast tanks on ships at sea, and they see wide use as atmospheric coatings to provide barrier protection against corrosion and mechanical damage on steel and concrete.

Electronic Gages

Paint application specifications, such as SSPC-PA 2, require very large numbers of quality control measurements to assure consistency of film thickness. Results of these measurements must be recorded and kept on file by coatings inspectors in case there is premature coatings failure. Today, this job is simplified and made productive by electronic gages that store data and allow its download into computers.

Like digital devices in other industries, quality control gages for coatings inspection become more sophisticated and powerful year after year.

Other Digital Devices and Systems

Many readers, responding to *JPCL*'s email survey about new products, cited various advances in information technology as top products—general advances such as computers, the internet, cell phones, and GPS systems, as well as advances in this area that are more specific to the coatings industry, such as the internet portal PaintSquare, which is also the web site of this journal.

It goes without saying that digital devices and systems pervade our working as well as our private lives; and the protective and marine coatings industry could not have advanced to its current level without these products.

Honorable Mention

Other products receiving some mention from readers and editors included the following.

- Field-portable steel grit recycling machines. These machines are significant because in lead paint removal operations on large structures, they have reduced the quantity of abrasive needed to remove coatings and clean the underlying steel, and therefore, they have reduced the volume of hazardous waste generated by these operations.

- Field containment systems. These systems, which can be made airtight, reduce the impact of coatings work on the public and the environment.
- SSPC visual standards. These standards have simplified the assessment of surface cleanliness achieved with a variety of tools and methods: wet and dry blast cleaning, hand- and power-tool cleaning, and waterjetting.
- Flash rust inhibitors. These products enable greater surface preparation productivity by allowing blast-cleaned steel surfaces to remain untopcoated for 24–96 hours. Otherwise, requirements to blast and coat before flash rust develops means that one operation is interrupted to allow the other to commence, a very inefficient practice.
- Tin-free antifouling technologies. Replacements for tributyltin (TBT) antifoulants on ships' hulls, including self-polishing, copper-based systems, and low-energy, non-biocidal systems, have stopped the damage that TBT has caused to the marine ecosystem.
- Polysiloxanes. Introduced in the 1990s, the organic-inorganic hybrid polysiloxane technology has provided very high quality esthetic properties through UV durability and very good corrosion resistance.
- Robotic waterjetting and wheel blasting machines. These so-called "crawlers" have found use on large, relatively flat surfaces, such as ships' hulls and storage tanks, where they clean surfaces and remove debris very productively.
- Wet blast equipment. This equipment combines the virtues of water and abrasive—effective cutting and scouring by the abrasive and dust suppression by the water. Numerous advances in the various types of this equipment have been made in the past 25 years.
- Cementitious epoxy resurfacers. These materials provide a level surface for topcoating cast-in-place and pre-cast concrete. They bond well to the surface and require no further surface preparation.
- Bristle blasters. This new power tool achieves a profile similar to that achieved by air abrasive blast cleaning in a single step and cleans steel to a high degree of cleanliness.

JPCL

Regulations and Coatings Work:

Key Developments over 25 Years

By Alison B. Kaelin, CQA, KTA-Tator Inc., and Karen A. Kapsanis, *JPCL*

Regulations on protecting workers and the environment (including the public) have driven many developments in coatings work for industrial structures, bridges, and ships. This article looks at key regulations and guidance documents affecting surface preparation, coatings, and worker protection over the past 25 years. Federal regulations and guidance documents from the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the National Institute for Occupational Safety and Health (NIOSH) are referenced most frequently, but some state and local regulations are identified as well. The article is not intended to be comprehensive.

Surface Preparation and the Environment

Silica

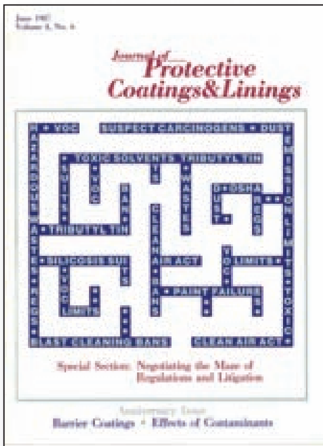
Up until the 1980s, silica sand was the primary abrasive used for abrasive blast cleaning (then called sandblasting), even though the potential health effects had been documented since the 1930s. In the mid-1980s, several civil lawsuits were filed by citizens due to alleged property damage and health effects from open abrasive blast cleaning involving silica abrasives and lead (e.g., *JPCL*, October 1985, p. 3). A case in Allegheny County, PA, resulted in local air pollution control regulations being implemented in 1987 (*JPCL*, June 1988, pp. 24–25, 235–236). This regulation included limitations on silica (free silica) in the environment of 100 µg/m^3 for an eight-hour day and limitations on the amount of free silica in the abrasive to less than 5%. Texas, California, and other states implemented similar regulations on abrasive blasting (primarily to control emissions or limit free silica in the abrasive) throughout the early 1990s (*JPCL*, February 1991, pp. 55–116).


Regulation News

Hazardous Dust (Lead, Other Heavy Metals)

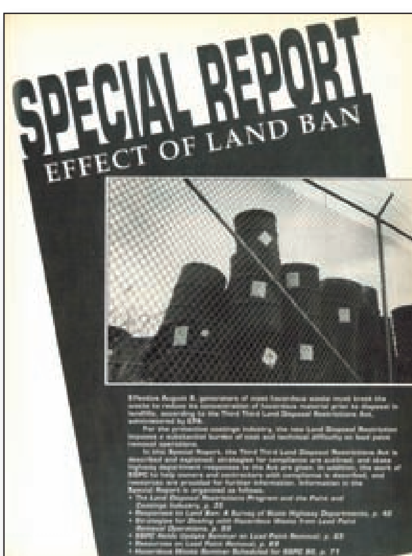
Civil lawsuits in the 1980s and increasing concerns related to lead exposures also resulted in state and local regulations for controling emissions of lead. Additionally, the painting industry became more aware of EPA regulations required by the provisions of the Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act (RCRA) that were applicable to paint removal operations involving lead and other metals.

SSPC convened a symposium in January 1987 to discuss the impact of regulations and litiga-



tion on protective coatings (*JPCL*, June 1987, pp. 59–93) and in 1988 hosted two symposiums; one on lead paint removal from industrial structures and the other, in conjunction with the FHWA, on removal and disposal of lead-containing bridge paints. In response to the above and the potential risk of litigation due to alleged exposure to lead (and silica), many transportation departments and other facility owners began to establish specification requirements for containment, environmental monitoring, and management of hazardous waste.

In 1990, EPA implemented changes to the testing procedures for hazardous waste from the EP Toxicity Test to the Toxicity Characteristic Leaching Procedure (*JPCL*, May 1990, pp. 68, 99) and introduced the Land Disposal Restrictions (40 CFR 268). Known as "Land Ban," 40 CFR 268 prohibited the land disposal of any leachable lead-bearing hazardous wastes without treatment to stabilize the lead below hazardous levels (*JPCL*, August 1990, pp. 34–71).



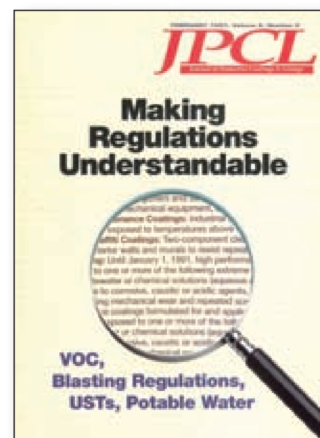
In 2008, EPA revised the National Ambient Air Quality Standard (NAAQS) for lead, resulting in reduction of allowable ambient lead from 1.5 µg/m^3 to 0.15 µg/m^3 (*JPCL*, January 2009, pp. 9–13). Much of the health effects data provided with the revised NAAQS for lead appears to indicate that blood lead levels as low as 10 µg/dL can harm children and adults.

Coatings and the Environment

Volatile Organic Compounds (VOC)

The Clean Air Act called on the EPA to establish measures to reduce air pollution. EPA focused early on six air pollutants—lead, ozone, particulate matter, sulfur dioxide, nitrogen oxide, and carbon dioxide—and set limits on their acceptable ambient levels. Acceptable levels were identified in EPA's NAAQS. States with any of the six pollutants above the NAAQS were considered "non-attainment" states and were required to develop plans to reduce air pollutant levels to the NAAQS or below. Ozone—both ground level, which is harmful to human beings, and stratospheric, which is harmful to the earth—has figured prominently in the manufacture and application of coatings (SSPC, Steel Structures Painting Manual, Vol. 1, *Good Painting Practice*, 1993, 3rd edition, 1993, pp. 560–572).

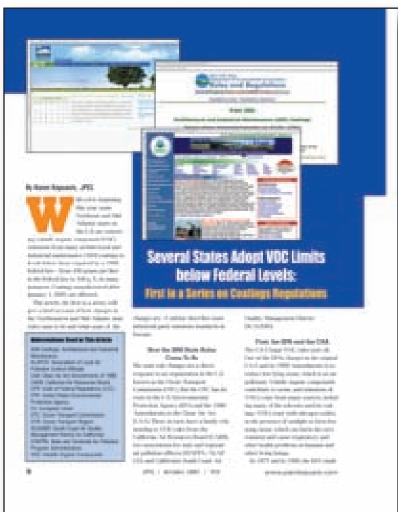
While coatings do not produce ozone, many of the solvents and other components of coatings are ozone precursors—VOC, which react with nitrogen oxides in the presence of sunlight and heat to form ozone. Coatings are not the only products that use VOCs—they come from many industries as well as cars. The original Clean Air Act did not require the regulation of VOC content in coatings, but EPA developed a model or control technique guideline (CTG) that non-attainment states could (and many did) adopt or adapt to regulate VOC emissions from the coating of "miscellaneous metal parts and products," shop coating, in essence (SSPC, *Good Painting Practice*, 1993, 3rd edition, 1993, pp. 560–572).



However, by 1990, some non-attainment states and localities, most notably, air quality districts in California, such as in Los Angeles' South Coast Air Quality Management District (SCAQMD) and San Francisco Bay's Bay Area Air Quality Management District (BAAQMD), were regulating not only coatings applied in shops but also architectural and industrial maintenance (AIM) coatings applied to ships and stationary structures such as bridges. Similar to the EPA's CTGs, California developed model rules that its air quality districts could adopt or adapt. Other states such as Texas and New York also began to regulate AIM coatings for VOCs. By 1990, the U.S. had a patchwork of coating regulations, with limits for most industrial maintenance coatings ranging from 420 g/L to 540 g/L (*JPCL*, February 1991, pp. 55–116).

The 1990 Clean Air Act Amendments (CAAA) called for EPA to establish a national rule for VOCs in AIM coatings and marine coatings, among others. After a rulemaking and negotiating process that included much input from the public and industry, the EPA issued its rule in 1998, 40 CFR 59, "National Volatile Organic Compound Emission Standards for Consumer and Commercial Products." The rule restricts VOC content in most industrial maintenance and marine antifouling coatings to 450 g/L, well above restrictions in some states and districts, including those in California districts. State or local regulations can be equal to or more restrictive than federal rules. SCAQMD's 100 g/L is the tightest restriction on VOCs in AIM coatings. (*JPCL*, October 2005, pp. 36–42).

The 1990 CAAA also called for the formation of Ozone Transport Commissions (OTC) to address the problem of ozone from one state drifting into the airspace of a bordering state. The New England and Mid-Atlantic states formed the first OTC, which developed model rules on VOC sources, including coatings. States within the OTC can adopt or adapt the rules as each state deemed necessary. Many OTC states (e.g., CT, DE, DC, ME, MD, NH, NJ, PA, NY, VA) have adopted the OTC rule's VOC level of 340 g/L for most industrial coatings (*JPCL*, January 2008, p. 65).



Anti-Fouling Coatings

Anti-fouling coatings, intended to prevent marine organisms from attaching themselves to a ship or other immersed structure, are regulated for the constituent that prevents fouling. Fouling increases shipping costs: It adds weight to a ship and the resultant rough surface increases drag, both of which increase the amount of fuel a ship needs. (*JPCL,* June 2000, pp. 50–65).

Since the 1950s, organotins, especially the related compound, tributyltin (tbt), have been used successfully in coatings to prevent barnacles and other organisms from attaching to ship hulls. However, organotins also kill non-targeted marine species and have therefore come to the attention of governments around the world (*JPCL*, June 2000, pp. 50–65).

The U.S. Navy put a moratorium on the use of organotin-containing anti-foulings in the mid-1980s, with some exceptions (*JPCL*, April 1986, p. 19, and *JPCL*, March 1987, p. 25). Subsequently, the U.S. Organotin Anti-Fouling Paint Control Act of 1988 (33 USC Chpt 37) prohibited the use of organotin-containing coatings on ships less than 25 meters long; limited the leaching rate of anti-fouling paints on vessels; and banned, with some exceptions, the sale, purchase, and application of anti-fouling paint containing organotins in the U.S., as noted in a summary prepared for a June 10, 2009, meeting of the U.S. House of Representatives' Subcommittee on Coast Guard and Maritime Transportation Staff. The Subcommittee heard testimony on anti-fouling systems and considered the International Convention on the Control of Harmful Anti-fouling Systems on Ships. Adopted in 2001 by the International Maritime Organization (IMO), of which the U.S. is a member, the Convention is a treaty that calls for its signatories to ban the new application of organotin-containing anti-fouling paints and to require removal or over-coating of existing organotin-based anti-foulings (*JPCL*, February 2008, pp. 48–52). The U.S. Congress ratified the treaty on September 26, 2008, but, according to a July 2009 response from the Subcommittee office to an inquiry from *JPCL*, the Congress has not yet created the legislation necessary for the U.S. to comply with the Convention.

Protecting Coating Workers from Specific and General Hazards

Protecting Workers from Exposure to Silica

It has long been known that significant silica exposures can occur during blast cleaning with abrasives that contain silica. In 1975, NIOSH issued "Recommendations for a Crystalline Silica Standard." 1979, NIOSH recommended that silica sand or other material containing greater than 1.0% crystalline silica (quartz) be prohibited as a media for abrasive blasting.

Banned as an abrasive in many countries, crystalline silica sand is not prohibited in the U.S. but exposure to crystalline silica (in any abrasive) is regulated in construction under 29 CFR 1926.55, Gases, Vapors, Dusts, and Mists, and in general industry under 29 CFR 1910.1000. Essentially, these "catch-all" regulations say that if a worker exceeds the Permissible Exposure Limit (PEL), the employer must implement administrative and engineering controls followed by respiratory protection to reduce occupational exposures below the PEL. Silica is also referenced in 29 CFR 1926.57, Ventilation, which requires the use of an abrasive blasting respirator when abrasive blasting with silica.

In 1998, NIOSH issued a report, "Evaluation of Substitute

Materials for Silica Sand in Abrasive Blasting" to evaluate the surface preparation performance and potential worker exposure contaminants in silica and alternative abrasives (*JPCL,* August 1999, pp. 49–71).

While OSHA has failed to issue any comprehensive regulations for silica, it did issue a National Emphasis Program [NEP]—Crystalline Silica in 2008 (*JPCL*, April 2008, pp. 12–17). The NEP establishes policies and procedures for inspection and changed how the PEL for silica is calculated. The NEP specifically targeted employer classifications such as painting and paper hanging; general contractors; and highway, bridge, and tunnel construction; and it explicitly identifies abrasive blast cleaning as a high exposure activity.

In May 2009, OSHA issued Publication 3362, *Controlling Silica Exposures in Construction,* but did not address abrasive blast cleaning. Around the same time, the International Safety Equipment Association and the Risk and Insurance Management Society petitioned OSHA to prohibit the use of silica in abrasive blasting (www.paintsquare.com, News, May 11, 2009).

The OSHA regulatory agenda for Spring 2009 indicates that development of a standard for occupational exposure to crystalline silica is in the pre-rule stage. A peer review of health effects and risk assessment data was to start in June 2009.

Protecting Workers from Exposure to Lead

In 1993, OSHA issued a comprehensive standard, 29 CFR 1926.62, Interim Final Rule—Lead Exposure in Construction (*JPCL*, July 1993, pp. 46–51). This regulation brought sweeping changes to the paint industry through its requirements for engineering controls (i.e., ventilation in conjunction with containment), work practices, respiratory protection, training, and medical and worker exposure monitoring.

OSHA issued subsequent comprehensive standards regulating other heavy metals, including cadmium, 1926.1127; arsenic, 1926.1118; and hexavalent chromium, 1926.1116 (*JPCL*, April 2008, p. 12).

The lead-in-construction standard has continuously been augmented by NEPs initiated in 2001 and again in 2008 (*JPCL*, May 2009 pp. 66–69). In the 2008 NEP, the reported blood lead level established for triggering an OSHA inspection was lowered from 40 μg/dL to 25 μg/dL raising the question of whether OSHA intends to lower the allowable level of lead in the blood. Similarly, the Council of State and Territorial Epidemiologists are recommending reducing and redefining elevated blood lead level for adults to be the same as for children at 10 μg/dL.


OSHA's New Rule on Lead:
Changing the Practice and Price of Lead Paint Removal

Why the New Rule?

Protecting Workers from Hazards of the Trade

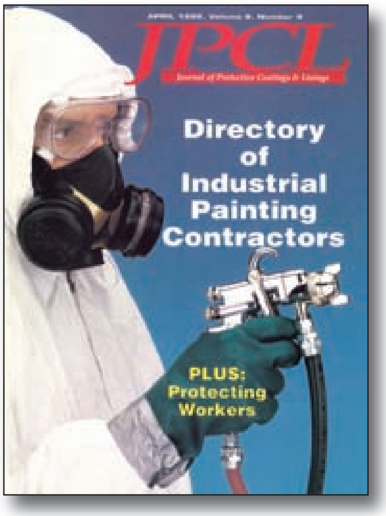
Coating materials themselves and their application also put painters at risk. Organic solvents can harm the central nervous system. They and other chemical compounds used in painting and surface preparation can affect the respiratory system or travel into the blood stream and damage internal organs (*JPCL*, April 1992, pp. 46–54).

Typical routes of exposure for most materials used in surface preparation and painting are inhalation, ingestion, and, in some cases, absorption. For protection against inhalation exposures, OSHA's standard for construction workers is 29 CFR 1910.134, on Respiratory Protection. Originally, 29 CFR 1910.134 was adopted in 1971 for general industry, as was the original construction industry standard for respiratory protection, 29 CFR 1926.103. In 1998, OSHA overhauled 29 CFR 1910.134 and applied it to general industry, construction, shipyard, longshoring, and marine terminal workplaces (*JPCL*, March 1998, pp. 65–80). Among the key elements of the 1998 rule were procedures for selecting respirators, medical evaluations and training of employees required to use respirators, fit testing procedures, procedures for cleaning and maintenance of respirators, training for employees in respiratory hazards as well as in the proper use of respirators, and development of a respiratory protection program, with an assigned administrator to evaluate effectiveness.

The most recent changes to the respiratory protection standard came in 2006, with Final Rule for Assigned Protection Factors (APFs) for respirators. The 2006 revision eliminated inconsistencies for APFs found in various OSHA standards, and it standardized APFs by type of respirator. An April 2009 OSHA guidance document "Assigned Protection Factors (APF) for the Revised Respiratory Protection Standard" summarized the 2006 revisions.

Different surface preparation and painting processes create other hazards. Water jetting, when misdirected, can amputate a worker's limb or otherwise severely injure a worker. Particles from painting or blasting can rebound into unprotected workers' eyes or other parts of the face. Equipment that powers abrasive blasting can exceed acceptable noise levels and can damage workers' hearing. Chemical stripping with materials that contain methylene chloride can put workers at increased risk of cancer; damage to the heart, liver, central nervous system; and skin or eye irritation.

OSHA's 29 1926.28 (a) states: "The employer is responsible



for requiring the wearing of appropriate personal protective equipment in all operations where there is an exposure to hazardous conditions or where this part indicates the need for using such equipment to reduce the hazards to the employees." The standard refers the user to subpart E for standards on Personal Protective Equipment (PPE). In 1926.95, OSHA requires employers to provide protective gear for workers, generally at no cost.

Other relevant construction industry standards in subpart E are 29 CFR 1926.96, Occupational Foot Protection; 29 CFR 1926.100, Head Protection; 29 CFR 1926.101, Hearing Protection; 29 CFR 1926.102, Eye and Face Protection. A construction standard for controlling exposures to methylene chloride (29 CFR 1926.1152) was introduced in 1997.

Protecting Painters and Blasters in Shipyard Operations

Protection of coating crews and all other workers performing ship repair, ship building, and related operations at shipyards is regulated under the Agency's Maritime or Shipyard Standards, in particular, 29 CFR 1915, Occupational Safety and Health Standards for Shipyard Employment, most recently revised in December 2008. In addition to provisions for scaffolding and staging, confined spaces, hand tools, and other operations or equipment that pose hazards at shipyards, 1915 has standards that apply specifically to cleaning and painting work. Subpart C on Surface Preparation and Preservation includes 1915.32, Toxic cleaning solvents; 1915.33, Chemical paint and preservative removers; 1915.34, Mechanical paint removers; 1915.35, Painting; and 1915.36, Flammable liquids.

In December 2006, OSHA issued the guidance document, *Abrasive Blasting Hazards in Shipyard Employment*, primarily on protection against air contaminants generated during blasting.

Because of a high incidence of shipyard work-related fatalities, injuries, and illnesses, the Maritime Advisory Committee for Occupational Safety and Health (MACOSH) will meet September 1–2, 2009, in Newport News, VA, to discuss injury and fatality data, initiatives, and other topics, according to a July 17, 2009, announcement from OSHA.

Other Construction Hazards in Coating Operations

OSHA continues to revise other standards related to construction safety. OSHA's comprehensive revision to the Fall Protection Standards (29 CFR 1926 Subpart M – Fall Protection) in 1994 eliminated the use of body belts and expanded the scope of the standard. Revisions to the Scaffolding Standards (29 CFR 1926 Subpart L – Scaffolds) in 1996 resulted in new training requirements for scaffold users, erectors, and designers. As many containment systems utilize suspended platforms, this standard governs their design, erection, maintenance, and use.

In 2002, OSHA updated 1926.201, Signs, Signals, and Barricades, to require that all traffic control signs or devices used for protection of construction workers comply with the FHWA Manual on Uniform Traffic Control Devices (MUTCD).

A proposed rule to update the 1971 Cranes and Derricks (29 CFR 1926.550) standard was issued in November 2008 to address the considerable changes in both work processes and crane technology that have occurred since 1971.

In November 2007, OSHA issued a proposed rule "Confined Spaces in Construction." Because of substantial comments from industries and organizations, OSHA extended the comment period through most of 2008. OSHA's regulatory agenda indicates that comments will be analyzed in October 2009, but no date for final rulemaking has been set.

Conclusion

The above discussion is far from comprehensive, but it does identify some of the key environmental, safety, and health issues that have figured prominently in the protective coatings industry over the past 25 years. Much more information is available. For example, all OSHA documents are available at www.osha.org. EPA documents are available at www.epa.gov. Documents from NIOSH are available at www.cdc.gov/niosh. For SSPC publications, visit www.sspc.org. For issues of *JPCL* from 1995 to the present, go to www.paintsquare.com.

Alison B. Kaelin, CQA, Quality Assurance Manager at KTA-Tator, Inc., frequently writes about regulations for *JPCL*.

JPCL

Hampton Roads Meeting with Special Speaker

Virginia State Senator Frank Wagner will be addressing the September meeting of the SSPC Hampton Roads Chapter, on September 15, 2009. The Chapter dinner meeting will take place at the Crown Plaza Hampton Hotel in Hampton, VA.

The chapter has about 350 members, including contractors who apply coatings; manufacturers who make the coatings, equipment, and supplies necessary to apply them; the engineers and specialists that specify them; and the people who own the structures that need protection.

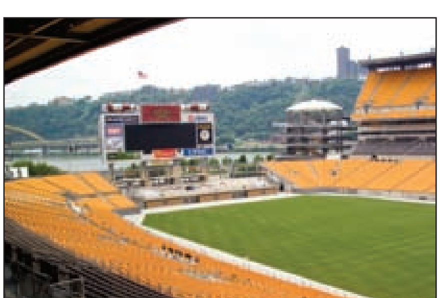
The chapter holds five meetings each year, in January, March, May, September, and November. The meetings typically feature a speaker who discusses a new product or process.

For further information, please contact Mr. Frank Saunders, Chair, SSPC Hampton Roads Chapter—tel: 757-620-6928; email: frank.saunders@sherwin.com.

SSPC and IBC Tour Heinz Field

On Tuesday June 16, 2009, 13 SSPC staffers and International Bridge Conference attendees took a tour of Heinz Field, the home to the Pittsburgh Steelers since 2001.

Beginning in the Coca-Cola Great Hall, tour participants learned about the history of the Steelers. One of the NFL's most storied franchises, the Steelers rose from humble beginnings in the 1930s to become six-time Superbowl Champions. The tour also included viewings of the club level, private VIP suites, Heinz Red Zone Score Board, and the inner sanctum—the Steeler's locker room.



Heinz Field. Photo used with permission of the Pittsburgh Steelers.

Architects HOK Sports designed the stadium, and Hunt Construction Group/Mascaro constructed it in a joint venture with HOK. Construction of the facility required 12,000 tons of structural steel, 48,000 cubic yards of cast-in-place concrete, and 30,000 gallons of paint.

Three Rivers Chapter Visits Amusement Park

Pictured at Kennywood are Andy Quinn, Kennywood; John Ekiert and family, KTA; Shawn Nedley and Barb Fisher, SSPC; Dan Schmidt and Heather Ramsey, Sauereisen; Michael Eckert and family, Sherwin-Williams; and Nick Bressler, World International Testing.

On Friday, June 12, members of the SSPC Three Rivers Chapter and their families enjoyed a perfect-weather day at Pittsburgh's National Historic Park, Kennywood. The members and their families were given a personal tour by Andy Quinn, whose family has been involved with the amusement park for three generations. After the tour, the group enjoyed dining on Kennywood food and drinks as well as riding and playing games.

Next Generation Bridge Engineers Exhibit at IBC

Three students from Chartiers Valley Middle School exhibited at the International Bridge Conference, held June 14–17 at the David L. Lawrence Convention Center in Pittsburgh. SSPC was a co-sponsor of IBC.

The students, Cody Reinstadtler (son of SSPC Member Steve Reinstadtler, of Bayer MaterialScience, LLC), Paul Novelli, and Ryan O'Connell, set up a tabletop display on the structural integrity of bridges. The exhibit was part of a science project that the young men worked on for school.

Pictured left to right are Cody Reinstadtler, Paul Novelli, and Ryan O'Connell

Continued

Training Roundup

Recent SSPC training programs spanned the globe.

Students of SSPC's Protective Coatings Inspector (PCI) course held April 1–12 in Batam, Indonesia, pictured with instructor Alex Wijaya

On April 1-12, SSPC held its Protective Coatings Inspector (PCI) course in Batam, Indonesia. The class was presented in the evening to accommodate students who worked during the day. Eight students attended the course, which Alex Wijaya taught.

Students of SSPC's Fundamentals of Protective Coatings (C1) Training Courseheld June 10–11 in Vancouver, WA. Hosted by Thompson Metal Fab, Inc., with instructor Web Chandler of GPI/Greenman-Pedersen, Inc.

Thompson Metal Fab, Inc. hosted two sessions of the SSPC Fundamentals of Protective Coatings (C1) Training Course on May 12–13 and June 10–11 in Vancouver, WA. The instructor was Web Chandler of GPI/Greenman-Pedersen, Inc.

For persons interested in attending an SSPC training course, contact Dee Boyle—email: boyle@sspc.org; for companies interested in hosting an SSPC training course, tutorial, or workshop, contact Jennifer Merck—email: merck@sspc.org.

SSPC Individual Member Update

Below is a list of people who joined or renewed their SSPC membership in April, May, and June 2009. For information about joining, contact Terri McNeill, mcneill@sspc.org.

- Gunnar Ackx, Brugge, Belgium
- Pri Gustari Akbar, Air Tawar, Barat, Padang, Indonesia
- Ahmed Al Mantawi Heliopolis, Cairo, Egypt
- Jeffrey Ames, Tampa, FL
- Victor Amsdell, Oregon, OH
- Peter Andree, Bloomfield, NM
- Chad D. Anschuetz, Fort Lauderdale, FL
- John A. Arnold, Schaumburg, IL
- Dinesh Bankar, Pune, India
- Md Basar Banting, Selangor, Malaysia
- Glenn Battoia, Chesapeake, VA
- Norazriyana Bte Bazuri, Singapore
- Brian Beck, Tulsa, OK
- Paul Bergevin, Minneapolis, MN
- Ken Bingaman, Lodi, CA
- Zach Bingham, Albuquerque, NM
- Christopher J. Bothell, San Diego, CA
- Terence T. Brandon, Lakewood, NJ
- Ed Branstutter, Toledo, OH
- Collins Brent, Greenville, MS
- Casey Brumfield, Pleasant Hope, MO
- Donnie Bullins, Eden, NC
- Troy K. Burklund, Houston, TX
- Kevin Burns, Houston, TX
- Krista Buszkiewicz, New Berlin, WI
- Billy Campbell, Novato, CA
- Michael Campbell, Bedford, IN
- John Caramanian, Venice, FL
- Dean Carmen, Boise, ID
- Kenneth W. Cason Jr., Pittsburgh, PA
- Walt Chandler, Duncan, SC
- Yan Cheng, Shanghai, China
- Herb Chilman, Houston, TX
- Noppadol Chuenjai A., Muang Rayong, Thailand
- Trey Collier, Houston, TX
- James Copeland, Mableton, GA
- Val Corcoran, Edmonton, AB, Canada
- Clyde Crawford, Seattle, WA
- Helmut Dahm, Brunner, ON, Canada
- Joshua Davis, Norfork, AR
- Terry Deamer, Endicott, NY
- Gregory Dennis, Bradford, PA
- Sébastien Déry, St-Nazaire du Lac, St-Jean, QC, Canada
- James Dillon, Smithfield, VA
- Nevri Djamaris, Batam Island, Indonesia
- Lee V. Emerson, Madison, WI
- Jose Francisco Espaillat, Norfolk, VA
- Richard Esser, Panama City Beach, FL
- Alison Flatau, College Park, MD
- Chris Flores, Cypress, TX
- Don F. Futch, Queen Creek, AZ
- Travis Gafka, Edmonton, AB, Canada
- Juan Jose Garcia, La Estrella Antioquia, Colombia
- Will (Roger) Garriss, Beaumont, TX
- Nicholas Gerrits, Milwaukee, WI
- Mike L. Gilmore, Patrick AFB, FL
- Sharhonda Glover, Shreveport, LA
- Claudio Barahona Godoy, Antofagasta, Chile
- Norris Graves, Lawton, OK
- Douglas Greig, Glendale, CA
- Jim Griffis, Martinez, CA
- Chris Hackbarth, Missouri City, TX
- Bradley Hall, Weidman, MI
- Ben Hammond, Keller, TX

Continued

- George Harvey, Newport News, VA
- Kevin Headrick, Paducah, KY
- Kurt Hoffman, Pineville, NC
- Ron Hogeland, Paso Robles, CA
- Elton L Holley, Elizabeth City, NC
- Gene Hu, New York, NY
- Bryan Hulst Kapolei, HI
- Neil Hruzek, Conroe, TX
- Natarajan Jayakumar, Singapore
- Michael Jeske, Houston, TX
- Philip L Johnson, Santee, CA
- Ralph Jones, Newport News, VA
- Mark Joseph, Decatur, AL
- Edward Kaouas, Athens, Greece
- Meg Karney, Austin, TX
- Hans Kiefer, Rosemont, IL
- Jon Kinney, Springfield, OR
- Kenneth R. Kisloski, Buffalo, NY
- Debra A. Koons, New Albany, IN
- Mark Kramer, Chula Vista, CA
- Joe Lang, Tualatin, OR
- Al Landwehr, Bettendorf, IA
- Floye Lavarnway, Wichita Falls, TX
- Donald Lee, Chattanooga, TN
- Eliina Lizarraga, San Diego, CA
- Tim Loomis, Kilgore, TX
- Andy Lott, Plainview, NY
- David Luoto, Mayport, FL
- Natan Lustgarten, Miami, FL
- Pete Luther, West Palm Beach, FL
- Bruce Lyden, Topeka, KS
- James O. Malley, San Francisco, CA
- Don Malsbary, Monterey, CA
- George Mann, Houston, TX
- Mario Marcil, Jonquiere, QC, Canada
- Marcelo Alejandro Marino, La Plata–Tolosa, Buenos Aires, Argentina
- Matt Markowski, Bakersfield, CA
- Chris McKeehan, Ponchatoula, LA
- David McGraw, Santa Clarita, CA
- Jason Meaux, Crowley, LA
- Amando A. Mendoza, Batam, Indonesia
- Philip Mesenbrink, Houston, TX
- Lynda Mink, Clute, TX
- Carey Mogdan, Calgary, AB, Canada
- Georges Morcos, Kuwait City, Kuwait
- Steve Morse, St. Louis, MO
- Aaron Moseley, Bessemer, AL
- Ralph E. Mosely, Newport News, VA
- Kevin Munns, Cambridge, ON, Canada
- Terry Murphy, Chula Vista, CA
- Terri Mutz, Lemont, IL
- Roberto Nava, San Ysidro, CA
- Scott Neal, Cheyenne, WY
- Romulo Neyra, Chorrillos Lima, Peru
- Jorge Alejandro Niglia, Ensenada, Buenos Aires, Argentina
- Jerard Norman, Newport News, VA
- Tobi Ogden, Nashville, TN
- Indra Bayu Parawita, Gading Serpong, Tangerang, Indonesia
- Brian R. Parlin, Skowhegan, ME
- Dan Patterson, Indianapolis, IN
- Kyle Paulson, Little Canada, MN
- Mark H. Payne, San Juan, PR
- Katherina A. Petrus, Johor Bahru, Johor Darul, Takzim, Malaysia
- Adriaan Pittius, El Paso, TX
- Tom Price, Woodland, CA
- John A. Quent, Newport News, VA
- Jacinto Ramirez, Houston, TX
- Brad Reeves, Clackamas, OR
- Shaun Riley, Newport News, VA
- Gary Rogers, Las Vegas, NV
- Chad Rohland, Onalaska, WI
- Henrik Rosencrantz, Knoxville, TN
- Grant B. Rowe, Cynthiana, KY
- Mike J. Royer, Humble, TX
- Aaron Ruccio, New York, NY

- Hector Ruffo, Santa Fe, Argentina
- Gregory Rumple, Waterdown, ON, Canada
- Tim Rupert, Pittsburgh, PA
- Patrick Ryan, Bettendorf, IA
- Ruben Salinas, Corpus Christi, TX
- Guy Samuel, Le Havre, France
- Eric Schnellbacher, Belleville, NJ
- David A. Schoales, Port Orchard, WA
- Steven C. Schroeder, Rancho Dominguez, CA
- Tom Schueck, Little Rock, AR
- David Schwarzmann, Severna Park, MD
- Mark Sears, Lakeland, FL
- David Shoemake, Biloxi, MS
- Pat Sicilia, Jacksonville, FL
- Kevin Sides, Winona, MS
- Richard C. Sillner, Southington, CT
- Lawrence Slaughter, Newport News, VA
- Mike Smith, Syracuse, NY
- Timothy Smith, Titusville, FL
- Nathan Sprang, Whitelaw, WI
- Kathline A. Spring, Reno, NV
- Gregory S. Sprinkle, Tempe, AZ
- Paul Stacy, Marietta, OH
- Raymond E. Staton Jr., Brooklyn, NY
- Larry Stewart, Cocoa, FL
- Ed Storer, Seattle, WA
- Robert Stow, Bellingham, MA
- Lothar Straub, Stoughton, WI
- Christy Stuchel, Holly Springs, NC
- Ng Boon Sua, Derrick, Singapore
- Paul Sumner, Piedmont, SC
- Pengundjungen Tarigan, Bandung, Indonesia
- Jesse Telaak, Amherst, NY
- Edoardo Tevere, Milano, Italy
- David Thompson, Lorain, OH
- Mike Trader, Hamilton, ON, Canada
- Rajesh Turakhia, Freeport, TX
- Kirk Tyler, Newport News, VA
- Robert Valle, Norfolk, VA
- Eric Van Cuyk, Appleton, WI
- Piet J. Van Dijk, Ijsselstein, The Netherlands
- Michael VanDuyne, Elkhart, IN
- Paula Vasquez, Katy, TX
- Wayne Vutech, Brooksville, FL
- Russell Wassenberg, Prior Lake, MN
- Maja Wiegemann, Geversdorf, Germany
- Brent D Wiggins, Newport News, VA
- Matt Williams, Mobile, AL
- Ralph Williams, Newport News VA
- Ron Winne, Fort Collins, CO
- Michael Woodlock, Clayton, VIC, Australia
- Darryl Yates, Section, AL
- Shaun Younger, Wilmington, DE
- Dan Zane, New Castle, DE

associations

CCAI Installs New Board, Announces Awards

The Chemical Coaters Association International (CCAI) installed its 2009-2010 officers and presented its Lifetime Achievement Award during the 2009 Annual Meeting in Scottsdale, AZ, in mid-June.

Officers chosen to serve on the National Board of Directors are the president, Bruce Bryan (Wagner Systems) of the Northern Illinois Chapter; vice president, Sherrill Stoenner (Pneu-Mech Systems, Mfg.) of the Central States Chapter; secretary/treasurer, Sam Woehler (George Koch Sons LLC); and recent past president, John Sudges (Midwest Finishing Technologies) of the Northern Illinois Chapter.

Larry Melgary (left) and Bob Warren (right) congratulate the 2009 James F. Wright Lifetime Achievement Award recipient, Phil Ruggerio (center).

During the awards luncheon, CCAI presented the James F. Wright Lifetime Achievement Award to Phil Ruggerio, a current chapter coordinator for the Twin Cities chapter. Ruggerio has also served two terms as the national president.

Chapter User and Supplier of the Year members were also acknowledged during the luncheon for year-long service and dedication to the chapters.

CEPE in Budapest Announces Program

The CEPE Annual Conference and General Assembly 2009 has published its conference program, which can be found at www.european-coatings.com/cepe. This year's conference will be held in Budapest, Hungary, at the Ramada Plaza Budapest on September 23-25, 2009. Conference sponsors include PPG, AkzoNobel, Cin, Boero Group, and Sto.

The theme of the 2009 conference is "repositioning in economic headwind." Planned topics include sustainability, innovation, legislative burden, and business adjustment in tough times. Focus sessions will target industrial coatings, decorative coatings, and nanotechnology/functional coatings.

Continued

Corrosion Event Set for October

Corosave, an international trade fair for corrosion protection, preservation, and packaging, is planned for October 20–22, 2009, in Germany, at the Stuttgart Exhibition Centre. Information offered at Corosave will include equipment for corrosion protection, test and analysis systems, salt spray testing, technical literature, education, and trade associations.

Running concurrently with Corosave will be parts2clean, an international trade fair for cleaning in the production process and maintenance. The location and dates are the same.

For more information on either event, visit www.corosave.de or www.parts2clean.de.

PDA Schedules Sept. Meetings, Course, 2010 Conference

The Polyurea Development Association (PDA), headquartered in Kansas City, MO, has scheduled its September 2009 Leadership, Committee, and Board of Directors meetings; the next Applicator Spray Course; and the 2010 Annual Conference.

On September 14, PDA will hold its 2009 Leadership Meeting in Kansas City, MO. From 1:00 p.m. to 4:00 p.m. will be the Committee Meetings, followed by the Committee Recap from 4:00 p.m. to 5:00 p.m. The Leadership Networking Dinner will take place from 6:30 p.m. to 8:30 p.m. A Board of Directors Meeting is scheduled for 8:00 a.m. to noon on September 15.

PDA's next Applicator Spray Course will be held October 6–9 in Houston, TX. The course is designed to give an in-depth analysis of commercially available equipment designs and hardware components from the spray application of polyureas.

The 2010 Annual Conference is planned for April 13–15, 2010, at the International Plaza Resort, Spa, & Casino in Orlando, FL. More information will be available on the web site, www.pda-online.org.

News

regulations

OSHA's Maritime Advisory Committee to Meet

The Maritime Advisory Committee for Occupational Safety and Health (MACOSH) will meet September 1–2, 2009, in Newport News, VA, at the Newport News Marriott Hotel to discuss injury and fatality data initiatives and defective containers, among other topics, according to the Occupational Safety & Health Administration (OSHA). Worker protection for all trades at shipyards is regulated under OSHA's Shipyard Industry standards. With a charter that expires every two years, MACOSH was re-chartered in December 2008 because of the high incidence of worker injuries, illnesses, and fatalities at shipyards, according to an announcement in the Federal Register on December 18, 2008.

The Shipyard and Longshoring workgroups will meet on September 1 from 8:00 a.m. to 4:30 p.m. The full committee meeting will take place on September 2 from 8:00 a.m. to 4:30 p.m. The committee advises the Assistant Secretary of Labor for OSHA on issues relating to occupational safety and health policies and programs and standards in the maritime industries, focusing on the shipyard and marine cargo handling industries. The committee improves OSHA's outreach and training programs through innovative partnerships, expedites the development of maritime standards, and makes recommendations on issues related to reducing injuries and illnesses.

Written comments can be submitted for consideration no later than August 18 to Danielle Watson, Office of Maritime, U.S. Department of Labor, Room N-3609, 200 Constitution Ave., N.W., Washington, D.C. 20210 or faxed to 202-693-1663.

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companies

Freeworld Coatings to Acquire Napier

Freeworld Coatings Global has exercised its option to acquire the North American operations of Napier Environmental Technologies Inc. (www.napiere.com) of Vancouver, Canada, Napier has announced.

Napier will cease manufacturing its product lines, which include prep, coating removal, and wood restoration products for the industrial, commercial, and retail markets.

The deal's closing had been delayed by regulatory approvals, which have now been obtained. As a result of this delay, the companies' so-called NAFTA Option Agreement has been renegotiated to include an additional $1.125 million goodwill payment to Napier.

In addition, Freeworld will pay Napier approximately $605,000 ($55,000 for production machinery and $550,000 for inventory), subject to the actual value of inventory at closing, for a total of about $1.73 million.

Napier has received $602,000 in payment so far; the balance will be paid on July 31, 2009, when the deal is scheduled to close

Altana Reappoints Wolfgruber as CEO

Altana AG (Wesel, Germany) has reappointed Dr. Matthias L. Wolfgruber as chief executive officer, effective July 1, 2009. He is reappointed for a five-year period as chairman of the management board, composed of himself and Martin Babilas, chief financial officer.

Dr. Matthias L. Wolfgruber

Dr. Wolfgruber has a doctorate in chemistry. He has been the CEO of Altana AG since 2007 and was previously the CEO of Wacker Chemical Corporation in the U.S.

Kryton Hires East U.S. Manager

Kryton International, headquartered in Vancouver, British Columbia, Canada, has hired Paul Anderson as the territory manager for the eastern U.S. He will work from his base in West Islip, NY.

Paul Anderson

Continued

Anderson has 14 years of experience in the construction industry. He will serve as the main point of contact for all ready mix concrete suppliers, engineers, architects, and general contractors working with the company's crystalline concrete waterproofing products.

Houston Corrpro Team Earns Safety Award

Corrpro Companies, Inc., headquartered in Medina, OH, announced that its Houston, TX-based crew was honored with the Houston Business Roundtable (HBR) Gold Award in Safety Excellence.

HBR accepts nominations for the award only from client/owner companies. This is the second year in a row that ExxonMobil has nominated Corrpro for its work at the Baytown, TX, facility. Corrpro was nominated in the "Specialty Contractor Soft Crafts/Environmental Small" category and last year received the bronze award.

Corrpro Companies, Inc. is a subsidiary of Insituform Technologies, Inc., and provides cathodic protection systems; corrosion control engineering services; and coatings and equipment for infrastructure, environmental, and energy markets.

Spider Hires District Sales Rep

Spider (Seattle, WA), a division of SafeWorks, LLC, hired Doug McCormick as the district sales representative for its Chicago, IL, location. McCormick will be responsible for solving suspended access and safety challenges for contractors and facility owners in northern Illinois, eastern Iowa, and all of Wisconsin, with the exception of the western region.

McCormick holds a BA in psychology and business management from DePaul University. He most recently managed sales and operations at Sky Climber Chicago LLC.

NLB Relocates to Bigger Building

NLB Corp., headquartered in Wixom, MI, has relocated its Houston, TX, branch to a larger space in LaPorte, TX. The company says that the new 10,800-square-foot building is more than twice the size of the one NLB used for the past 20 years.

The NLB Texas branch is led by manager Larry Slavin, who has been with NLB for 15 years. The facility includes a service area, parts department, and training room.

NLB Corp. manufactures a full line of water jetting systems and accessories for contractor and industrial uses.

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CDCLarue Adds Six Distributors

CDCLarue Industries, Inc. (Tulsa, OK) has announced the addition of six new distributor partners for its Pulse-Bac® powered dust collection systems.

The additions are Arrow Tools (Van Nuys, CA); Marr Industrial Coatings, Inc. (Winnipeg, Canada); Desco Coatings of Alberta (Edmonton, Canada); Klein and Company (Canton, GA); Global Concrete Solutions (Coburg, Australia); and PRP Plus (Denver, CO).

Int'l Paint Completes Facility Expansion

International Paint Protective Coatings announced that the expansion of the Berea, OH, manufacturing facility has been completed. The goal of the expansion was to bring the company's Ceilcote® and Enviroline® brands under one roof.

According to the company, the expansion will better control the escalating costs of materials and supplies. The expansion, combined with made-to-order capabilities expected to double product production, is expected to help minimize price increases.

International Paint Protective Coatings is an AkzoNobel company. The company acquired Ceilcote® in 2007 and Enviroline® in 2008 to extend its portfolio of linings and protective coatings products.

IRL Publishes S. American Paint Profile

Information Research Ltd. (IRL), in Ealing, London, recently published *A Profile of the South American Paint Industry, 2nd Edition*. The book covers protective, marine, and decorative markets. According to the report, growth in the South American countries is expected in 2010, with only Peru and Colombia expected to show growth in 2009. Major drivers for coatings demand on the continent are said to be state spending on infrastructure, oil exploration, and industrial development.

Dow Plans to Raise Prices

The Dow Chemical Company (Midland, MI) raised the list and off-list prices for several products in the Oxygenated Solvents portfolio in North America, effective July 1, 2009, or as contracts allow. The increase is due to a cost escalation of raw materials, particularly propylene, according to Mark Bassett, global business director of Oxygenated Solvents.

Evonik Raises Polyester Prices

Evonik Industries' Coatings & Additives business unit increased prices for coating polyesters, effective

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July 1, 2009. The affected brand names are sold in Europe, Africa, and the Middle East. Prices increased by up to €0.1/kg. The company says that the increase is unavoidable due to price hikes of raw materials.

Reichhold Names New Distributors

Reichhold, Inc., a manufacturer of unsaturated polyester resins and a supplier of coatings resins located in Research Triangle Park, NC, announced that it has expanded its distribution network in the U.S. Pacific Northwest. TCR Industries and P.T. Hutchins will now serve customers in Washington, Oregon, Montana, Idaho, and Colorado. The previous distributor for this area was LV Lomas Limited of Delta, British Columbia, Canada. LV Lomas will continue to distribute all resin products in Canada.

TCR Industries, headquartered in La Palma, CA, markets specialty chemicals to manufacturers of coatings, adhesives, sealants, inks, and related products. P.T. Hutchins, which serves the coatings, adhesive, plastic, ink, and building materials markets, is located in Industry, CA.

Belzona Opens Office in Hong Kong

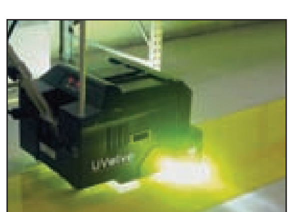
Belzona recently opened a new corporate office in Hong Kong, making this the company's fifth corporate office. The Hong Kong location will provide specialist engineering support from a team of industry professionals.

Belzona provides products to the water and wastewater, marine, petrochemical, oil and gas, power generation, and manufacturing industries. The company has distributors in over 120 countries and corporate offices in the UK, U.S., Canada, Thailand, and now Hong Kong.

products

Floor Coating Cures with UV

DSM Desotech, Inc. (Elgin, IL) has introduced the UVolve® Instant Floor Coatings, a concrete floor coating that cures with a specially designed, ultra-violet curing machine. According to the company, the product is a low-odor and no-VOC coating that demonstrates hardness and resistance to wear, scratches, slip, and chemicals. The floors can be returned to service immediately, even for forklift or other heavy traffic, the company says.



For more information, visit www.uvolvecoatings.com.

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News

Accelerated Test Can Mimic 63 Years of UV

Atlas Material Testing Technology in Chicago, IL, has designed a new device for ultra-accelerated exposure testing. The technology will provide approximately 63 years of South Florida UV radiation exposure in one year, the company says. Atlas developed the technology in partnership with the National Renewable Energy Laboratory (NREL) and the Russian Institute of Laser Optical Technology (ILOT) under a U.S. Department of Energy (DOE) program.

The device tracks the sun and concentrates reflected sunlight using multiple focusing mirrors onto a target area of approximately 10 cm by 10 cm. According to the company, materials that require a long service life and coatings applied to metal are good candidates for this technology.

Visit www.atlas-mts.com for details.

Enmet Offers Carbon Dioxide Sensor

Enmet (Ann Arbor, MI) has released its new carbon dioxide (CO_2) sensor/transmitter, the EX-5165. It features an infrared sensor that can be calibrated to detect CO_2 ranges of 0-500 ppm to 0-100% by volume CO_2.

According to the company, the product has been approved for location in Class I, Division 1, Group B, C, and D atmospheres. The sensor can operate in an anaerobic environment and has a display to show gas concentration.

Visit www.enmet.com for details.

Two New Products From Graco

Graco (Minneapolis, MN) announced its new XM Plural-Component Sprayer with dosing technology that allows the resin to constantly flow while the hardener is injected at higher pressures. The new sprayer has a USB drive that

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allows contractors and equipment manufacturers to insert a flash drive and download data. According to the company, the product can support multiple spray guns, is ideal for corrosion-control applications, and several of the configurations are approved for enclosed areas.

XM-Plural Component Sprayer

The base model includes a frame, mix manifold, Graco Xtreme pumps, flush pump, controls, dosing valves, USB drive, two static mixers, a Graco XTR-7 gun, Xtreme-Duty hose, power supply, and recirculation kit.

The company's new Graco Reactor H-VR is a variable ratio dispensing system that handles polyurethane foams and polyurea coatings. According to the company, it is designed for materials with extreme differences in viscosity between components, and it can spray variable volumetric ratios ranging between 1:1 and 2.5:1.

Reactor H-VR

For details, visit www.graco.com.

New Gas Detector for iNet Line

Industrial Scientific (Pittsburgh, PA) has added the MX4 iQuad to the company's line of iNet-ready gas detectors. The new unit can detect one to four gases, is third-party tested, certified IP66 and IP67, and dust-tight as well as resistant to water submersion.

The line of iNet is a software-based service that offers an alternative to buying gas detectors. Those who subscribe to iNet receive gas detection as a service.

Visit www.indsci.com for more information.

DeFelsko Adds Automated Adhesion Tester

DeFelsko (Ogdensburg, NY) has announced its new PosiTest AT-A Automatic Adhesion Tester, which measures the bond strength of coatings to concrete, metal, wood, and other rigid substrates. The company says that the product tests adhesion with the push of a button and is electronically controlled by a hydraulic pump that automatically applies pressure. Internal memory stores the maximum pull-off pressure, rate of pull, test duration, and dolly size. The built-in rechargeable batteries can perform 200 tests per charge.

For more information, visit www.defelsko.com.

Stripper Removes Lead Paint

Enviro-Prep System® in Wausau, WI, has a new product, 33073 Enviro-Prep® Chemical Stripper. According to the company, the stripper is a water-based, zero VOC product for stripping lead-based paints from a variety of substrates. It can be applied with most conventional painting equipment and works well for projects where blasting is not recommended, the company says.

For details, visit www.enviro-prep.com.

Two New Polyurethanes Available

Progressive Epoxy Polymers, Inc. is now offering two-part polyurethane coatings, also known as Linear Polyurethanes (LPU). The Acrylic Poly UV Plus™ is a two-part polyurethane clear coat that is available in gloss or

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satin. According to the company, it is formulated to contain maximum amounts of UV blockers and absorbers. The LPU Marine™ is a polyester polyurethane available in gloss white only.

The Pittsfield, NH-based company is an internet supplier of epoxy resins/coatings, fillers, and thickeners for marine, commercial, and residential use.

For more information, visit www.epoxyproducts.com.

Resin Eliminates Foam in High-Solids

Tego Coating Additives & Specialty Resins (Hopewell, VA), a business line of Evonik, recently introduced its TEGO® Airex 944 for eliminating micro- and macro-foam in pigmented industrial and high-solids coatings. The resins cover two-component epoxy, two-pack polyurethane, and high-solids alkyds, the company says. Systems can be applied by brush, roller, and spray equipment. Applications include epoxy coatings for parking garages, warehouses, and pigmented solvent or solvent-free coatings based on polyurethane and alkyd resins.

For more information, call customer service at 800-446-1809.

OLFA Unveils Multi-Use Scrapers

OLFA-North America (Rosemont, IL) has introduced its first assortment of high-performance, professional scrapers and replacement blades. The scrapers are designed for contractors, builders, industrial users, and do-it-yourselfers.

The Multi-Edge Arc Scrapers (T-25 and T-45) are suitable for flooring, walls, and roofing, according to the company. These scrapers have a four-edge blade design with one sharp side, two coarse sides, and one blunt side. The Extra Heavy-Duty Scrapers come in a choice between an 8 in arm (BSR-200) or a 12 in arm (BSR-300) for two-handed use. Both have die-cast metal rounded handles, a steel striking hammer tip, and 4-in wide heavy-duty, dual-edge blade with one sharp and one coarse side. The SCR-S and SCR-L are the Multi-Purpose Scrapers in the collection, and the company says they are ideal for walls, glass, or light-duty flooring.

For information on any of the products, visit www.olfa.com.

Pirate Brand Introduces New Products

Pirate Brand® (Indianapolis, IN) is introducing its new line of air dryers and moisture separators to remove moisture in compressed air for more reliable abrasive blasting.

The air dryers are portable and come in five sizes. Some of the features include an air motor with a filter, regulator, lubricator, and muffler; steel skid forklift channels; minimal pressure drop; two dryer site windows; and a large fan. The moisture separators are available in two sizes and can be configured to be portable or stationary, according to the company.

For more information, contact the Forecast Sales/Pirate Brand sales team at sales@forecastsalesinc.com.

Send news about associations, companies, and products to Karen Kapsanis, editor, *JPCL*, kkapsanis@protectivecoatings.com

Abhe & Svoboda to Recoat Astoria-Megler Bridge

By Brian Churray, Paintsquare

Abhe & Svoboda, Inc. (Prior Lake, MN), SSPC-QP 1- and QP 2-certified, was awarded a contract of $13,369,910 by the Oregon Department of Transportation to recoat the 2,468-foot-long steel cantilever through-truss section on the Astoria-Megler Bridge, a 21,474-foot-long steel structure over the Columbia River. The project, which is jointly funded by the Oregon and Washington departments of transportation, involves abrasive blast cleaning and overcoating the structural steel with a moisture-cured urethane system. The existing coatings contain lead, necessitating containment according to SSPC-Guide 6. The Oregon DOT is also conducting a competitive bid process for an estimated 17,000 hours of related coatings inspection work.

Photo courtesy of James Norman, Oregon DOT

Corps of Engineers Awards Lock & Dam Rehabilitation Contracts

Photo courtesy of USACE, Portland District

Triad Mechanical, Inc. (Portland, OR) secured a contract of $1,499,450 from the United States Army Corps of Engineers, Portland District, for the refurbishment of three roller chain penstock gates at Lookout Point Dam on the middle fork of the Willamette River. The ARRA-funded project includes shop-coating the gates and replacing roller chains, sheaves, wire ropes, seals, and sacrificial anodes. The contractor will transport one gate per year to an offsite facility for repairs and coatings application. The coatings work, which requires SSPC-QP 1 and QP 2 certification, includes lead-based paint abatement. The gates will be abrasive blast cleaned to a White Metal finish (SSPC-SP 5), thermal-spray metalized with 85/15 zinc/aluminum, and coated with a moisture-cured urethane system.

The United States Army Corps of Engineers, Jacksonville District, awarded a sole source agreement for $2,634,681 to American Contractor & Technology, Inc. (Gulf Breeze, FL) under the 8(a) Small Business program to perform coatings application at Moore Haven Lock. The ARRA-funded project includes abrasive blast cleaning and recoating two steel gates, flotation tank surfaces, and structural steel at the 250-foot-long by 50-foot-wide lock chamber that connects the Caloosahatchee River and Lake Okeechobee in Glades County, FL.

Photo courtesy of USACE, Jacksonville District

Knight Construction & Supply, Inc. (Deer Park, WA) signed a contract with the United States Army Corps of Engineers, Portland District, to repair three 45-foot by 46-foot spillway tainter gates at Foster Dam on the South Santiam River. The project includes applying a vinyl coating system to the gates. The contract, which is valued at $1,144,246, includes the use of containment to control the emission of the potentially hazardous existing coatings.

Photo courtesy of the Bonneville Power Administration

Utah DOT Lets Bridge Painting Project

Photo courtesy of Utah DOT

The Utah Department of Transportation awarded a contract of $1,081,215.50 to the Gateway Company (Salt Lake City, UT), SSPC-QP 1- and QP 2-certified, to coat steel and concrete surfaces on an existing 8-span bridge over Starvation Reservoir. The bridge, pictured here during its construction in 1969, is 1,674.25 feet in length. The project includes abrasive blast removal of the existing finish on 235,691 square feet of steel down to the red primer, followed by overcoating with a 100%-solids epoxy penetrating sealer primer and intermediate and a silicone alkyd finish. The project also includes applying a penetrating sealer to 3,350 square feet of existing concrete surfaces.

Ahern Painting Contractors Wins Passaic River Bridge Painting Project

Ahern Painting Contractors, Inc. (Woodside, NY), SSPC-QP 1- and QP 2-certified, won a contract of $30,857,890 from the New Jersey Turnpike Authority to recoat existing steel surfaces on the 6,948-foot-long Washington Memorial Passaic River Bridge. The project includes recoating 1,600,000 square feet of carbon steel surfaces and 220,000 square feet of weathering steel surfaces. The steel will be abrasive blast cleaned to a Near-White finish (SSPC-SP 10) and coated with a zinc-epoxy-aliphatic urethane

Continued

Purcell To Repair Thickener Tank

Purcell Painting and Coatings (Tukwila, WA), SSPC-QP 1- and QP 2-certified, was awarded a contract of $345,000 by King County (WA) to repair corrosion damage to three existing dissolved air flotation thickener tanks at the South Treatment Plant. The project includes coating metal piping, equipment, and disassembled skimmer flights with a high-solids epoxy system, as well as repairing deteriorated wall linings with an epoxy/urethane primer, a mastic intermediate, and a PVC sheet finish.

Olympus to Recoat Sunnyvale Tanks

Olympus & Associates (Reno, NV) secured a contract of $787,430 from the City of Sunnyvale, CA, to recoat the exterior surfaces of three 5 MG water storage tanks. The contract, which required SSPC-QP 1 and QP 2 certification, includes lead abatement with containment according to SSPC-Guide 6. A total of approximately 37,800 square feet of steel on each tank will be abrasive blast cleaned to a Near-White finish (SSPC-SP 10) with a lead-stabilizing abrasive additive and coated with an epoxy-polyurethane system.

system. The contract includes full containment for removal of the existing lead-bearing coatings. The project also includes applying a waterproofing membrane to 11,310 square feet of substructure surfaces.

West Virginia DOT Awards Bridge Painting Contract

The West Virginia Department of Transportation allocated a portion of its ARRA funding for bridge painting work, including a $5,595,373 contract to Blastech Enterprises, Inc. (Baltimore, MD), SSPC-QP 1- and QP 2-certified, to recoat a 7-span, 1,964-foot-long steel truss bridge over the Cheat Lake. The steel will be abrasive blast cleaned to a Near-White finish (SSPC-SP 10) and recoated with an organic zinc-rich primer and waterborne acrylic intermediate and finish coats. The contract includes containment because of the existing lead-bearing coating system.

Oswego County Lets Communication Tower Painting Project

Oswego County (NY) awarded a contract of $9,000 to Preferred Tank and Tower (Evansville, IN) to recoat three existing guyed communication towers with heights of 220 feet, 340 feet, and 370 feet. The tower surfaces will be spot-cleaned and spot-coated with a rust converter, followed by zinc primer application and orange and white stripe finish application according to FAA Standards.

F.D. Thomas Wins Crane Painting Job

F.D. Thomas, Inc. (Medford, OR), SSPC-QP 1- and QP 2-certified, was awarded a contract of $68,400 by the Port of Portland (OR) to repair 4,800 square feet of failed coatings on a marine terminal crane. The crane surfaces will be needle gun-cleaned using HEPA vacuum-shrouded tools, spot-primed with inorganic zinc, and coated with an epoxy-polyurethane system.